FINAL REPORT

SRI LANKA – JAPAN RURAL DEVELOPMENT PROJECT

DEWAHUWA

FEBRUARY 1977

LAND CMMISSIONER'S DEPARTMENT

MINISTRY OF AGRICULTURE AND LANDS SRI LANKA

AGRICULTURAL DEVELOPMENT COOPERATION DIVISION

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA), TOKYO JAPAN

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FOREWORD

In response to the request of the Government of Sri Lanka, the Government of Japan agreed to extend technical cooperation to the Sri Lanka-Japan Rural Development Project in Dewahuwa, one of the government-supported settlements in a dry zone where future agricultural development is strongly desired.

This project is designed to implement an integrated rural development which will contribute to the future increase in agricultural production in Sri Lanka.

Previously agricultural cooperation of Japan to Sri Lanka had been extended only on a research level under the Colombo Plan.

Japan's cooperation in this Project was for a period of 7 years consisting of 1 year for feasibility study, 5 years for project implementation and 1 year for after-care.

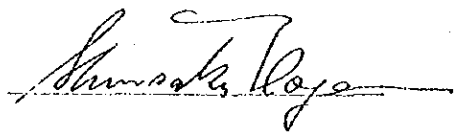
This may be regarded as a pilot project in the field of integrated rural development which will become increasingly important in the future.

I hope this report will serve as a guidance for future agricultural development not only in Sri Lanka, but also in other countries.

I wish to express my respect and hardfelt appreciation to the Government of Sri Lanka and the Japanese Government organs for their cooperation as well as to the local officials of Sri Lanka and Japanese experts concerned for their hard work.

February 1978

Shinsaku Hogen



President

Japan International
Cooperation Agencies

SRI LANKA - JAPAN RURAL DEVELOPMENT PROJECT

DEWAHUWA

CONTENTS

Writers:

Name	Fields	Period of duty
Takao Sato	Project leader cum crop cultivation	1970. 1.20 - 1976. 9.30
Teru Sasaki	Agricultural co-operatives	1969.11.15 - 1972. 5.15
Masamichi Numata	Agricultural machinery	1971. 4.25 - 1975.10.18
Masaki Shimizu	Irrigation	1972.10.22 - 1975.10.18
Toru Mase	Hydrology	1973. 3.10 - 1975.10.18
Shoji Nishikawa	Coordination	1973. 5.24 - 1975.10.18

1. Introduction

Circumstances which led to the opening of Dewahuwa Sri Lanka Japan Rural Development Project.

1.1 Background of the Project

A large percentage of the imports in Sri Lanka (known as Ceylon at that time) was covered by food materials and therefore in order to improve her economic development, priority had to be given to agricultural development, so that self sufficiency in food items could be achieved in a short time. At a time under such circumstances the then Prime Minister of Sri Lanka, Late Mr. Dudley Senanayaka, during his visit to Japan in 1967 met the Prime Minister of Japan, Mr. Eisaku Sato and discussed the promotion of agricultural co-operation between the two countries. In accepting this co-operation the Sri Lanka Government requested Japan for her co-operation directly in the field of agricultural productivity maximization which in contrary to the co-operation seeked usually in the field of research. In response to this request the "Agricultural Development Primary Investigation Team for Sri Lanka (The first survey team) led by Dr. Shiroshi Nasu, Professor Emeritus, Tokyo University and former Japanese Ambassador to India, arrived in Sri Lanka in July 1968. This team investigated for the possible fields in which agricultural co-operation could be extended. This team observed that the agricultural co-operation within the country remained as a show piece or a demonstration with little penitration of technique to the farmers, and therefore it had very little impact on agricultural productivity maximization or in other words on the living standards of the rural community. Therefore the team proposed to the Sri Lanka Government that Japan's co-operation should be in the form of easily acceptable techniques to the farmers. The team recommended over all community development work which composed of following main items:

(i) Development of villages forming the main body in agricultural production,

(ii) Infra-structural development to improve land productivity,

(iii) Stabilization and extension of modern agricultural technology,

(iv) Improvement of farmers' organizations and other rural institutions related to agricultural production.

1.2 General Survey and the Preparation of Project Plan
(Arrival of the second survey team)

The governments of Sri Lanka and Japan agreed to follow the advice of the first survey team. The Overseas Technical Co-operation Agency (present Japan International Co-operation Agency), Japan, with the approval of the Ministry of Foreign Affairs, Japan, undertook the development programme and the Feasibility Survey Team (Second Survey Team) to Sri Lanka. This team was led by Dr. Hitoshi Fukuda during the first half of their duration in Sri Lanka and by Mr. Motonaga Ohto during the second half. This team consisting of 12 members arrived in Sri Lanka in February 1969. Soon after arrival this team, with the help of a Sri Lankan counterpart team inspected eight locations which were choosen by the Sri Lankan authorities. They selected Dewahuwa Scheme as the site for working out the project, but due to financial limitations had to limit project activities to the upper region of the scheme which is $\frac{1}{3}$ the area of the whole scheme. The upper region consisted of 771 acres of paddy land and 464 acres of highland cultivated by 153 families with the family cottages located on the highlands. The investigations required for the over all rural development project were conducted and the following basic plans were made.

(1) Farm Management improvement plan,
(2) Infra-structural improvement plan,
(3) Pilot Farm scheme,
(4) Agro-Industry development plan,
(5) Better living programme,
(6) Project maintenance and operation programme,
(7) Agricultural Co-operative development plan.

Dewahuwa is located towards the centre of the island, 90 miles away from Colombo and it falls within the two administrative districts Matale and Anuradhapura where the government is expecting rapid agricultural development. Dewahuwa is a major irrigation scheme where settlement started in 1951. The reservoir has a capacity of 8,800 acre feet and it is a small tank compared to the mammoths in the dry zone.

Table 1.2 Area of Dewahuwa Scheme

Tracts	1	2	3	4	Project Total	5	6	7	8	9	Devahuwa Scheme total
Paddy land (acres)	68	51	538	114	771	331	250	315	482	170	2,319
Homested and high-land acres	39	30	324	71	464	198	157	195	292	106	1,412
Number of settlers	13	10	107	23	153	65	52	63	98	35	466

1969 July - August

1.3 Arrival of the Third Survey Team

A design investigation team led by Mr. Koichi Imoto worked out implementation designs and plans for various constructions and structures according to the contents of the implementation programme prepared by the second survey team. The designs and plans were on the following:

(1) Agricultural mechanization centre,

(2) Renovation of paddy field irrigation system and farm roads,

(3) Upland irrigation,

(4) Pilot farm,

(5) Domestic water supply.

1969 November - 1970 May

1.4 Pre-project Co-operation, until the Time of the Seventh General Election of Sri Lanka

Responding to the request by the Sri Lanka Government for pre-project co-operation Mr. M. Horie, Expert on irrigation and Mr. T. Sasaki, Expert on rural institutions were sent to Sri Lanka in November 1969, Mr. T. Sato, Expert on Agronomy, joined them in January 1970. They worked as Colombo Plan Experts at Dewahuwa and carried out preparatory work prior to the project inception.

On the other hand the Sri Lankan authorities appointed a Deputy Director of Agricultural Development, Mr. Gamini Iriyagolla from the Ministry of Agriculture and Food to look after the activities of Dewahuwa Project. He was to become the Director of the project in the future. At Dewahuwa following officers were posted to assist the Japanese Experts.

Section	Post	No.	Department
Agricultural Co-operatives	Assistant Commissioner of Co-operative Development	1	Department of Co-operative Development
	Co-operative Development Inspector	1	Department of Co-operative Development
Agronomy	Agricultural Officer	1	Department of Agriculture
	Agricultural Instructor	1	Department of Agriculture
	Agricultural Extension Workers	3	Department of Agriculture
Irrigation	Technical Assistant	1	Department of Irrigation

The construction of living quarters for the experts was also under progress.

1.5 Pre-project Co-operation Period, May - October 1970

The project idea and the pre-project co-operation came up during the UNP regime. The United Front regime which came into power in 1970 May re-assesed the project programme and decided to start the project. As a result an agreement on the project was signed between the two governments on October 19th, 1970.

According to the Agreement the duration of the project is 5 years and the total cost was estimated as Rs. 7,000,000 out of which Rs.3,610,000 would be borne by the government of Japan in supplying machinery and equipment which are not available in Sri Lanka. The balance cost would be borne by the Government of Sri Lanka in the construction of various structures, supply of fuel, maintenance of machinery and equipment, provision of labour etc.

In order to effect smooth implementation of the project policies a Joint Committee precided by the Secretary to the Ministry of Agriculture and Lands was formed. From the Sri Lanka side this committee included representatives from the related ministries and departments, the Project Director, Government Agent who is the local administrator of the district where the project is located, the Project Co-manager and one representative from among the farmers. The Japanese team was represented by the Project Manager and two other experts. A representative from the Japanese Embassy also attended the committee meetings. This committee was responsible in making important

policy decisions, approval of the annual budget etc.

At local level there was a sub-committee presided by the Project Director, with representatives from the Ministry of Agriculture and Lands, Government Agent of the Anuradhapura district or his representative, representatives from related government departments; Project Manager and the team of Japanese Experts, Project Co-Manager and his project staff. This committee was responsible in taking minor decisions in the course of implementing the project programme and in generating new ideas. All matters which were of much importance were forwarded to the Joint Committee.

Dewahuwa Sri Lanka Japan Rural Development Project was one of the 13 special projects in Sri Lanka and like in the rest of the special projects the Project Director (Additional Land Commissioner) was responsible as the Chief Co-ordinator at Departmental level and as Chief Administrator. The Government Agent of Anuradhapura District was responsible as the local administrator and as officer in charge in implementing project programme.

At project level the Manager and the Co-Manager were jointly responsible for implementing annual programmes and technical matters.

The Co-Manager was also responsible for the administrative and managemental matters within the project.

2. General Progress of the Project

2.1 Inception of the Project

2.1.1 1970/71 Maha Paddy Cultivation

On 20/10/1970, the day after the signing of the Agreement Maha 70/71 paddy cultivation was started at Dewahuwa with the opening of the tank sluice for the first issue of water. However it is on the 3rd November the Japanese experts could settle down at Dewahuwa and start their work on the Maha 70/71 paddy cultivation. Therefore an opportunity to provide a timely and appropriate guidance was lost to the project management.

The delay in the signing of the Agreement aroused a rumour among the farmers and Sri Lankan staff at Dewahuwa, that the project was going to be cancelled and as a result the guidance on the farmers became very passive. On the other hand there was a delay on the farmers side in their pre-

parations for the Maha 70/71 cultivation, due to a delay in the harvesting of the 1970 Yala paddy crop, which the farmers have succeeded for the first time since the beginning of the colonization scheme.

Under these circumstances the management decided to provide intensive guidance for 150 acres of selected area, out of the 771 acres total project area. This was called the "Intensive Demonstration Area" and it was cultivated by 30 farmers. 23 two wheel tractors (out of 200 donated by Japan to Sri Lanka under the Kennedy Round Aid Programme) were used for the land preparation. 40 young men selected from the project were specially trained to operate the two wheel tractors. The technical staff of the Iseki Agricultural Machinery Manufacturing Company, who were stationed in Colombo at the time largely co-operated in training these operators and as a result it was possible to start commercial ploughing operations from the 16th of November.

47% of the 150 acre intensive demonstration area was ploughed by these two wheel tractors and the operations were extended outside the intensive demonstration area. By doing so it was possible to complete 30% of the total project are (755 acres) by the 24th of December 1970. The total acreage ploughed by two wheel tractors upto this date amounted to 215 acres. Consequently it was possible to overcome the delay in the sowing period satisfactorily and it was possible to complete sowing and transplanting operations in the project area by the beginning of February 1971, in accordance with the cropping calendar.

The farmers were given advice and guidance in crop husbandry with more stress on adopting transplanting, and application of fertilizer with special reference to the application of top dressings. The young girls in the project area and neighbouring villages were put into groups and they were trained to do row transplanting on a commercial basis with the support of the project staff. Top dressing of fertilizer was explained to the farmers during the Neighbourhood Group Meetings arranged to discuss problems pertaining to agriculture. As a result of these efforts it became possible to increase the transplanting: broadcasting ratio from 32:68, as planned earlier by the farmers, to 43:57. The quantity of fertilizer applied as top dressing was also increased compared to the estimate at the beginning of the season, however the quantity remained less than the previous corresponding season due to unexplained reasons. Due to the rational application of fertilizer by the farmers the yield

remained at 53 bushels per acre which is the same as in the previous corresponding season. The results of the intensive demonstration area indicated that the use of pure seeds of high yielding varieties, application of fertilizer and adoption of row transplanting and random transplanting, were very effective in increasing the yields. The results of the intensive demonstration area and the crop cutting survey indicated that 90 bushels per acre average yield, which is the project target could be attained without much difficulty.

A clear idea was given to the farmers about the importance in water management by themselves, during the Neighbourhood Group Meetings mentioned above. This was all that could be done at the time since the equipment for water management had not arrived from Japan.

The role played by the young farmers in this Maha paddy cultivation indicated the magnitude of the idling energy in the community that could be utilized for future social development through proper guidance and objectives.

2.1.2 Settlement of the Staff

Some of the members of the Japanese Experts team arrived at Dewahuwa as indicated below:

Post	Name	Arrival
Project Co-ordinator	Mr. M. Fukushima	December 1970
Hydrologist	Mr. T. Ohtani	March 1971
Machinery Expert	Mr. M. Numata	April 1971

All experts required for operating the project gathered except for an Agricultural Economist whose presence was felt essential. On the Sri Lankan side the Co-Manager, Agricultural Officer and the other supporting staff personal were all settled, except for the Irrigation Engineer and the Co-operative Development Officr who were required to work as counterpart officers to the Japanese Experts.

2.1.3 Amalgamation of the Multipurpose Co-operative Societies

Three co-operative societies which have been operating independently of each other within the project area amalgamated into one organization to form the Dewahuwa Multi-purpose Co-operative Society.

2.1.4 Visit by a Survey Team lead by Dr. S. Nasu

In March 1971 Dr. S. Nasu and Dr. H. Fukuda along with several others visited Dewahuwa Project. They suggested various solutions for problems which had arisen from the Agreement and in the course of its implementation. They also expressed their blessings on the project on the occation of its inception. The first Joint Committee on the project was held towards the end of March.

2.1.5 The 1971 Insurrection

On the night of April 5, 1971 an uprising of insurgents occured all over the country and the police stations became their main targets of attack. The management expected that the project too will be drawn into the vortex of insurrection due its location in the two districts of Anuradhapura and Matale where activities of the insurgents were fairly intensive. However it was observed that they did not intend to do any harm to the project (probably understanding the project policy) and the project staff continued their normal work. However the day time curfew which continued for quite some time and the rain which fell subsequently delayed the harvesting and threshing operations considerably. These conditions induced the rot of paddy grains in the field causing a decrease in the net paddy yield.

2.2 Project Activities in Yala 1971 (April - July 1971)

2.2.1 Infra Structural Improvement Work and Paddy Field Re-Arrangement.

A general meeting of the farmers was held towards the end of the 1970/71 Maha season to discuss about the programme of work for 1970 Yala season. This meeting was presided by the Government Agent, Anuradhapura. In this meeting the farmers agreed to forgo the Yala 1971 cultivation inspite of the fact that the tank was full, in order to provide time for the desilting and reinforcement work of the main irrigation channel and its tributaries and for repairs to farm roads. This decision arose as a result of their eagerness to co-operate in solving the eternal water distribution problem.

The work commenced towards the beginning of March 1971 with the repairs to farm roads. A shovel dozer borrowed from the Irrigation Department and a few four wheel tractors from several private circles were

used in this work, since the equipment intended for this work did not arrive in time from Japan. However a shipment of dump trucks and a shovel dozer arrived from Japan in July. This fact clearly indicated the time lag between the commensing of work and the arrival of equipment from Japan.

The water issues for Maha 70/71 paddy cultivation was stopped at the end of March and the desilting of the main channel was started. This work was done by human labour, and very unexpectedly ahead of schedule, and by end of August 16,000 feet of farm roads were repaird and 55,600 feet of channel was desilted.

With the arrival of two units of bull-dozers, two expert operators on paddy field re-arrangement also arrived from Japan, under the Colombo Plan aid programme. They re-arranged 27 acres of paddy fields belonging to 5 farm households, as a demonstration. This work was interrupted by the Maha rains towards the end and the completion was possible in the middle of November. Under this demonstration 800 fragments in the 27 acres were levelled and re-arranged to form 67 fragments.

2.2.2 Agricultural Machinery

In April 1971, 17 units of two wheel tractors were newly added making a total of 40 two wheel tractors out of which 30 were supplied by the government of Japan and 10 obtained under the Kennedy Round Aid programme. A few boys were selected from the 40 operators to be trained as mechanics. Another batch of young men were selected to be trained as operators.

2.2.3 1971 Yala Cultivation

Saving irrigation water for a Yala paddy or subsidiary food crop cultivation by economizing during the Maha season was one of the important ideas of the project. This Yala no water was issued from the tank for a general cultivation due to infra-structural renovation work. Therefore trial cultivation of several subsidiary food crops were done on an acre of paddy field borrowed from a farmer, utilizing the water leaking from the main sluice. This cultivation was a demonstration to the farmers and a training to the officers.

In the middle and lower stream areas out side the project 30 acres of subsidiary food crops (Legumes) were cultivated under the guidance of the Sri Lankan officers. The water for this cultivation was lifted from the main drainage channel, Hevanella-oya. The Sri Lanka Japan Rural Development

Project co-operated by extending the services of the two wheel tractors for land preparation. The project agricultural extension staff provided the technical know how and guidance. Both these plots were successful and agricultural officers from the Department of Agriculture and people from many other places inspected the cultivation at various stages. Thus the initiative taken in the cultivation of subsidiary food crops in the paddy fields during Yala season had a great impact on the farmers and the project staff.

2.2.4 Other Important Matters

(a) Mr. H. R. Amith resigned from Sri Lanka Government service and Mr. W. R. B. Rajakaruna was appointed as the project director on 31/7/1971.

(b) Training for Counterpart officers in Japan

Mr. M. D. Abeywardena, T. A. was sent to Japan to follow a course in Irrigation and Drainage from 1971 to February 1972.

(c) The Joint Committee decided on 29/7/71 that the functions of the mechanization centre should be limited to repairs and maintenance of machinery since the New Farm Machinery Training Centre expected to be completed at Anuradhapura under West German aid is intended to function as a training centre.

2.2.5 Preparations for the 71/72 Maha Cultivation

In preparation for the first project guided Maha cultivation an implementation programme was prepared by the project staff for 1971/72 Maha and 1972 Yala and submitted to the Government of Sri Lanka. The projects aim was to achieve an average paddy yield of 90 bushels per acre at the end of the 5 year period by gradually improving the 45 bushels per acre average yield at the time of project inception. An average yield of 53 bushels per acre were achieved in 1969/70 and 1970/71 Maha seasons due to the efforts of the Sri Lankan staff. The Management decided to set the yield target for 1971/72 Maha season as 66 bushels per acre, which is an increase of 25% over the previous season. This target was fixed so as to impress the farmers that paddy cultivation is very much paying and also to create self confidence in the project staff. In order to attain this target the following farm managemental practices were planned. These however depended on the availability of irrigation water.

(i) Cultivate improved varieties over the entire project area,

(ii) To increase transplanted acreage to 60% compared to the 42% in the previous season. 10% of the acreage to be row transplanted.

(iii) Application of fertilizer according to the general recommendation of the Department of Agriculture for the Dry Zone.

The broadcast sowing of paddy and the transplanting of the nursery plants were to be completed by the 20th and 30th of November respectively. Therefore the operation of the two wheel tractors was planned to be worked under the control of the project management.

(1) Factors inhibiting the attainment of the target.

Availability of water, proper guidance of the farmers and the farmers readiness and courage are some of the factors required for achieving the yield targets mentioned above. In addition to these the input of production materials also holds a very important place. During the preparations for 1971/72 Maha paddy cultivation a survey was conducted to investigate the availability of funds with the farmers for the cultivation. A socio-economic survey was conducted by a team from the People's Bank of Sri Lanka and these surveys revealed that more than half the number of farmers did not possess the necessary funds required for the provision of inputs for the coming Maha 71/72 cultivation these surveys revealed the following facts. (Table 2.2.5).

(i) 22% of the farmers had lost their cultivation rights partially or totally due to their indebtedness. This amounts to 32 farmers out of the 153. When this factor is expressed in terms of acreage, 94 acres (12.2%) of the entire project area were under the two illegal transactions "Ugas" (Mortguage) and "Vikineema" (Out right sale), where the creditors carried out the cultivation. Under the "Ugas" system the cultivation is usually done by a third party comming from outside the colony, and such people practice their own cultivation methods without due consideration to project advice as such the yields will be low. Such people have no regard to the stringent water management practices of the project and they disturb the water distribution very often.

(ii) Generally in Sri Lanka most of the farmers lack individual capital accumulation and they depended heavily on the government "Paddy cultivation loans" issued through the People's Bank. However, the ever increasing number of loan defaulters was chronic headache for the government. Every year the farmers who qualified themselves by

repaying the cultivation loans decreased in number. Such was the case at Dewahuwa Project too. 63 (39%) farmers out of the 160 legal cultivators were defaulters. Out of the 32 farmers mentioned in (i), who had lost their cultivation rights due to indebtedness, 27 were total loan defaulters.

(iii) Existance of indifferent farmers; There were 37 farmers (23%) who did not borrow the government cultivation loan. This however was due to their indifference in the investments in paddy cultivation and not because of the availability of their own capital.

In short it was very clear from the above (i), (ii) and (iii) that the highest yield obtainable was 40 bushels per acre, since 60% of the farmers were unable to obtain their inputs for the paddy cultivation and they would simply broadcast their fields to produce only their consumption paddy. It was also observed that even if 40% of the farmers would attain more than the targeted yield (i.e. 66 bushels per acre), the average yield of the project would be not more than 55 bushels per acre.

(2) Methods of overcomming the factors inhibiting the attainment of the target.

The farmers mentioned in (iii) above could be trained and educated and made to change their attitude towards the commercial rice production. However the problems mentioned in (i) and (ii) needed some action taken from outside. Therefore a decision was taken to liquidate the rural indebtendness of the project farmers and at the same time to provide the loan defaulters with an expanded credit system where they could obtain inputs such as seed paddy and fertilizer and services such as ploughing and transplanting on loan. This decision was taken on the advice of the Japanese Expert on Rural Institutions. Under these circumstances an Intensive Agronomic Extension and Supervision Drive was felt necessary, for which the preparedness of the Japanese and Sri Lankan staff as well as that of the farmers were quite indispensable. Otherwise it would be a repetition of the failure experienced by the government of Sri Lanka in giving cultivation loans to the farmers. This whole operation was termed the "Productivity Maximization Programme" which stood on the three pillars of "Liquidation of Rural Indebtedness", "Expanded Credit System" and the "Intensive Agro-extension cum Supervision Drive".

The productivity maximization programme for 1971/72 Maha season was

explained to the farmers and young farmers towards the end of August. A farm management plan was prepared with the participation of the farmers and the cultivation committee. The cultivators were adviced to submit lists of inputs which they required individually, which calculations were made regarding the requirements of inputs by the defaulters under the expanded credit system. Special approval of the Secretary, Ministry of Agriculture and Lands was obtained to implement the "Rural Indebtedness Liquidation Plan" and the "Expanded credit system" for the loan defaulters. A special loan of Rs.55,000/= from the Peoples Bank was arranged for the Dewahuwa Multi Purpose Co-operative Society with a year's grace period in the repayment and with a 7% interest per year to be repayed in 5 years. With this money the indebtedness of 32 farmers were liquidated before the end of September 1971. Government Agent, Anuradhapura provided Rs.30,000/= as a special low interest loan (2% interest) on the 22nd of September to work out the "Expanded Credit System". Rs.67,326/= were received by the 65 cultivators elegible for government cultivation loans in mid August under the normal cultivation loan system for 1971/72 Maha season. As a result all farmers in the project were able to obtain their inputs for 1971/72 Maha paddy cultivation. Dewahuwa Multi Purpose Co-operative Society on receiving the order lists for inputs from the farmers undertook to supply all the materials required such as seed paddy, fertilizer, agro-chemicals and etc. Therefore from the end of September the farmers could devote their full attention on the Maha 71/72 paddy cultivation forgetting their worries and grievances in obtaining the inputs for the cultivation. (Re. Table 5.1 (2))

2.3 1971 - 72 Maha Season (October 1971 - April 1972)

2.3.1 Implementation of the Cultivation Programme and Results

(1)Farm Management

The main sluice of the tank (full of water) was opened on the 24th of September and ploughing operations were commenced simultaneously with the 40 units of two wheel tractors operated by the young farmers. These tractors were deployed under the control of the project, dividing the area into six divisions according to the distribution of the secondary irrigation channels. The simultaneous deployment of the two wheel tracters resulted in the freequent occurance of damages to the tractors due to the rough and careless handling by

the operators inspite of the fact that a large acreage was ploughed by this system. In order to avoid such damages to the tractors it was decided to allocate a specific tractor to each operator for his exclusive handling. In one month after the commencing of ploughing operations, primary ploughing of 85% of the cultivable acreage (638 acres) were completed. These two wheel tractors were used for the secondary ploughing of 296 acres (39% of the project acreage) within a period of 25 days from 27/10/71 to 22/11/71. The secondary ploughing in the remaining area was done by buffaloes owned by the farmers. The time taken for land preparation was greatly reduced and it took only 59 days for the entire operation. Accordingly sowing and transplanting were completed before the scheduled dates, 25th of November and 10th of December respectively.

The guidance on farm management was intensified and extended to each and every house hold. The farmers choose their seed paddy from the government recommended varieties, 199 bushels of BG 11-11 a newly recommended 4 month high yielding variety and 240 bushels and 112 bushels of H4 and H8 respectively which are both traditional recommendations of the government. These three varieties accounted for 56% of the seed paddy used during the season.

Free transport facilities were provided to the farmers from the Multi Purpose Co-operative Society Stores to their fields to get their basal and top dressing fertilizers to the fields. 114 farmers (74.5%) applied the basal fertilizer and 118 farmers (77%) applied the top dressing fertilizer. These ratios of fertilizer application amounted to 77% of the fertilizer target in the implementation programme for 1971/72 Maha. The ratio of transplanting: broadcasting stood at 67:33 surpasing the project target of 60:40. 62 acres which amounted to 8.2% of the total acreage was row-transplanted. Voluntary row-transplanting in 39 acres was also observed, carried out by farmers inspired by the work done by the girls row-transplanting groups.

(2) Water Management

A cultivation Committee composing of 12 farmers was formed as the central body for water management over the entire area, which was divided into 11 divisions according to the channel system so that a member of the cultivation committee could be in charge of the water distribution and management in each division. Six members of the young farmers club were

assigned as liaison agents to assist the cultivation committee in water management and to be trained as assistants to the Agricultural Extension Workers. However, it is hard to say that inspite of the efforts made to effect better water management the results obtained were not as satisfactory as expected. This could be attributed to the following reasons. The farmers had very little understanding in the benefits of water management and as a result they did not regard water as a very precious common property and at the same time the competence or the authority of the cultivation committee was also not clearly understood.

(3) Liquidation of Rural Indebtedness (loan) Expanded Credit System (loan) and the Normal Cultivation Loan

127 colonists (83.5%) out of the 153 enjoyed at least one of the above mentioned loans.

Table 2.3 (1)

Utilization of funds for the 1971/72 Maha Cultivation

	Number of Farmers	Percentage (%)	Normal Cultivation Loan		Expanded Credit(loan)		Liquidation of Rural Indebtedness	
			Total Amount (Rs)	Amount per Farmer (Rs)	Total Amount (Rs)	Amount per Farmer (Rs)	Total Amount (Rs)	Amount per Farmer (Rs)
(a) Normal Cultivation loans	61	41	35,176.65	576.67	-	-	-	-
(b) Expanded credit	35	23	-	-	20,815.90	594.70	-	-
(c) Liquidation of rural indebtedness and expanded credit	31	19.5	-	-	23,892.20	770.70	42,595.00	1,374.00
Non Borrowers	27	17.5	-	-	-	-	-	-
Total	153	100	35,176.65	-	44,708.10	-	42,595.00	1,374.00

The above table illustrates the type of loans given to the farmers. There were 27 farmers who did not utilize any of the loans extended to them. Out of these 27 farmers 7 managed from their savings and therefore the remaining 20 were the farmers who were indifferent to the application of inputs.

4. Results

(i) Water issues from the tank were stopped on the 30th of March. The harvesting which started towards the end of February continued till the 11th of April, the New Year day and the farmers celebrated the new year with a part of the money they obtained by marketing the paddy. The previous habit of borrowing money for harvesting and threshing by mortguaging a part of their paddy fields ready for harvest and the habit of out right sale of the expected harvest before actually harvesting were fortunately conquered this season.

The results of the crop cutting survey conducted by the project agronomic extension staff indicated an average yield of 74 bushels per acre which is a 40% increase over the paddy yields of the previous season (53 bushels per acre). The 114 farmers who followed the project advice diligently attained a 50% yield increase over the previous season. All these yields were the highest ever achieved since the inception of the Dewahuwa Colonisation Scheme.

(ii) Recovery of the different loans given to the farmers

A large sum of money has been given to the project farmers under different types of loans, which is unusual from the point of view of any outside farmer. As a result the process of loan recovery at Dewahuwa attracted the attention of many government officers as well as people interested in Dewahuwa Project, since the recovery of cultivation loans was an eternal headache to the Government of Sri Lanka.

Fortunately the loan recoveries at Dewahuwa were excellent and was the best achievement in the District of Anuradhapura so far. This provided a clue to the government in the process of recovering cultivation loans.

The farmers who received rural indebtedness liquidation loans made a special effort to repay an amount twice as high as the repayment made by the farmers who obtained normal cultivation loans. However, it was felt that a further 2 to 3 years will be required by the farmers who received rural indebtedness liquidation loans to complete the repayment of this loan.

Table 2.3 (2) Repayment of 1971/72 Maha Paddy Cultivation Loan

Type of loan	Number of farmers receiving loans	Number of farmers fully repaying the loan	Number of farmers partially repaying the loan	Number of farmers who made no attempt at all in loan repayment	Amount to be repayed per farmers (Rs.)	* Amount repayed per farmer (A) (Rs.)	** (A) converted to bushels of paddy (bu)	Percentage of repayment (%)
Normal cultivation loans	61	57	2	2	616.50	586.40	41.9	95.1
Expanded credit	35	22	12	2	985.48	772.02	55.2	78.3
Rural indebted-ness liquidation loan	31	16	13	2	1,658.22	1,238.04	88.5	74.7
Total	127	95	27	6	-	-	-	81.9

* including 9% of an annual interest
** 1 bushel = Rs. 14/=

(iii) Savings for the Project

Rs.9,000/= were earned and saved under the two wheel tractor programme by the young farmers who operated the tractors, another Rs.6,000/= were earned and saved by the girls transplanting groups. This amounts to about Rs.100 per household.

The success of the 1971/72 Maha cultivation could be atributed to the reasons given below:

1) The availability of irrigation water in abundance; 20,000 acre feet of tank water was utilized and the tank spilled again in December 1971.
2) The "Rural Indebtedness Liquidation Loan"and the "Expanded Credit System which were tried in Sri Lanka for the first time, made funds readily available for the provision of inputs.
3) The intensive agronomic extension cum intensive supervision of the cultivation, under the guidance of the Japanese experts.

The results achieved in this season gave plenty of confidence to the Sri Lankan staff as well as the farmers.

2.3.2 Arrival of the Investigation Team on Better Living and Agro Industries

In November 1971 a team led by Mrs. M. Yamamoto with 5 members arrived at Dewahuwa to investigate the possibilities of better living and the developments of Agro Industries. During their 3 weeks stay in Sri Lanka they made out a concrete development plan for better living and Agro Industries in Dewahuwa. This plan replaced the inadequate plan prepared by the second Feasibility survey team. The Joint Committee on 7th April 1972 decided to work out the better living and agro-industries plan proposed by this investigation team. (Ref. "Better living in Dewahuwa", by OTCA, Tokyo, Japan).

2.3.3 Other Note Worthy Incidents and Matters

1) January 15, 1972. Opening of the Dewahuwa Multipurpose Co-operative Society Rural Bank. The Rural Bank is under the control and supervision of the People's Bank and its main activities were savings and the issue of loans.
2) January 28, 1972. Hon. Mr. Hector Kobbekaduwa, Minister of Agriculture & Lands visited Dewahuwa on an inspection tour at the invitation of His Excellency S. Matsui, Japanese Ambassador in Sri Lanka.

3) February 1972. Relocation of land for the construction of the Mechanization Centre and buildings for the pilot farm. The site was located at the foot of the gravelly hill in the central project area, which was a government reserve land. The earlier site for the Mechanization Centre and pilot farm buildings was a marshy land unsuitable for the purpose, which was also occupied by seven squoters.

2.4 April - September 1972 (Yala Season)

At the general meeting of the cultivators held on 30th March 1972, it was decided to forgo the 1972 Yala cultivation in order to effect improvements to the irrigation system in the project. This was the second time farmers willingly agreed to forgo the Yala cultivation and it clearly indicates their keenness and desire in having all the irrigation difficulties cleared. However the Technical Assistants at Dewahuwa joined an island wide strike of the Technical Assistants staged for the betterment of their status and working conditions. The strike went on for 40 days and very badly affected the construction programmes at Dewahuwa, compelling a complete stopping of work and a big set back in the progress of work in the project.

2.4.1 Renovation of Irrigation Channels and Farm Roads

Setting of irrigation check gates, repairs to the water outlets and construction of side protection walls in the main channel were scheduled to be carried out during this period, however, due to the delay in the arrival of gates and construction equipment such as the compressors, concrete mixtures, jack hammers etc. from Japan the work could not be carried out. Only side protection walls to a length of 1,480 feet could be completed depending on manual labour. 11,860 feet farm road repair works were also carried out.

(2) Paddy Field Re-arrangement Work

A report on paddy field re-arrangement was prepared based on the obervations and inferences made on the demonstrative and experimental paddy field re-arrangement work carried out last year. This report was read at the Sub-Committee and forwarded to the Joint Committee for advice. The Joint Committee decided to carry out paddy field re-arrangement work under the following conditions. Out of the total cost of paddy field re-arrangement work of Rs. 1,000/= per acre, Rs.200/= will be borne by the government. The remaining Rs.800/=

will be borne by the farmers to be paid back in 20 years at an annual interest rate of 2%.

The work commenced on April 20th with a target of completing 115 acres in tract 4 before the beginning of next Maha season. Two units of D-50 type bulldozers arrived from Japan in May strengthened the fleet of heavy machinery. However due to the operators unfamiliarity to the machinery and the Technical Assistants strike only 60 acres could be completed, which is half the target.

2.4.2 Agricultural Machinery

Towards the end of the land preparation work in the 1971/72 Maha season, most of the two wheel tractors had received damages of varying degrees. The selected mechanics were throughly trained to handle the repairs. However since spare parts are not available in Sri Lanka, repairs were solely dependent on the supplies from Japan. On the other hand the standard 10% supply of spare parts which is the usual custom in Japan, was quite insufficient under the conditions prevailing at Dewahuwa, qualitatively and quantitatively. For example 15 units of two wheel tractors became unserviceable simultaneously due to the unavailability of throttle wires.

Difficulties were also experienced in the use of paddy threshers. It was found that the high efficiency automatic threshers from Japan performed less satisfactorily compared to the buffalos, due to the traditional harvesting pattern of the farmers where harvested paddy culms are nither collected in bundles nor in any other form of uniformity, therefore a 10% of the grains remain unthreshed. The high shattering quality is another disadvantage for mechanized threshing. This fact was immediately conveyed to OTCA, Japan, and a request was made for the cancellation of the previous order for threshers. However by this time OTCA had already contacted the makers of threshers and with much difficulty they managed to cancell the order for threshers.

2.4.3 Yala Cultivation

There was a successful demonstrative cultivation of subsidiary food crops in the paddy fields during the last Yala season. A similar demonstration was laid out this season, with pump lifted water from the drainage channel, in $19\frac{1}{2}$ acres with the participation of the Young Farmers Club members. 8 voluntery farmers joined the programme by cultivating 8 acres. The crop established was green gram and these cultivations were carried out under the

Demonstration Programme of the Department of Agriculture. This was the first time it was cultivated in such a large extent and the cultivators were able to attain the standard yield for green gram in the country and made net profits of Rs.600/= per acre. The income from this cultivation is equivalent to the income from a Yala paddy cultivation where the yield target is fixed as 60 bushels per acre, which is very high. Lessor water consumption of highland fields is another advantage. These demonstrations helped the management to implant confidence in the farmers and create a group of conciousness in farming under well controlled water management, which is very essential for the success of the project. In this demonstration the farmers were trained in the art of ridge making by 2 wheel tractors for Yala highland crop cultivations on the paddy fields. It was also observed that the 6 HP two wheel tractors brought to the project do not exactly suit for the Yala ploughing due to the hardness of the soil. Usually a large extend had to be ploughed within a very short time after every rain, during this rain scarce season and as a result a tractor of a bigger capacity was required for Yala cultivation.

2.4.4 Institutional Activities

(1) Establishment of the Young Farmers Club

Two separate associations were organised by the Japanese expert on rural institutions at the inception of the project for the young men and women of the project. These two associations were amalgamated to form a young farmers club under the guidance of the counterpart officers in farm management and better living, with the encouragement of the Department of Agriculture, Sri Lanka. There were 36 males and 48 females registered as members by the 15th of September 1972.

(2) Re-organization of the Cultivation Committee

The cultivation committee consisted of 12 members out of whom one of them elected as the president. The remaining eleven members were each responsible for the water management of 11 sub-divisions of the project area. The cultivation committee met once a month regularly and also when ever required to discuss matters of special interest and importance. They were trained in such a manner to act as a co-ordinating agents between the management and the farmers in farm management and water management.

2.4.5 Agro-Industries

The suggesions made by the investigation team which arrived in Sri Lanka in November 1971 on Agro-Industries, was approved by the Dewahuwa Sri Lanka Japan Rural Development Project Joint Committee, held on 7/4/1972. A sum of Rs.72,000/= was allocated for the purchase of material and equipment for Agro-Industries, in the following year's budget. The following decisions were also taken at a subsequent meeting on agro-industries held on 12/7/1972, initiated by the Secretary to the Ministry of Agriculture and Lands.

(1) Installation of the one ton per hour capacity rice mill already imported to the project from Japan.

(2) To study the suitability of weather and soil conditions at Dewahuwa prior to the import of a manioc chipping and starch manufacturing plants.

(3) To study the feasibility of domestic duck rearing and fresh water fish culture, with the assistance of the Ministry of Fisheries.

(4) Possibility of bee keeping

(5) Black-smith shop to manufacture hand tools for agriculture and simple spare parts required for the repairing of agricultural machinery. This unit to be attached to the already established Project Mechanization Centre.

(6) Import an Incubator for the development of poultry farming.

(7) It was also decided that only simple and locally available equipment should be used in agro-industries. As a result only Rs.3,500/= out of the Rs.72,000/= voted for agro-industries was approved, to cover the cost, insurance and freight charges of the incubator.

2.4.6 Pilot Farm

The subject of Pilot Farm was discussed for the first time in March 1971 since the signing of the agreement and after several examinations the following conclusions were made in May 1971.

(1) Paddy Pilot Farm: The earlier idea of working out the pilot farm at the already selected site was abandoned due to the unsuitability of the soil, which was a swamp and also due to the fact that it was located too far away from the central project area. It was decided to entrust the paddy pilot farm work to a colonist to be carried out on his own field.

(2) Upland Pilot Farm: The site selected earlier was ill drained and a good portion of the site was occupied by squotters. This site too was too far

away from the central project area and the mechanization centre. As a result it was decided that the upland pilot farm too should be worked out on a farmers field.

On the other hand the project personal could not devote any time on the pilot farm activities due to their through involvement in the productivity maximization programme and in convincing and giving confidence to the farmers. Therefore in 1972 when the working of the 1971/72 Maha cultivation got into smooth operation, the Japanese experts team made a request to the Sri Lankan government, to get down a Junior Japanese Expert to supervise the pilot farm activities. However the consent of the Sri Lankan government could not be obtained on this matter and the only concession provided was the appointment of an Agricultural Instructor to look after the affairs of the pilot farm.

The Sri Lankan officers indicated a negative attitude in working out a pilot farm at Dewahuwa, insisting that it would be a too much of a burden to the project to manage a pilot farm, looking from the point of view of the size of the project, and pointing out that it would be a repetition of work carried out by the Agricultural Research Stations of the Department of Agriculture. They also suggested that the pilot farm should be worked out with the co-operation of a project farmer on his field under a consignment basis.

As a result of this discussion the size of the pilot farm was reduced and the site was located closer to the Project Mecanization Centre on a farmers field. A plot of $2\frac{1}{4}$ acres from a government reservation closer to the mechanization centre was cleared for the uplant pilot farm in order to start the work from 1972/73 Maha season and a disbursement of Rs.5,000/= was admitted.

2.4.7 Preparations for 1972/73 Maha Cultivation

The "Implementation Programme for the 1972/73 Maha season" was submitted to the Project Director in July 1972 and arrangements were made for the farmers to know the contents as early as possible. The purpose and the contents were as follows.

(1) Direction

(i) To ensure 100% participation of the project farmers in the projects "improved paddy cultivation programme". There was only 75% participation in the previous season.

(ii) To provide advice and guidance to the farmers to make their own "farm management plan".

(iii) Education of the Cultivation Committee to up grade their technical standard so that it would act as a consulting organization to the farmers. Promotion of group cultivation and group management and utilization of machinery by allocating machinery to each group of farmers formed around each member of the Cultivation Committee.

(iv) To foster young farmers club and utilize this club fully for the cultivation.

(v) To set up the average yield target as 82 bushels per acre, which is 10% above the average yield achieved during the previous season.

(2) Preparations

(i) Explanation of the planning to the farmers.

The cultivation plan was explained to the cultivation committee members thoroughly on the 19th of August 1972. The project area was divied into 11 divisions according to the irrigation channel system with each area comming under the management of a cultivation committee member. This system was expected to ensure smoother management and it was explained to the cultivators at a general meeting held on the 28th of August 1972.

The farmers were made to submit their cultivation plans by the end of August. These plans contained the extent they wished to plough with the two wheel tractors, their fresh requirement of seed paddy, the crop establishment pattern, fertilizer requirements and the cultivation loan requirements. The Multi-purpose Co-operative Society provided the credit and materials required, according to the plans prepared by the farmers. The whole month of September was spent on discussions and preparations for the cultivation with the farmers and from the 18th the farm management group started the neighbourhood group meetings to brief the farmers on various technical matters.

(ii) Expanded Credit System

Expanded credit was extended to 66 defaulters previous season as mentioned in 2.3.2 (2) and as a result 37 farmers out of this 66

became eligible for cultivation loans. However another 4 farmers from the non-defaulter group became defaulters and the total number of defaulters with the addition of the 3 habitual and incorrigible defaulters remained as 36. The expanded credit was extended to 33 defaulters this year too, however the 3 habitual and incorrigible defaulters were excluded. The outstanding debts of the farmers were settled from the funds borrowed from the project tractor fund in order to make them eligible for the normal government cultivation loans. An intensive agricultural guidance programme was also extended to the farmers who received these special credit.

(iii) Rural Indebtedness Liquidation Loan

5 cultivators received credit under the Rural Indebtedness Liquidation Scheme. They were settled by utilizing the balance of the Rs.50,000/= allocated previous year for the same purpose.

(iv) Treatment for the farmers who did not qualify for cultivation loans.

A suggestion was made at the Dewahuwa Multipurpose Co-operative Society, Board of Directors Meeting to take over the fields belonging to the 3 habitual defaulters to be cultivated under the management of the Co-operative Society. It was also suggested for the co-operative society to provide funds for the cultivation so that several selected young farmers could carry out the cultivation. The Board of Directors of the Co-operative Society rejected this proposal on the ground that it would be unreasonable to bestow such a benefit only on the farmers of the upper stream leaving out those in the middle and lower stream. As a result the above 3 farmers were left out without loans.

2.4.8 Training of Counterpart Officers in Japan

The following counterpart officers of Dewahuwa Sri Lanka Japan Rural Development Project were sent to Japan for training in the fields as indicated.

Mr. G. I. Wijetunga; Irrigation and Drainage; April 1972 - February 1973

Mr. R.W.A. Ehelepola; Paddy cultivation; April 1972 - February 1973

Mr. L.M.C. Goonaratne; Agricultural Machinery; April 1972-February 1973

Mr. H.C.Perera; Agricultural Co-operatives; September 1972-December 197

Mr. W.R.B.Rajakaruna; Director of Dewahuwa Project also visited Japan to observe agro-industries and other related agricultural works in Japan, for 3 weeks in September 1972.

2.5 1972/73 Maha Paddy Cultivation

2.5.1 Implementation of the Programme and Results

(1) Farm Management

As mentioned above funds required for the 1972/73 Maha Paddy Cultivation was secured for 150 farmers out of the 153 in the project. There were 6,500 Ac.Ft. in the tank. A proposal was made by the Japanese Experts to try out group utilization of tractors as an initiative to the group farming. This proposal too had to be dropped out since the Cultivation Committee Members of the 11 areas could not take the responsibility of releasing the tractors to the farmers for their free use, with confidence. As a result the 38 two wheel tractors and a four wheel tractor were deployed for ploughing under the control of the project management in the previous seasons. The project area was divided into 8 regions according to the water distribution system to effect easier management and supervision of the ploughing programme.

The primary ploughing by project tractors which started on the 4th of October continued for one full month covering an area of 632 acres. The secondary ploughing which commenced on the 27th of October continued till the 20th November covering an acreage of 221 acres. In comparison with the previous season the extent under primary ploughing remained unchanged and the extent under secondary ploughing decreased. The broadcast sowing ended on the 25th of November as in the previous year. Transplanting of paddy seedlings ended on the 6th of December, 4 days earlier than in the previous year in spite of the fact that the acreage increased by 128 acres compared to last year. The actual acreage transplanted covered 84% of the project area which is well over the project target of 75%. The labour requirements for transplanting was obtained from Attam (Sri Lankan term for the Japanese work "Yui"). Row transplanting which gave the highest yield covered 175 acres. 95 acres out of this was done by the girls transplanting groups of the young farmers club and six newly organised village groups.

V 1 mixture was incorporated to the soil as the basal fertilizer at the time

of secondary ploughing. Area was used for the first and the second top dressings of fertilizer and TDM-2 which contained Nitragen and Pottassium in the ratio of N 31%: K 20% was used as the third top dressing. Convenient transport facilities for fertilizer were provided to the farmers at a reasonable charge from the warehouse to their fields. 660 acres received both basal and first and second top dressing fertilizers. In other words 144 farmers out of the 153 farmers in the project applied the basal dressing, first top dressing and the second top dressing fertilizer. However the third top dressing was applied to only 20% of the acreage in the project due to a severe drought experienced towards the end of the season.

(2) Water Management

Towards the middle of December soon after the completion of the crop establishment it became evident that the amount of water remaining in the tank was insufficient to be issued till the end of the season. As a result frequent discussions were held among the farmers representatives (Cultivation Committee Members), Japanese Experts and the Sri Lankan counterpart officers. The responsibility of water management in the branch channels and the field channels were entrusted to the cultivation committee members in charge of each of the 11 divisions mentioned earlier. A young farmer was attached to each cultivation committee member for liaison purposes between the member and the farmers.

This water scarecity which occured towards the end of the season made the farmers realize the necessity for water management. This scarecity also demonstrated the effect of timely cultivation and transplanting by the arrival of water at the tail end of the channels in sufficient quantities. The fields at the tail end of field channels received little water even during normal seasons in the past.

(3) Water Scarecity

On the 6th of December 1972 the water level in the tank read as 1,300 Ac.Ft. Which was sufficient for only 10 days. The quantity of water in the tank increased slightly due to some rain experienced towards the end of December and the accumulation in the tank was sufficient to last for one month. No rain was received in January and therefore water was issued on a very severe rotation of once in seven days. However, in spite of such a severe rotational water issue the tank exhausted on the 17th February. When all issuable water

was over it rained several times in February and March although it contributed in only a small way. Credit should be given to the efficient water management since only 8 acres were completely destroyed out of the 753 acres. However decrease in paddy yields occured in a greator part of the project area.

Net irrigation days : 111
Total amount of water issued 16,600 Ac. ft.
Gross duty of water per unit area : 7.09 Ac. ft.
Net duty of water per unit area : 3.38 Ac. ft.

The gross duty per unit area compared to the net duty was far bigger and considering the rainfall received during the latter half of the season which was very little, the acute water scarecity is clearly evident.

(4) Paddy yield of the Season

The harvesting which started on the 18th of February was completed by the 13th of April before the Sinhala New Year. The yield fell off in comparison with that of the previous season, due to the water shortage and the non application of top dressing fertilizers at the time of panicle premodia initiation stage. (formation of the very young ear head). The average yield was 72 bushels per acre which is only 3% decrease over the previous season. This 3% yield decrease was incomparable with the 30% yield decrease experienced on the average in the whole of Anuradhapura District. The Sri Lanka government highly appreciated this achievement.

The targets and the results achieved are tabled below. The planned targets were mostly achieved except for the following three items.

(a) Renewal of seed paddy,

(b) Acreage under secondary ploughing,

(c) Application of top dressing fertilizer (due to water sca recity)

If not for the water shortage the target yield of 82 bushels per acre would have easily been achieved.

Table 2.5 (1) The Target and Achievements of the 1972/73 Maha Season

Type of plan	Renewal of seed paddy (bushels)	Acreage under different varieties					Acreage ploughed by two wheel-tractors		Plant establishment types (acres)			Last date of crop establishment		Fertilizer application (tons)			Number of farmers who used fertilizer	Average yield perac acre (bushels)
		BG 11-11	H 4	H 8	Others	Total	1st	2nd	Row trans-planting	Random trans-planting	Broad casting	Trans plant-ing	Broad cast-ing	N	P	K		
Project plan	600	600	100	45	10	755	-	-	20.5	55.0	25.0	Nov. 30	Nov. 20	22.0	13.2	13.2	153	82
Farmers plan	442	430	246	73	6	755	664	353	26.6	57.0	16.4	-	-	-	-	-	140	80
Farmers results	336	443 1/4	199 1/4	90	18 1/2	753	639 1/2	221	23.3	60.7	10.0	Dec. 6	Nov. 27	16.6	12.6	7.7	144	72
71/72 Maha results	562	195	320 1/4	218 1/4	21	754 1/2	638	295	13.0	55.8	33.2	Dec. 10	Nov. 25	16.0	10.0	4.9	114	74

Table 2.5 (2) Repayment of 1972/73 Maha Paddy Cultivation Loan

Type of loan	Number of farmers receiving loans	Number of farmers fully repaying the loan	Number of farmers partially repaying the loan	Number of farmers who made no attempt at all in loan repayment	Amount to be repaid per farmer		Amount repaid per farmer		Percentage of repayment (%)
					* Amount Rs. cts	** Equivalent in bushels	Amount Rs. cts	Equivalent in bushels	
Farmers who were eligible for loans 72/73 Maha season	95	86	6	3	793.35	41.1	685.80	38.1	92.8
Farmers who had been defaulted 71/72 loans	15	6	7	2	1,045.80	58.1	737.44	41.0	70.5
Farmers whose credid deficits were paid by the project	35	12	20	3	1,626.45	89.3	970.72	53.9	60.4
Total	145	104	33	8	-	-	-	-	72.5

* including 9% of an annual interest
** 1 bushel = Rs. 14/=

2.5.2 Rice Mill

A meeting was held on the 7th November 1972 to discuss the installation of the rice mill, following the directive on the 12th of July 1972 as mentioned above. A few more discussions were held on the rice mill until April 1973. The decisions taken were:

(i) The rice mill supplied by Japan (1 ton per hour capacity) to be transfered to Dewahuwa Multi-purpose Co-operative Society, and the management to be carried out by Dewahuwa Multi-purpose Co-operative Society.

(ii) The milling of paddy to commence from the 72/73 Maha harvest.

(iii) Dewahuwa Multi-purpose Co-operative Society to receive technical and managerial advice from the Sri Lanka Paddy Marketing Board.

(iv) To mill par boiled rice in the future.

(v) To put up the rice mill building with a capacity of 2,500 bushels.

(vi) To put up the rice mill building on the rear side of the Dewahuwa Multi-purpose Co-operative Society head office building.

(vii) Dewahuwa Multi-purpose Co-operative Society to apply for a loan from the People's Bank to put up the building to house the rice mill.

2.5.3 Other matters

(1) Mr. P. Pinidiyaaratchy, Co-Manager was transfered to Kandalama Special Project, Dambulla as the Manager, on the 1st of November 1972. Mr. R. Doluweera, Counterpart officer in agronomy assumed duties as Co-Manager while continuing to work as counterpart officer in agronomy, although it caused lot of inconvenience.

(2) At the Sub-committee meeting held on the 1st of November, 1972, Government Agent, Anuradhapura made a request for the use of Project two wheel tractors for the benefit of the middle and lower stream farmers on the completion of primary ploughing in the upper stream. The team of Japanese Experts after consulting the Embassy of Japan in Sri Lanka gave a negative answer, due to the fact that no spare parts are supplied from Japan during this year. The same request was made by the farmers of middle and lower stream farmers much earlier during the last Yala and Maha seasons.

(3) On the 2nd of December 1972 the electric power supply line from Galewela

to the Project was completed. Galewela town is located $5\frac{1}{2}$ miles from the project. Rs.320,000/= (¥16,000,000) was released by the Sri Lanka Government from the funds obtained from Japan under the Kennedy Round Aid Programme. Additional funds amounting to Rs.90,000/= (¥4,500,000) from the Japanese budget was used for the import of transformers and accessories.

(4) The Sri Lanka Government indicated a change in her attiutude towards Agricultural Mechanization. Dewahuwa Sri Lanka Japan Rural Development Project was a aiming at "Modernized Farming" through mechanization. However the Sri Lankan economy deteriorated rapidly and the unemployment problem rose to a new peak. As a result the government was compelled to adopt systems where the surplus labour is readily absorbed. On account of this the order for paddy threshers for the year 1971 which were intended to be used in the Pilot Farm. The idea of importing combine harvestors was also dropped.

(5) Mr. M. Horie, Irrigation Engineer left for Japan in mid November 1972 after the termination of services at Devahuwa, which lasted for 3 years. Mr. M. Shimizu his successor arrived in Sri Lanka in late October 1972. Mr. T. Ohtani, Hydrlogist and Expert on paddy field rearrangement returned to Japan at the end of March 1973 after completing 2 years of service at Dewahuwa. Mr. T. Mase who succeeded him arrived in Sri Lanka in early March.

2.6 April 1973 - September 1973, Yala Season

2.6.1 Infra-structural Renovation and Paddy Field Rearrangement

(1) Re-inforcement of the irrigation channels and repairs to farm roads. The water issues from the tank came to an automatic stop in February 1973 since the water level went below the level of the tank sluice. As a result it became possible to construct side retention walls to the intake channel which draws the water from the centre of the tank to the sluice. There was no rain in 1973 Yala and the work could be continued even through the 1973/74 Maha season since there was no rain at all. The following work items were completed.

(i)	Desilting the main irrigation channel	12,800 feet
(ii)	Bank reinforcement in the main channel	1,900 feet
(iii)	Installation of parshal flume	1 No.
(iv)	Construction of bridge (supplied from Japan)	1 No.
(v)	Improvement of drainage channels	3 places
(vi)	Installation of check gates	2 places
(vii)	Replacement of the old main channel water outlets with new outlets supplied from Japan	48 gates

The drainage channel improvement work and the road repair work were completed at the end of 1973.

(2) Paddy Field Re-arrangement

Work on the 55 acres in track 4 which was left undone last year was started on the 5th April with the only buldozer which was operative at the time. Other bulldozers needed repairs. Work on the newly targetted 100 acres was also started with the repairing of three buldozers with parts made from Japan (Parts obtained under the supplies for 1973 from Japan). The farmers were made to sign an agreement with the project which bound them to pay the cost of paddy field rearrangement. The digging, enlarging and rough levelling of this 155 acres of paddy fields were completed by the end of October 1973. However the final levelling of the paddy fields was compelled to be done under dry conditions due to the insufficient rainfall and tank water. Therefore the quality of levelling was inferior compared to levelling under wet conditions and in December 1973 when rain came in a sudden gush the farmers had to hurry through their cultivation. As a result there was uneven growth of paddy in most of the rearranged fields due to the difference in water stagnation levels in different places within the same partition.

2.6.2 Suspension of the Upland Irrigation cum Domestic Water Supply Programme

There have been many doubts from the very beginning regarding the availability of water in sufficient quantities to start the programme. As a result several investigations regarding the availability of water was carried out after the inception of the project and the plan was modified to accomodate two proposals of the Sri Lankan officers, i.e. (i) The domestic water supply

scheme should cover the entire colonization scheme and (ii) The excess water in Maha should be utilized to cultivate 100 acres of highland (0.7 acres per household) in the upper stream area. The Japanese Experts placed orders for pumps, pipes and other equipment required for the upland irrigation cum domestic water supply programme. The total cost of these equipment amounted to Rs.210,000/= (¥12,500,000) and covered 55% of the total budget for this item. The equipment arrived during the same year and the Japanese experts did their best to promote the programme. However, this programme had to be abandoned in spite of the arrival of equipment.

The Japanese Experts explained the reasons for ordering the equipment for the domestic water supply programme at the two Sub Committee Meetings held on March 7th and April 19th, 1973 and at the Joint Committee Meeting held on April 27th. During the above joint committee the Chairman, Mr. Mahinda Silva, Secretary to the Ministry of Agriculture and Lands expressed that "We are in favour of the plan in principle, however we should work out the plan only after obtaining the farmers agreement, since they are to bear a part of the construction cost and the expenditure incurred in maintenance. On the 11th of May 1973, the Project Director following the advice of the Secretary to the Ministry of Agriculture and Lands called a meeting of the members of the cultivation committee and the farmer's representatives in order to listen to their opinions regarding the upland irrigation cum domestic water supply programme. During this meeting the Project Director offered the following comparatively favourable conditions to the farmers.

(1) Out of the cost of construction of the project Rs.650,000/=, the cost of the pumps Rs.130,000/= could be repaid within a period of 15 years with an interest of 2% per annum. Therefore the annual payment per farmer will be Rs. 70/=.

(2) Each farmers share in the operation and maintenance cost of the project would be Rs. 170/= per annum.

As a result the total cost per farmer per year would be Rs.240/=.

The farmers rejected the offer on account of the following reasons:

(1) The farmers did not require any suplimentary irrigation during the Maha season since they could manage their crops comfortably with the Maha rains.

(2) They could not use the upland irrigation facilities during the Yala season when water is most required on the highlands, since there is not sufficient water in the drainage channel to be lifted for upland irrigation during Yala.

(3) The recommended crops under upland irrigation could not be cultivated profitably during the Maha season. These crops grew well in Yala.

(4) The farmers did not agree to pay Rs.20/= per month as water tax.

(5) The cultivation committee did not have confidence to undertake the maintenance and management of the scheme.

Out of the above reasons (2) was the most strongly persisted. On account of the above objections by the farmers the Sri Lankan government expressed that this would be taken up again after a cooling off period of a year. However the team of Japanese Experts felt that, starting after another year's waiting would not enable the completion of the construction within the few years left for the Project. As such they proposed to the Sri Lanka government to take a decision before the end of January 1974. The Japanese team held several meetings with the Embassy of Japan in Sri Lanka and had close contacts with the Overseas Technical Co-operation Agency of Japan on this subject. In the meantime the Fukuda Technical Investigation Team arrived in Sri Lanka and on the 25th of September this team and the Secretary to the Ministry of Agriculture and Lands agreed to abandon the Upland Irrigation cum Domestic Water Supply Scheme and to find out other possible ways of utilizing the equipment imported for the benefit of the project. As such new suggestions were to be presented to the Japanese Experts as early as possible.

2.6.3 Farm Management

(i) Yala 73 cultivation

No water issues could be expected from the tank since there was very little left after the 72/73 Maha cultivation. There was a very thin stream of water in the Hevanella Oya, main drainage channel which could be lifted by pumps to irrigate 20 acres of subsidiary food crops. There were many volunteers expressed their wish to join the cultivation of subsidiary food crops in the paddy fields during Yala and very unfortunately they had to be discouraged due to the limitation of water. Only the young farmers club members were allowed to cultivate 22 acres under green gram in the paddy fields with lifted water from the drainage channel. This cultivation prooved to be a great success with an average net income of

Rs.600 per acre which is comparable to a yield of 60 bushels of paddy under the prevailing prices.

(2) Preparations for the 1973/74 Maha paddy cultivation

As usual the 1973/74 Maha and 74 Yala implementation programme was presented to the government of Sri Lanka towards the end of June 1973. The targeted yield for paddy in Maha 73/74 was 86 bushels per acre. However even till the end of September 1973 there were no prospects of doing a cultivation since the water level in the tank remained very low. In the past the project management would call for farmers individual managemental plans and their applications for cultivation loans by the end of August and make all necessary preparations for the on coming Maha cultivation so that water issues could be made in September.

During this time there was an all island drought in Sri Lanka and a world wide food shortage, which affected Sri Lanka to a certain extent. The Government of Sri Lanka promoted a "National Food Production Campaign" to overcome the shortages. As a part of this campaign, the government extended a loan of Rs.100/= per acre (upto a maximum of 3 acres per farmer) to those farmers who were unable to obtain normal cultivation loans due to defaulting of cultivation loans issued to them during earlier years. In addition to this convenience, seed paddy and fertilizer were supplied in kind on loan from the 1st of October.

2.6.4 Visit of Fukuda Technical Investigation Team

A technical investigation team lead by Dr. H. Fukuda (Irrigation Engineer) and with members incharge of Agronomy, Agricultural Machinery, Rural Institutions and general management arrived in Sri Lanka on the 14th September to inspect Dewahuwa Sri Lanka Japan Rural Development Project. This team carried out an integrated evaluation of the performance of the project in the past three years and investigated the possibilities of the various programmes and activities in the comming two years. They also discussed several items presented by the Sri Lankan government, listed up below:

(i) Transfer of the rice mill and the 6 ton lorry to Dewahuwa Multi-purpose Co-operative Society.

(ii) Lending of two wheel tractors to the middle and lower stream farmers.

(iii) Alternate uses of the equipment imported for the Upland irrigation and domestic water supply programme.

This mission having made observations on the local conditions and the project work left for Japan on the 26th of September 1973. The report of this mission on the project has been published by the Overseas Technical Co-operation Agency of Japan in January 1974 (Report of the Japanese Technical Guidance Team for Dewahuwa Rural Development Project, Sri Lanka.)

- 2.6.5. Other Important Matters

(1) Completion of the Mechanization Centre and the Pilot Farm Buildings.

The construction of the mechanization centre and the pilot farm buildings which started in February 1972 was completed in April 1973 after taking a little over a year. Due to some additional work required in the reinforcement of the roof and electricity distribution wiring the shifting of tractors and the work shop from the temporary buildings to the New Mechanization Centre was delayed till June. It took $2\frac{1}{2}$ years waiting after the inception of the project to start work in the spacious new mechanization centre. The mechanics had come upto a fairly high standard by this time and they could handle most of the repairs of the tractors by themselves. The pilot farm buildings included several rooms for farmer education and meetings.

(2) Augmentation of Devahuwa tank from Nalanda Reservoir

Augmentation of Dewahuwa tank from Nalanda reservoir has been a long standing and a strong request of the farmers. The limited size of the Dewahuwa tank catchment area did not provide enough run off water to accumulate in the tank to irrigate the paddy fields through out the year and sometimes through out a Maha. This wish of the farmers has not been seriously considered upto now. However on encountering severe droughts several times their interests in this diversion increased and they made several representations to the local member of Parliament and higher government officers in order to effect early consideration. This point was raised in relation to the proposed upland irrigation scheme. The Project Director pledged his support for the farmers in representing matters to the higher officials in getting the augmentation. This question was taken up at the Joint Committee Meeting held on 27th April 1973 and the Additional Secretary to the Ministry of Irrigation Power and Highways who was a member of the joint committee promised to forward a tentative estimate for the next budget.

(3) Project Co-ordinate Mr. M. Fukushima returned to Japan after completing 2 years service. Mr. S. Nishikawa his successor took over duties on 24th June 1973.

(4) The following officers returned from Japan in February 1973 after completion of the training courses in Japan

Mr. R. W. A. Ehelepola : Agricultural Instructor : Paddy cultivation

Mr. L.M.C. Goonaratne : Agricultural Instructor : Farm Machinery

Mr. G. I. Wijetunga : Technical Assistant : Irrigation and Drainage

(5) The supplies from Japan for the year 1972, valued at Rs.550,000/= (¥32,900,000/=) arrived at the Colombo Port and unloaded on the 29th April. The transport of their equipment from Colombo Port to Dewahuwa was started on the 25th May and it was completed in the latter part of July. The transport was done on a priority basis according to the requirements at Dewahuwa.

(6) On a request by the colonists of Muslim Community living in tract 4 and 5 a branch store of the Dewahuwa Multi-purpose Co-operative Society was declared open by the Member of Parliament for Dambulla Electorate and Minister of Social Services Mr. T. B. Tennakoon on 5/8/1973. This store handled rationed goods such as rice and sugar and other consumption items. This branch handled about 700 rice ration books and its functions were limited only to the handling of consumption goods. The agricultural produce, inputs and cultivation loans were handled by the other branches as before.

(7) The "Pubudu" young farmers club celebrated its first anniversary on 30/9/1973. The membership was over 60 and they contributed largely in the agricultural mechanization, seasonal cultivations other cultural activities.

2.7 Maha 73/74 - October 1973 - April 1974

2.7.1 The Drought and the Delay in the Starting of Maha Cultivation

Everything was ready for the 73/74 Maha cultivation and the farmers and the officers were waiting impatiently for the water issue. No water could be issued from the tank due to very low level and the rains had to be awaited. The government took a special measure to support the loan defaulters in the whole country by issuing seed paddy, fertilizers and agro chemicals as a special credit in kind and providing Rs.100/= per acre to cover operational costs, upto a maximum of 3 acres per farmer. This new credit scheme was an

incentive for the farmers under the "National food production drive", 41 farmers in the Sri Lanka Japan Rural Development Project received credit under this scheme.

There were only 600 acre feet of water in the tank at the beginning of the season which was only 1/14 of the tank capacity. This made it impossible to start the cultivation by issuing water with confidence. In the past during normal seasons it has been possible to open the tank sluice, by the middle of October the latest. However this season there was not enough rain to fill up the tank to the required level to commence water issues. At last the rains which fell from the middle to the end of December filled the tank upto 90% of its full capacity making it possible to start the Maha cultivation. Until then the farmers and the project officers could not do any thing other than conducting meetings and discussions regarding the cultivation. The contents of the discussions and meetings have been summarised below.

October 9 : A decision was taken to wait until the 15th November to start the water issue in case the drought continued at a project staff meeting.

October 27 : Cultivation Committee Meeting

(i) To start primary ploughing without using tank water from the middle of November to enable at least dry sowing.

(ii) To make a group of 5 farmers and to allocate a single tractor to each group.

(iii) To encourage the farmers to forward their loan application early for the special loan provided this year under the National Food Production Campaign and for normal cultivation loans. Applications of only 2/3 of the farmers have been received inspite of the fact that loans are issued immediately after the opening of the tank sluice.

(iv) To cultivate three month varieties in the case of failure of rains.

November 9 : Cultivation Meeting of Dewahuwa Colonization Scheme

(i) If the tank water storage increases to 5,000 acre feet at the beginning of December, to use tank water for the secondary ploughing and transplant 4 month varieties.

(ii) If the tank water storage increases to only upto 4,000 acre feet in mid December to work out the same plan as in (i) in half the area of paddy fields under the tank. The other half will remain fallow.

(iii) In case the water storage in the tank does not increase over 3,000 acre feet even in January to broadcast 3 month varieties. The management to prepare 3,000 bushels of seed paddy from a three month variety (BG 34-8) required for the cultivation. The group cultivation decided in the previous meeting had to be given up since the farmers felt that in an emergency like at present it is not possible to work out such group programmes. The Cultivation Committee also explained their difficulties in managing the groups. A decision was also taken to extend the services of 10 tractors to cover 200 acres in tract 6 as a test.

November 23 : Cultivation Meeting of Dewahuwa Colonization Scheme
The tank water storage was not more than 1,000 acre feet even with the month of December in sight and therefore fresh decisions had to be taken.

(i) To cultivate 3 month varieties in the entire area.

(ii) To prepare for a "Bethma" cultivation (Cultivation of only a portion of the total area)

(iii) To hold a farmers meeting again when the water level reaches the 15 feet mark.

December 22 : Cultivation Meeting of Dewahuwa Colonization Scheme
The tank water storage was only 1,800 acre feet by this time and there was an increasing tendency due to the rain fall since the 13th of December. The decisions taken were as follows:

(i) The Japanese experts, Sri Lankan officers and almost all the farmers except for those who had already prepared their land for dry sowing insisted for a "Bethma" Cultivation of half the extent under the tank with three month varieties for safety. Under the "Bethma" each farmer will be able to cultivate $2\frac{1}{2}$ acres. However Government Agent, Anuradhapura disallowed

the request and ordered to cultivate the full extent under the tank. This decision would have been due to political pressures under the "National Food Production Drive"

(ii) To complete primary ploughing before the 15th of January without using tank water and to start water issues from 15th onwards for secondary ploughing to finish sowing before the end of January.

(iii) To stop water issues on the 1st of April.

Upto this time the project management was also planning for various alternatives. A combination of paddy and subsidiary food crops or a cultivation of subsidiary food crops or vegetables on the paddy fields was suggested. However the farmers insisted upon waiting for rain so that they may be able to cultivate paddy. They did not mind even failing to cultivate paddy in case the rain fails after waiting for a long period. The Government of Sri Lanka adviced the Japanese Experts to listen to the farmers opinion.

At the beginning of December 1973 it was felt that paddy cultivation in Maha 73/74 was impossible. The Japanese experts distributed 10,000 cuttings of manioc and 3,000 cuttings of sweet potatoe for planting to the farmers free of charge. This was done in order to help them overcome their food crisis. The manioc cuttings were planted around their homesteads in 0.5 acres on an average and this contributed in a large way in solving their food problems even later in the 74/75 Maha season where no paddy was cultivated.

2.7.2 1973/74 Maha Paddy Cultivation

This was started with the order by the Government Agent, Anuradhapura to cultivate the whole extent under the tank. Under this order the primary ploughing had to be completed before the 15th of January without using tank water. However around January 3rd and 4th after the rain ceased the paddy fields dried up in 4-5 days and it became very difficult to plough without using tank water. As a result the earlier decision was changed and it was decided to utilize tank water for primary ploughing so that sowing could be completed before end of January. In the actual performance 90% of the ploughing was completed by the end of January by mobilizing the 2 wheel tractors, 4 wheel tractors and buffalos and 97% of the fields (i.e.2,005 acres) were sown by the

middle of February although there was a slight delay according to the calander fixed.

The harvesting was over by the end of June. In spite of the farmers' and officers utmost precautions to save water 11.7% of the acreage dried up without any yielding. The total amount of water issued from the tank was 11,428 acre feet which amounts to 5.2 feet per acre in the field, which becomes 6 feet on adding the 0.8 ft. of effective rain fall. In comparison with the 7.1 ft. in the previous season where water shortage was experienced towards the latter part of the season it would be easier to understand the gravity of the water shortage experienced during 1973/74 Maha cultivation.

The fertilizer input dropped to $\frac{1}{2}$ to 1/3 of the previous season due to the unreliable water situation. The ratio of transplanting: broadcasting dropped to 13:87 compared with the performance in the previous season. The broadcasted fields had prominant weed growth due to the scarecity of water for natural weed control. The average yield in the fields which could be harvested was 33 bushels per acre. Therefore the average yield in the entire project area would be less than 30 bushels per acre.

As a result of this poor yield only 14 farmers could repay their cultivation loans in full, 27 were able to pay back a part of the loan and 104 farmers could not pay back anything at all. When expressed in terms of money only Rs.14,209/= was repaid out of the Rs.105,074/= (with interest) due to the Co-operative Society. In other words only 13.5% of the loans issued were recovered. The paddy purchased by the Co-operative Society stores was only 4,937 bushels which is very low in comparison with the 23,745 bushels purchased last season.

2.7.3 Alternative Plan for the Upland Irrigation cum Domestic Water Supply Scheme

As mentioned in 2.6.4 the Sri Lankan counterparts were supposed to propose alternative plans for using the equipment imported for the upland irrigation cum domestic water supply scheme to the Japanese experts. The Japanese experts changed their mind and they too co-operated in thinking of alternate plans. Three alternate plans were forwarded by them. In February 1974 the Sri Lankan counterparts suggested to use the equipment imported for the upland irrigation cum domestic water supply, for irrigating a new area on

the left bank of Hevanella Oya. Later it was found that the equipment could be used for irrigating 160 acres of highland crops and 100 acres of paddy field on opening the new area.

2.7.4 Agro Industries

(1) Rice Mill

There was a request from the Dewahuwa Multi-purpose Society for the transfer of the rice mill received under the Japanese aid programme to the Co-operative Society. According to the suggestions of the Watanabe investigation team (2.6.4) the Government of Sri Lanka and the Dewahuwa Multi-purpose Co-operative Society came to an agreement regarding the rice mill. According to the agreement the rice mill and equipment would be rented out to the Co-operative Society at a fair rate within the duration of the project period and after the termination of the project the Multi-purpose Co-operative Society to purchase the paddy mill out right. The Board of Directors of the Co-operative Society agreed to put up a building to install the rice mill and to use as a warehouse, by obtaining a bank loan.

(2) The Joint Committee agreed to import a manioc chipping machine from Japan for Agro industries, since the manioc cultivation has widely spread in the project with the National Food Production Campaign.

(3) A decision was taken to encourage poultry keeping by the farmers as training so that they would reach a good standard in this field by the time the incubator in put into operation.

2.7.5 Pilot Farm

An experimental high yield paddy cultivation based on different methods of crop establishment and water management was conducted on the advice of the Fukuda investigation team. However the results could not be achieved due to water scarcity causede by the drought. Sunnhemp was sown on the upland pilot farm for green manure to improve soil fertility in order to cultivate vegitables and other highland crops under rain fed conditions during the Maha season.

2.7.6 Family Planning

A family planning campaign was launched with the co-operation of the Medical Officer of Health Services, Dambulla and Public Health Inspector

of Dewahuwa Colonization Scheme. Several family education programmes were conducted with the help of visual aids. Several film shows were also arranged. There was 50% attendance for these meetings and it prooved to be a success. There were several volunteers of either sex for the contraceptive operation.

2.8 1974, April - October 1974

2.8.1 Paddy Field Rearrangement and Infrastructural Renovation Work

The paddy field rearrangement work was started a little later than usual due to a delay in the harvesting of the 73/74 Maha paddy cultivation which continued till late June. Although the paddy field rearrangement work was started in late May in early harvested fields, repair work on the irrigation channel had to be delayed till early July, due to the water issues along the channel for late cultivators. However due to a delay in the starting of 74/75 Maha cultivation the work could be continued till October 1974. The progress made during this period is summarised below:

(1) Repairs and improvements to irrigation channels and roads

Reinforcement of enbankment	2,845 feet
Check gates on main channel	2
Farm road bridges	2
Sluice gates for main channel outlets	28

(2) Paddy field rearrangement work

The crank shaft of a buldozer brokedown accidentally, several other machines were also in need of repairs. Although a request was for an emergency supply of bulldozer spare parts from Japan nothing could be received due to an economic confusion in Japan which has arisen due to the "Oil Crisis". As a result only one out of the four buldozers could be operated and only 47 acres could be rearranged out of the target of 150 acres fixed for this season.

(3) The alternative plan for the Upland Irrigation cum Domestic Water Supply Scheme

(i) In June 1974 Watanabe inspection team urged the Sri Lankan Government to suggest an alternative plan for the utilization of equipment imported for the Upland Irrigation cum Domestic Water Supply Scheme.

(ii) The lift irrigation scheme on the Hevanella Oya left bank, with a capacity of irrigating 100 acres of paddy field and 160 acres of highland was approved by the cultivation committee.

(iii) A meeting of the encroached cultivators and project farmers of the proposed Hevanella Oya lift irrigation area was held in August 1974. There were 36 colonists among the encrochers, with another, 76 from outside the project there were 112 encrochers. The proposed lift irrigation scheme, its purpose and re-allocation of land was explained to the encrochers. Only 2 acres will be given to each encrocher and a water tax of Rs.300/= per acre will be charged from the alloties. The young farmers club will be given special preference and a block of 25 acres will be allocated to them. The gathering agreed for the scheme and pledged their full support.

(iv) The Hevanella Oya Lift Irrigation Project Plan was approved by the Secretary, Ministry of Agriculture and Lands in late August 1974.

(v) September 1974 : Commencing of land survey by the Survey Department of Sri Lanka

(vi) October 1974 : Appointment of a working committee to expedite the construction.

2.8.2 Arrival of Watanabe Inspection Team

An inspection team led by Mr. S. Watanabe and comprising of 4 other members was sent by the Agricultural Co-operation Department of the Overseas Technical Co-operation Agency of Japan. The purpose of this visit was to re-examine the direction of the technical co-operation that should be extended by Japan during the remaining $1\frac{1}{2}$ year period of the Project. The team stayed in Sri Lanka for six days from the 15th of June 1974 and had several discussions with the officers of the Sri Lanka Government. The memorandom prepared by the team was handed over to the Secretary, Ministry of Agriculture and Lands. The contents were as follows:

(i) The Japanese experts team should prepare technical manuals on Agronomy, utilization and maintenance of Agricultural Machinery and water management to be used as guide books in the future in achieving higher paddy yields in the future.

(ii) Paddy Pilot Farm programme to be adjusted as follows:

Maha : demonstration of paddy cultivation with rational water management

Yala : demonstration of the cultivation of subsidiary food crops and vegetables.

(iii) Completion of paddy field rearrangement work in 300 acres in 1974 and 1975.

Prepare a technical manual on water management based on the actual experimentation in the rearranged paddy fields. Continuation and completion of the structures originally planned for the improvement of the irrigation channels.

(iv) To start the operation of the rice mill as early as possible.

(v) Preparation of an alternative plan for the utilization of equipment imported for the upland irrigation cum domestic water supply scheme, by the Sri Lankan officers as agreed with the Fukuda Inspection Team.

2.8.3 Farm Management

(1) Yala Cultivation

A decision was taken not to issue any tank water for a cultivation in Yala 1974 since only 1,650 acre feet of water were left in the tank at the end of the 1973/74 Maha cultivation. However a small scale cultivation was carried out as described below.

(i) Those farmers who finished the Maha 73/74 cultivation ahead of others cultivated 14 acres during Yala 74 in their paddy fields under subsidiary food crops utilizing their share of the irrigation water issued for paddy cultivation.

(ii) A 25 acre demonstrative cultivation of the Department of Agriculture of subsidiary food crops in paddy fields, irrigated by lifting water from the Hevanella Oya. 8 acres out of this were cultivated by the young farmers club. Crops cultivated were cow pea and green gram. The cultivation of tobacco under rain fed conditions in paddy fields during Yala was allowed for the first time.

The drought hardened soil required a pre-irrigation before ploughing. 4 wheel tractors were used for the primary ploughing and two wheel tractors for ridging, for the reason that the optimum period for ploughing was unexpectedly

short after irrigation.

(2) Preparations for the 1974/75 Maha Cultivation

Several meetings and discussions were held in-preparation for the 1974/75 Maha cultivation. However the tank water level remained very low and it was not possible to start the cultivation in October. There were no prospects for securing the cultivation loans. Summaries of the proceedings of the meetings and discussions held are given below.

(i) The 1974/75 Maha and 75 Yala Agricultural Implementation Programme of the Project was submitted to the government at the end of May 1974. However from 1974 onwards the newly formed Agricultural Productivity Committees were supposed to prepare the Agricultural Implementation Programmes for the areas under their control. Dewahuwa Colonization Scheme and the Sri Lanka Japan Rural Development Project came under 3 and 2 Agricultural Productivity Committees respectively. The fact that the scheme and the project were divided into several cultivation committee areas with no regard for the water distribution system, confused the matter further. The scheme and the project came under two different administrative districts making the matter worse. Although this caused inconvenience to the farmers no steps were taken by the government to ease out the situation due to political reasons. Priority was given for politics and not for agriculture.

(ii) 21,8.74 Cultivation Committee Meeting

28.8.74 Project Staff Meeting,

2.9.74 Discussions between the Project Director and the Project staff.

At the time of accepting farmers applications for cultivation loans it was observed that only 11 (7%) farmers in the project area were qualified for the normal cultivation loans. They have been forced to default the cultivation loans received in 1973/74 Maha due to the failure of the Maha cultivation forced on them by the Government Agent of Anuradhapura District. Therefore the project officers and the Japanese Experts having discussed the problem adequately with the farmers, represented matters to the Project Director to

find out a possibility of securing funds to be issued to the farmers as a special cultivation loan.

(iii) 18.9.74 Project Staff Meeting

19.9.74 Cultivation Committee Meeting

The following decisions were taken during the above two meetings

(a) Conduct a survey to determine the financial position of the cultivators regarding the 74/75 Maha cultivation.

(b) Prepare a new cultivation programme to start cultivation from October and estimate the amount of money required for supplying the inputs required and for land preparation.

(c) To give up dry sowing for this season.

(d) To carry out group farming and group utilization of machinery.

(e) To start water issues from the 1st of November 1974.

Survey conducted "(a)" revealed that 40% of the farmers were ready with finances to purchase their seed paddy requirement and for land preparation, but no one had enough money to purchase the fertilizer requirements.

(iv) 27.9.74, 10.10.74 and 11.10.74 - Project Staff Meeting

The Project Director informed that there is no possibility of obtaining a special fund to provide cultivation loans to the farmers. As such the project officers examined the possibilities of utilizing the "Dewahuwa Reserve Tractor Fund" which were savings made by the Mechanization Centre in hiring out tractors to the farmers, in order to purchase new tractors. This fund could be utilized to provide ploughing services on a loan basis to the farmers in the 1974/75 Maha season. The management also examined the possibility of allocating tractors to groups of farmers to be at their full control, in order to encourage group formation and farming. A reduction in ploughing charges was also decided for groups of farmers.

(v) 12.10.1974 Cultivation Meeting of Dewahuwa Colonization Scheme.

The decisions taken are listed up below.

(a) Water issues to be started only when the tank water level reaches the 18 feet mark i.e. 3,500 acre feet.

(b) Completion of sowing and transplanting by the 5th and 15th December respectively.

(c) Cultivate 4 month paddy varieties.

(d) Allocation of 32 and 15 units of two wheel tractors ot the upper and middle stream areas respectively.

(e) To send a petition to the co-ordinating secretary to the Prime Minister requesting to ease the conditions laid out to qualify for cultivation loans, considering Dewahuwa as a special case due to it's misadventure in the previous year.

(vi) 15.10.74 An appeal was made to the District Political Authority of Anuradhapura to provide a special loan or to ease the conditions required to qualify for loans. The Political Authority agreed to convey the message to the central government.

(vii) 21.10.74. A petition was sent through the Member of Parliament for Dambulla, Minister of Social Services, Mr . T.B. Tennakoon to the central government.

Even at the end of October the water situation and the position regarding the availability of funds did not show any improvement. The Japanese Experts informed Japan International Co-operation Agency about the seriousness of the situation at Dewahuwa without funds and water for cultivation, and requested the JICA to send Mr. T. Sasaki Expert on Agricultural Co-operatives and Rural Institutions, who has two years experience at Dewahuwa on similar problems. The request was granted and Mr. Sasaki arrived in Sri Lanka on the 31st of October to work at Dewahuwa for a three month period.

2.8.4 Other Important Matters

(1) Mr. K. Kanno, Expert on Agricultural Economics left the project on 7th June 1974 after serving for 2 years and 2 months. No successor was appointed.

(2) Counterpart Officers training in Japan.

Name of Counterpart Officer	Designation	Period of stay in Japan	Course of training
Mr.R.R.Uyangodage	Technical Assistant	April - September 1974	Irrigation and drainage
Mrs.G.K.Kandegama	Agricultural Instructor	July - September 1974	Individual course in Better Living
Mr.H.M.M.G.Kiribanda	Technical Assistant	September - December 1974	Irrigation and drainage

(3) Counterpart officer in Agricultural Machinery Mr. L.M.C.Goonaratna was transfered to Sri Lanka West German Farm Machinery Training Centre as a Farm Machinery Instructor on his request. However it was too the regret of the Japanese Experts since this was transfered soon after his return from Japan after following a course in Farm Machinery. Mr. D. B. Niyangoda, Agricultural Instructor joined the project as his scuccessor.

(4) The new mechanization centre buildings were completed in August 1974 almost 4 years after the inception of the project and electricity was provided. The young farmers club and the cultivation committee were given two separate rooms from the pilot farm building. The pre-fabricated building sent from Japan as part of the equipment supplies was erected on the Project Head Office compound. This work was completed in August 1974 and 1/3 of the building was used as the office and the balance for the project stores. However the building was quite unsuitable for an office.

(5) The "Pubudu" young farmers club members made a study tour using the project mini-bus and groups of farmers from the project area and the middle and lower streams also made several study tours utilizing the mini-bus.

2.9 November 1974 - June 1975 (Maha and Meda seasons)

2.9.1 The Preparations for the 1974/75 Maha Cultivation and its Suspension

The paddy cultivation programme prepared to start the cultivation from the 1st of November had to be abandoned due to the shortage of water. The storage in the tank was only 1,500 acre feet which was only 7-8% of the requirement for the cultivation of the entire area. However the Sri Lankan officers and Japanese Experts proceeded ahead in their planning so that the cultivation could be started at any time if water is available. The project officers worked hard to improve the financial position, rallying round Mr.T.Sasaki who is well experienced in such matters.

(1) The new Maha 74/75 paddy cultivation programme and preparations

(i) A decision was taken with the farmers consent to cultivate only half the area under paddy which amounts to 1,170 acres, if the water level reaches the 18 feet mark (3,500 acre feet) by the 30th of November. Later on this deadline was extended upto the 10th January

1975. Under this proposal each farmer would get $2\frac{1}{2}$ acres which is half the extent cultivated under normal circumstances. This system was called a "Half Bethma" and the cultivation was carried out only in the upper and middle stream areas. The land allocation for the "Bethma" cultivation was over by the end of November.

(ii) The "Bethma" plan included the following varieties and patterns of planting.

4 month varieties	BG 11-11	65%
	H4 or H8	35%
transplanting		85%
broadcasting		15%

Arrangements were made to secure 1,000 bushels of seed paddy recommended and certified by the Department of Agriculture and on the 24th of December 560 bushels of BG 11-11 and 450 bushels of H4 were obtained from the seed paddy stores of the Anuradhapura District Agricultural Extension Officer.

(iii) The quantity of fertilizer required for a successful cultivation at Dewahuwa was reexamined since the prices of fertilizer shot up three fold due to the oil crisis. The fertilizer requirements were calculated as follows according to the planning at (i) and (ii).

Basal Fertilizer	V 1	110 cwt.
	NPK 14:14:14	1,700 cwt.
First top dressing urea		490 cwt.
Second top dressing urea		490 cwt.
Third top dressing	TDM-2	70 cwt.

The above fertilizers were secured without any difficulty.

(iv) The yield target was set at 75 bushels per acre.

(v) Group farming: Groups comprising of 10 farmers and cultivating blocks of 25 acres were formed in order to promote better water management, effective guidance in farm management and group utilization of machinery. It was also proposed to allow the free use of a two wheel tractor to each of such organized groups for which the farmers showed a keen interest. However this plan did not develop into realization.

(vi) It was also decided to allocate 40 units of two wheel tractors to the upper strea area (project area) and 15 units to the middle stream area. 25 young men from the middle stream area were trained in the operation of two wheel tractors in November for this purpose.

(2) Procurement of the cultivation funds

A sum of Rs.600,000/= was required to implement the cultivation plan described above. Rs.100,000/= out of this total was available through the normal cultivation loans issued to the eligible farmers. However the balance Rs.500,000/= had to be procured by some other means. The following sources were contacted.

(i) Appeals were made to the government through Mr. T.B. Tennekoon, Member of Parliament of the area and the Minister of Social Services in November, and through Mr. Mahinda Silva, Secretary to the Ministry of Agriculture and Lands in December, in order to ease out the strict conditions laid down to qualify for the cultivation loans. This attempt was not fruitful and the Secretary suggested to borrow the funds required from the People's Bank.

(ii) Attempts were made in opening away to borrow the funds required from the Peoples Bank, from November. The Director General of the People's Bank showed keen interest in the cultivation plan of the season, the loan scheme and the repayment system and the treatment of the loan defaulters. He anticipated 100% recovery of the loans extended to the farmers under the project guidance. A report explaining the reasons for the application of a special loan was submitted to the People's Bank on 16.12.1974.

Appeals were made to the Secretary to the Ministry of Agriculture and Lands, Project Director, Commissioner of Co-operative Development, Government Agent, Anuradhapura, Assistant Commissioner of Co-operative Development, Anuradhapura, and the Embassy of Japan in Sri Lanka for their support in our attempt to procure funds for the cultivation. However at the Board of Directors Meeting of the People's Bank held on 10/1/75, our request was turned down due to the following reasons.

(a) If the Bank extends a special loan to Dewahuwa Sri Lanka Japan Rural Development Project, the members of parliament of the other special project

areas too may apply pressure on the Bank to extend special loans to their areas which is beyond the capability of the Bank.

(b) Even if 100% recovery of cultivation loans is expected this season, the performance in the previous season is very low at 15% to consider for a special loan this season. The Bank felt that the last seasons loan recovery was very low even if an allowance is made for the drought which prevailed through out the season. The results of the 73/74 Maha cultivation were very poor since an impossible order given by the Government Agent, Anuradhapura, to cultivate the full extent under-paddy had to be carried out. The farmers and the project officers felt that the cultivation of half the extent was the most appropriate.

There were no more possibilities of obtaining a financial aid for the cultivation. On the other hand, although there was a slight increase in the tank water level, the quantity of usable water was not more than 1,500 acre feet. With this only 200 acres could be cultivated under paddy and the share for each farmer would be less than $\frac{1}{2}$ acre. With a cultivation of such a small acreage farmers will not be able to produce enough paddy to repay the cultivation loans. The yields will be only sufficient for their consumption needs.

Towards the end of December 1974, Government Agent, Anuradhapura sent instructions to examine the possibilities of cultivating subsidiary food crops on the paddy fields utilising the little water available in the tank as a means of co-operating with the National Food Production Drive. Again at a national level conference of the Agricultural officers of the Department of Agriculture, the Director of Agriculture made a strong appeal to the participants to promote the cultivation of food crops other than paddy on paddy fields where it has become impossible to grow paddy due to the drought. The Deputy Director of Agriculture (Extension Division) encouraged the participants to promote the cultivation of sorghum on paddy fields since this crop required less than 1/3 the amount of water required by paddy. He also stressed on the cultivation of subsidiary food crops on paddy fields.

Accordingly the project staff soon set to work on the planning for the cultivation of subsidiary food crops on the traditional Maha paddy fields. A decision was taken to cultivate 720 acres under sorghum on a "1/3 Bethma" where each farmer could cultivate $1\frac{1}{2}$ acres and the farmers consented for this

proposal on 10.1.75.

2.9.2 Cultivation of Subsidiary Food Crops in 1975 Meda Season

(1) Countermeasures against the financial difficulties

Even for the cultivation of subsidiary food crops a certain amount of funds were required. The project officers and Japanese experts represented matters to the Secretary to the Ministry of Agriculture and Lands and several reliefs were obtained.

(i) To purchase sorghum seeds of a high germination percentage with funds provided by Government Agent, Anuradhapura. These seeds were to be issued on credit to the farmers through the Dewahuwa Multi-purpose Co-operative Society, to be recovered at the time of harvest.

(ii) To borrow the necessary fertilizers from the Sri Lanka Fertilizer Corporation and issue to the farmers on credit as mentioned in (i) above. The Fertilizer Corporation will be supplied with the stocks that are expected soon from Japan.

(iii) During this time the farmers were provided with drought relief work which provided an income of Rs.70/= per person per month. The farmers agreed to forgo this Rs.70/= and pay an additional fee of Rs.15/= to get one acre ploughed by the project tractors. The farmers and their family members were withdrawn from the normal drought relief work such as road construction and put on to the paddy fields to weed the fields where sorghum was expected to be cultivated. Mr. T. Sasaki, terminating his 3 month stay at Dewahuwa left for Japan on 31/1/1975.

(2) Cultivation of subsidiary food crops on paddy fields and the result

The allocation of land to the farmers under the 1/3 Bethma system was completed on the 20th of January. 500 lbs. of sorghum seed purchased from a private cultivator on 7.2.1976 were stored at the Co-operative Society Stores. The Sri Lanka Fertilizer Corporation approved the release of 54 tons of NPK and 36 tons of urea for Dewahuwa and a part of it was transported to Dewahuwa on 20th of February. However the farmers interest in the sorghum cultivation was very low since such a large scale cultivation was a novelty to them. As such the last date of sowing was prolonged from February to the middle of March.

Only 20% of the cultivators applied for fertilizer. There was only 52% of participation of the farmers in the sorghum cultivation. 247 farmers out of 464 participated in the programme. Out of the 247 participants only 169 were actual colonists, the other 87 were outsiders who had illegally bought the cultivation right of the land from the colonists. Only 3 colonist farmers out of the 133 in track ⁿ and 9 joined the "Bethma" Sorghum cultivation. For them the cultivation plots were too far away from their homes, sometimes a distance of more than 8 miles. Since the transport facilities within the project were very poor, these farmers felt that it is uneconomical for them to commute such a long distance to cultivate such a small plot under sorghum. These farmers managed some cultivations around their homesteds. The Japanese Experts clearly understood the difficulties of these farmers and the "Bethma" cultivation.

The total acreage cultivated by the farmers was 309 acres,and sorghum covered only 23% of this acreage, cow-pea 55% and other crops 22% inspite of the fact that the project planning was for a 100% sorghum cultivation. The reasons for this low acreage have been analysed below.

(Table 2-9 (1))

(i) The farmers preferred to cultivate, crops which they had lot of experience and which assured them with some return even under a drought condition. These crops were, cow-pea, green gram, tobacco, chillies, gingerly etc. Sorghum was introduced recently and they were totally unaccustomed to its cultivation under irrigation on the paddy fields since it was grown earlier only as a Maha rain fed crop on the high lands.

(ii) Farmers had successful experiences with the cultivation of cow-pea in the paddy fields.

(iii) There was very severe bird damage in sorghum during the time of heading.

(iv) The manioc cultivated under the "National Food Production Campaign" and the wheat flour supplied at a low price by the government made them self sufficient in carbohydrates 90% of the farmers had grown more than $\frac{1}{2}$ acre of manioc.

(v) The market price of sorghum was about to come down at the time of planting. The farmers had sensed this.

Towards the end of March the government increased the ration of wheat flour to ease of the food shortage during the Sinhala New Year. As a result the market price of sorghum came down to a new low. The price of a pound of sorghum which was at Rs.1/40 at the time of planting came down to =/40 cts. in March. The government decided to purchase sorghum seeds through the Paddy Marketing Board at =/60 cts. a pound. On the other hand the market price of cow-pea went down from Rs.3/00 per lb. to Rs. 1/50 per lb. However the loss to the farmers was not as much as in the case of sorghum. This was far from a matter of technical co-operation.

2.9.3 1975 Yala Cultivation

(1) 1,500 acre feet of usable water remained in the tank, however after careful examination of the situation it was decided to abandon the 1975 Yala cultivation. The Meda cultivation of subsidiary crops had overlapped with the Yala season. The following ideas were suggested by the project before taking the final decision to forgo the Yala cultivation.

(i) To increase the area already cultivated under cow-pea, sorghum etc. in Meda to go through the Yala season.

(ii) To cultivate 100 acres under seed paddy farms to procure the 1975/76 seed requirements of the project. An island wide seed paddy shortage was anticipated since the paddy cultivation in many districts have been unsuccessful.

(iii) Abandon organized large scale Yala cultivation

The only cultivations in the project were:

(a) A six acre demonstration of cultivation of black gram carried out by the Young Farmers' Club, sponsered by the Department of Agriculture.

(b) Small scale cultivation of legumes, tobacco and vegitables in 20 acres by several volunteer farmers.

(2) Cultivations in the highland allotments and the chenas (a type of high land)

There were 160 homesteads in the project highland allotments including those put up by the second generation of the settlers. The farmers and their family members in 154 highland homesteads were engaged in some kind of cultivation either on their highland allotments, or in government reserved land or in the chenas (highland cultivation done after clearing jungle or shrub jungle).

Each of these families cultivated more than 1/4 of an acre and the acreages under each crop were-

	Acrp
Chillie	169
Tobacco	68
Manioc	60
Vegitalbes & pulses	50
Total	330

The average area cultivated per house hold was 2 acres. As such most of the farmers were thoroughly involved in some sort of cultivation and as such they did not engaged much in dry farming in the paddy fields. It would be an important matter to select the crops that should be cultivated on the paddy field during Yala seasons once Yala paddy field irrigation is realized. A severe competition between tobacco, subsidiary food crops and paddy is anticipated.

Very fortunately due to the even distribution of rainfall during the Yala season, farmers obtained very good yields from their Yala cultivations. A certain farmer in the middle stream area obtained over 1,000 lbs.per acre in black gram and 2,000 lbs. from soya beans. He sold the produce at Rs.4.00 per lb. and purchased a two wheel tractor with the money obtained from sales.

2.9.4 Constructions and Renovations of the Infra-Structure

(1) Hewanella Oya left Bank Lift Irrigation Scheme

(i) The Ceylon Electricity Board of Sri Lanka submitted an estimate of Rs.94,000/= for the supply of hydro electricity to the pump house of the Hewanella Oya Lift Irrigation Scheme.

(ii) 160 acres of highland and 100 acres of paddy land were suggested for lift irrigation according to the plan. After the topographical survey conducted by the Sri Lanka Survey Department, the Secretary to the Ministry of Agriculture and Lands approved the 160 acre high land area for lift irrigation and as such the 100 acres selected for paddy cultivation was dropped from the plan.

(iii) In April 1975 the Ceylon Electricity Board, Sri Lanka submitted a fresh estimate of Rs.150,000/= for the supply of electricity to the Lift Irrigation Project. The sudden increase of the estimate was due to the increased prices of materials, fuel, labour charges etc. and the approval of the Secretary to the Ministry of Agriculture and

Lands was sought. It came in late May.

(iv) Work on the lift irrigation scheme was started on 2.6.1975. Construction of the barrage and the pump house and the installation of the pumps were completed in September 1975. The power installation work, pipe line and forebey for water distribution, and field channels were yet to be constructed.

The completion of the construction works within the project period was only a dream and therefore the team of Japanese Experts started worrying about the test running of the electric water pumps, since they were lying in the project compound for 2 years after arrival from Japan. Therefore the Japanese Government decided to despatch an expert on the electric water pumps for its trial run even if it happens after the termination of the project.

(2) Construction of side protection walls at the tank sluice on both embankments of the main channel with the special budget for emergency work from the Japanese Government

The main irrigation channel starts immediately from the tank bund in a deep gully with almost vertical slopes on wither side. As a result frequent soil errosion from the slopes have silted up the channel bed to a considerable hight. The construction of a partial flume 35 meters down stream from the tank sluice has accelerated the process of errosion. The side protection walls were intended to prevent this errosion. The expenditure estimated for the construction of side protection walls in other sections of the main channel has already been provided in the Sri Lankan budget for the Project, however it was not sufficient to cover the funds required for the construction of side protection walls near the tank sluice. Since this work was essential and urgent the Japanese experts requested Japan for Rs.55,000/= (¥2,420,000) which was allowed by their government.

The construction of side protection walls at the main sluice was started on the 2nd June 1975 after water issues for 1975 meda cultivation were completed. The work had to be completed before the starting of water issues for next Maha season which was scheduled for 14.10.1975.

(3) Paddy field rearrangement work

Two spare crank shafts for bulldozers arrived from Japan in early June by air and the whole month of July was spent in repairing the buldozers. Two

bulldozers fitted with new crank shafts were put to work from 3rd July in paddy field rearrangement work. This year the work was handled mostly by the counterpart officers who had received training in Japan and the result was quite satisfactory. By the end of September 57 acres of paddy fields belonging to 11 farmers were levelled and rearranged with new concrete water intake cum outlets. The rain water and tank water could be utilized for the final levelling and the target set for the year could be achieved, with the completion of balance work from previous year in addition.

2.9.5 Agro Industries

(1) Rice Mill

(i) The Board of Directors of the Dewahuwa Multi-purpose Co-operative Society decided in November 1974 to borrow Rs.106,000/= from the People's Bank, to put up a building to house the rice mill and to store paddy and rice. The necessary plans estimates and the cost of expenditure sheets were submitted to the Bank for their examination. However the bank rejected the application for a loan on the grounds that the paddy production at Dewahuwa has not stabilized and therefore the scale of the business and the profit ratio were not upto the standards set up by the bank.

(ii) As a result of the above decision by the bank, the Japanese experts requested the Project Director to consider the construction of a building for the paddy mill complex, which could be purchased by the Co-operative Society on instalment payment with a low interest within a period of 20 years. The approval of the Secretary, Ministry of Agriculture and Lands was obtained for this purpose.

The Ministry of Agriculture and Lands called for tenders for the construction of the building in July. The notice was unanswered and therefore the project management at Dewahuwa invited the attention of the public sector in the locality. However no tenders were received. It may have been due to the low construction cost laid down in the estimates, which seemed to be too low according to the prevailing prices of building materials. At the time of writing this report the management had already contacted the Director of Works Office, North Central Region of Anuradhapura for the construction of the Paddy Mill building and the result is yet unknown.

The rice mill was imported after a series of discussions and planning between the Sri Lankan officers and the Japanese experts and it was meant to be managed by Dewahuwa Multi-purpose Co-operative Society. However the question of putting up a building by the Co-operative Society has delayed the installation of the mill considerably. Now it has become a impossible task to start the operation of the rice mill before the termination of the project. The building should have been constructed on account of the government of Sri Lanka much earlier and transfered to the Co-operative Society on installement payment.

(2) The Black-Smith Shop at the Mechanization Centre

Manufacturing and Repairing of simple agricultural tools

(i) The mechanization center has developed to a creditable standard and automobile servicing was started from February 1975.

(ii) The Black-Smith shop was opened in mid July. An experienced professional black-smith was employed to train the mechanics attached to the mechanization centre. Sickles, hatchets, knives etc. were manufactured at the time of writing this report using worn out blades of the rotavators of two wheel tractors. Plans have been prepared to manufacture more sophisticated tools like the hoes, ploughs and seed drillers and to market them through the Dewahuwa Multi-purpose Co-operative Society. An additional set of black-smith equipment has been ordered as part of the 1974 supplies from Japan.

2.9.6 Preparation for the Final Report

A decision was taken at a sub-committee meeting that a final report of the Project has to be prepared by the joint efforts of the Sri Lankan officers and the team of Japanese experts. The final report compiling committee of Sri Lankan Officers and Japanese Experts met for the first time on 9.5.1975 and agreed to include both good and bad and success and failure of the project events in this report. Self examination and counter measures for the future were also to be included. It was also agreed that the Japanese experts would write a manuscript in Japanese while referring to the opinions of the counter-part officers and this Japanese manuscript be translated for examination by the committee members. Upon examination by the compiling committee it will be passed on to the Joint Committee for further ammendments. The Japanese

manuscript wil be printed in Japan after the termination of the Project.

2.9.7 Visit of Evaluation Survey Team from Japan

An evaluation team headed by Mr. S. Watanabe and with three other members on civil engineering, farm economics and agricultural co-operatives and co-ordination. The purpose of their visit was to evaluate the effect of Japan's co-operation in the field of Agricultural and Community Development at Dewahuwa and to exchange ideas with the Sri Lankan officers regarding the steps taken by them after the termination of the project agreement.

This team prepared a report on the progress, achievements, problems and their opinions of the project. They held several discussions based on their report and finally submitted an ammended report to Mr. Hector Kobbekaduwa, Hon. Minister of Agriculture and Lands, through his Secretary.

2.9.8 Delay in the Arrival of 1973 Supplies from Japan

The supplies from Japan usually arrived in Sri Lanka in between May and July every year. The shipping in Japan is done towards the beginning of the year (end of the financial year in Japan) so that the shipments reach Colombo Port in April and May. So far all supplies from Japan arrived at Dewahuwa within one year ordering. However the delay in the arrival of materials and equipment ordered for 1973 has affected the various programmes at Dewahuwa.

The supplies for 1973 (FOB ¥42,472,000= Rs.940,000) were considerably delayed and shipped in seven consignments due to a difficulty no procuring the equipment and materials attributed to an economic disorder in Japan caused by the oil crisis. The last consignment arrived at Colombo Port in April 1975, after a years delay.

As a result of these delays in shipments, work at Dewahuwa got considerably affected. e.g. the bulldozer spare parts did not arrive in time for the repair and as a result only 45 acres out of the targeted 150 acres could be completed in 1974 Yala.

Most of the supplies of 1974 are also supposed to arrive in Sri Lanka after the termination of the project, due to similar reasons. Only the first shipment for 1974 arrived in 1975 September just before the termination of the project on October 18th, 1975.

2.9.9 Other Important Matters

(1) Training of counterpart officers in Japan

Name of Officer	Designation	Period of Training	Course of Training
Mr.M.M.Mendis	Technical Assistant	April-September '75	Irrigation & Drainage
Mr.D.B. Kumburegama	Agricultural Instructor	April - July 1975	Agricultural Extension
Mr.D.B.Niyangoda	Agricultural Instructor	May - Dec. 1975	Agricultural Machinery

(2) Mr. A.T.M. Silva Secretary to the Ministry of Agriculture and Lands visited Japan in May 1975 from 6th to 15th at the invitation of the Japanese Government on an inspection tour of the Agriculture in Japan and to exchange views with the Japanese authorities on Japan's Corporation on Agricultural development in Sri Lanka.

(3) "Agrorama Japan" exhibition was held in Colombo from 20th-23rd March 1975 sponsored by the Japan International Co-operation Agency almini Association in Sri Lanka under the auspices of the Embassy of Japan in Sri Lanka and our Dewahuwa Project. The purpose of the exhibition was to introduce the culture, industries, agriculture, people and their living and Japanese co-operation in agricultural development in Sri Lanka, to the Sri Lankan masses. Dewahuwa Sri Lanka Japan Rural Development Project was specially featured in large photographs.

The exhibition was declared open by Mr. William Gopallawa, the Hon. President of Sri Lanka and Mme. Gopallawa in the presence of his excellency A. Yoshioka, Ambassador of Japan in Sri Lanka and Mme. Yoshioka. A message from the Mr. S. Hogen, President of the Japan International Co-operation Agency was read at the opening ceremony. The Japanese ladies residing in Colombo contributed in a large way in flower arrangements and various other decorations to make the exhibition a complete success. Over 20,000 people visited the exhibition.

(4) Mr. A.P.B. Manamperi, Government Agent of Anuradhapura District retired from government service in March 1975 and joined the National Milk Board as its chairman. Mr. Manamperi took office at Anuradhapura in August

1970 just before the inception of the project and he has completed 5 years of good work on project matter. Mr. Prasad Illangasinha succeded Mr. Manamperi as Government Agent, Anuradhapura District.

Table 2.9 (1)

1975 Maha Cultivation in the Puddy Field under Bethoma Dewahuwa

(1) Number of Participating Cultivators

Area	Number of Colonists	Number of Cultivators under Bethoma				Ratio
		Colonist	Ratio	Out of Colonist	Total	
Upper stream	160	70	44%	8	78	47%
Middle stream	180	96	45	70	169	54
Lower stream	133	3	2			
Total	473	169	36	78	247	52

(2) Acreage

Area	Acreage of Bethoma	Paddy		Sorghum		Cowpea		Others		Total		
		AC	%	AC	%	AC	%	AC	%	AC	%	%
Upper stream	265	18	16	$31\frac{1}{2}$	29	$45\frac{3}{4}$	41	15	14	$110\frac{1}{4}$	100	41.0
Middle and Lower	455	$16\frac{1}{4}$	8	$38\frac{1}{4}$	19	125	63	$19\frac{1}{4}$	10	$199\frac{1}{4}$	100	43.8
Total	720	$34\frac{1}{4}$	11	$69\frac{1}{4}$	23	$170\frac{1}{4}$	55	$34\frac{3}{4}$	11	$309\frac{1}{2}$	100	43.0

Note: Others

Green Gram	5 AC	Black Gram	$1\frac{1}{4}$ AC	Groundnuts	$\frac{1}{4}$ AC		
Soyabean	$14\frac{1}{4}$ AC	Chilli	$2\frac{1}{4}$ AC	Tomato	$2\frac{1}{4}$ AC		
Vegetable	5 AC	Gingelly	3 AC				

Table 2.2.5 (1)

PEOPLE' BANK
(Dept. of Co-op. & Rural Credit)
Colombo

CEYLON-JAPAN RURAL
DEVELOPMENT PROJECT
Dewahuwa

JOINT
SOCIO-ECONOMIC SURVEY OF DEWAHUWA COLONY
(Upperstream)

I: BASIC INFORMATION

Name of the Chief Occupant	Permit Holder / Tract Plot	Off-shoot	Reser-vation	Bulana-wewa	Caste	Religion	Language

II: FAMILY LABOUR COMPOSITION

FAMILY MEMBER					NO. OF PERSONS GAINFULLY EMPLOYED			
Total	Live Force		Schooling children		Old & Non-schooling children	In Agri-culture	In Manual labour	In Skilled labour	In Per-manent job
	M	F	B	G					
	/		/		/				

III: LAND UTILIZATION & HOLDING

CULTI-VATION SEASON	PADDY - FIELD							
	Total	Own Farm-ing	UGAS		ANDE		BADDA	
			Rs. Money-lender's men	acres ANDE	On his Own Field	On Other's Field	On his Own Field	On Other's Field
MAHA69-70	a.	a.	a.	a.	a.	a.	a.	a.
MAHA70-71	a.	a.	a.	a.	a.	a.	a.	a.

CULTI-VATION SEASON	HIGH - LAND				RESERVATION(Chena)	
	Total	Under Crops			Kinds of Crops	Acreage
		Perennial Crops	Others			
			Maha	Yala		
MAHA69-70						
MAHA70-71						

IV: CULTIVATION (OF HIS OWN-FARMING LIYYADDES)

PLOUGHING CULTIVATION SEASON	BUFFALOE all through		GOVT. TRACTOR plus Buffaloes					PRIVATE TRACTOR plus Buffaloes				
			Govt. Tractor			Buffaloes		Private Tractor			Buffaloes	
	acres	days	acres	days	Rs.	days	Rs.	acres	days	Rs.	days	Rs.
MAHA 69-70												
MAHA 70-71												

Table 2.2.5 (2)

IV: CULTIVATION (OF HIS OWN-FARMING LIYADDES) - (continued) -

PLOUGHING CULTIVATION SEASON	JAPANESE TRACTOR plus BUFFALOES				
	acres	Japanese Tractor		Buffaloes	
		days	Rs.	days	Rs.
MAHA 69-70					
MAHA 70-71					

CULTIVATION SEASON	PADDY - SEED SOWN					
	Transplanting			Broadcasting		
	Own/Purchased	Kind	Bushel/a	Own/Purchased	Kind	Bushel/a
MAHA 69-70						
MAHA 70-71						

CULTIVATION SEASON	ROW - TRANSPLANTING						RANDOM TRAS -			
	Acres	Yield	Farmily member	Atham	Colony labour	Outsiders	Acres	yield	Farmily member	Atham
MAHA 69-70										
MAHA 70-71										

	PLANTING BROADCASTING				
	Colony labour	Outsiders	Acres	Man days	Yield
MAHA 69-70					
MAHA 70-71					

FERTILIZER		
Ammonium Sulphate	Super Phosphate	Potassium

	HARVESTING Man-Days			
	Farmilly members	Atham	Colony labour	Outsiders
MAHA 69-70				
MAHA 70-71				

THRESHING			
BUFFALOE		TRACTOR	
Bushels	Days	Bushel	Days

Table 2.2.5 (3)

V : CREDIT

CULTIVATION SEASON	CULTIVATION - LOAN borrowed through N.P.C.S.						
	Ploughing loan	Seed-paddy	Fertilizer	Agro-chem.	Transp. loan	Weeding loan	Total
MAHA 69-70							
MAHA 70-71							

CULTIVATION-LOAN REPAID

	Cash	Paddy	Total
MAHA 69-70			
MAHA 70-71			

CULTIVATION SEASON (1969)	BORROWINGS FROM OTHER SOURCES					
	Sickness	Funeral	Marriage	Consumption	Others	Total
Borrowed from	Rs. (%)	Rs. (%)	Rs. (%)	Rs. (%)	Rs. (%)	Rs.
MUDALALI	Rs.	"	"	"	"	"
Relatives	Rs.	"	"	"	"	"
Friends	"	"	"	"	"	"
Banks	"	"	"	"	"	"
Others	"	"	"	"	"	"
Repaid :						
Balance:						
(1970)						
Borrowed from	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.
MUDALALI	"	"	"	"	"	"
Relatives	"	"	"	"	"	"
Friends	"	"	"	"	"	"
Banks	"	"	"	"	"	"
Others	"	"	"	"	"	"
Repaid :						
Balance :						

(% stands for interest-rate, if any)

VI : RECEIPTS & DISBURSMENTS

(a) DISPOSAL OF PADDY

CULTIVATION SEASON	Seed	Own Consumption	Sales to Merchants				Delivery to M.P.C.S.			
			Repayment of Loan		Cash		Repayment of Cultivation Loan		Cash	
	Bushels	Bushels	Bushels	Rs.	Bushels	Rs.	Bushels	Rs.	Bushels	Rs.
MAHA 69-70										
MAHA 70-71										

(b) SOURCES OF INCOME

CULTIVATION SEASON	Agricultural			Non-Agricultural			Others	Total
	Paddy	Chena	Wage	Wage	Business	Others		
MAHA 69-70								
MAHA 70-71								

Table 2.2.5 (4)

(c) PRODUCTION - COST

CULTIVATION SEASON	SEED (purchased)		FERTILIZER		PLOUGHING	SOWING WAGES		HARVESTING THRESHING		
	Bushels	Rs.	Lbs	Rs.	Wage	Broadcast	Transplant	Wage (excl. family labour & atham	Tractors Hirage	Buffaloe Hirage
MAHA69-70					Rs.	Rs.	Rs.	Rs.	Rs.	
MAHA70-71					Rs.	Rs.	Rs.	Rs.	Rs.	

(d) HOUSEHOLD EXPENDITURE (for the last one year)

FOODS					CLOTHINGS					
Rice	Fish/meat	Vegetables	Tea, Sugar, Condiments	Miscellaneous	Sarong	Saree	Shirts	Redda	Foot wear	Others

HOUSING Roof re-thatching	Others	EDUCATION Educational materials	FUELS	DONATION TO TEMPLES	Medical & MEDICINAL EXPENSES	TRANSPORT	SOCIAL EXPENSES	DRINK & SMOKING
Rs.								

UNCLASSIFIED		
Durable Consumer Goods	Savings	Others (incl. loan toothers)
Rs.		

VII : ASSETS

(a) DURABLE CONSUMER GOODS BELONGING TO THE FAMILY

Bicycle	Radio	Sewing-machine	PETRO-MAX	Wall Clock	Wrist Watch	Umbrella	Elec-Torch	Children's Bicycle	Bed	Chair	Table

Bench	Desk	Wardrobe	Others

(b) AGRICULTURAL MACHINERY & IMPLEMENTS

Tractor	Cart	Plough	Mammoty	Syckle	Harrow	Elavangu	Kathy	Axe	Others

(c) LIVESTOCKS

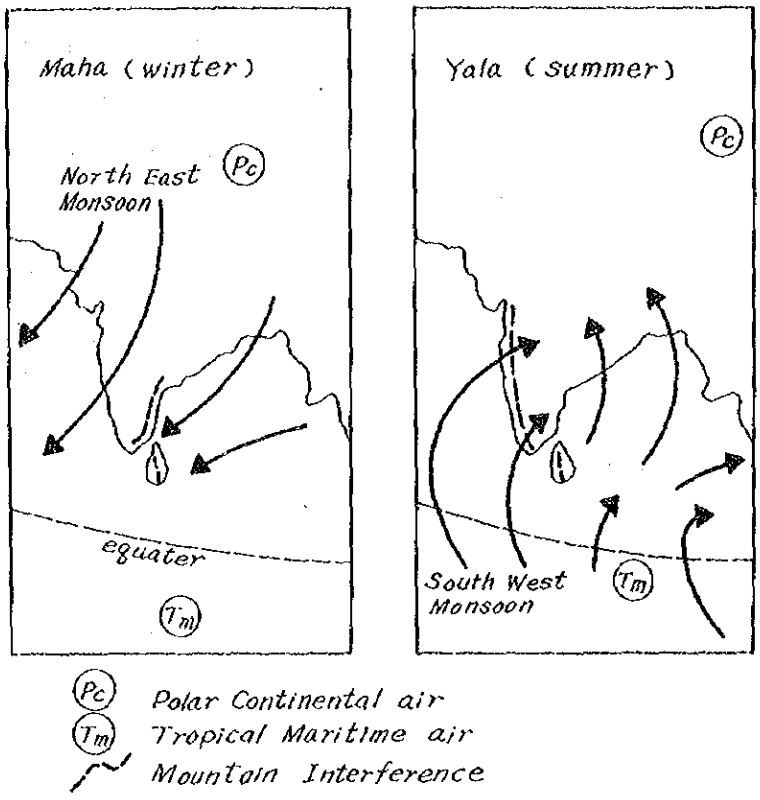
Bull	Caw	Buffalo Ploughing	Buffalo Idle	Poultry (hens)	Pig	Others

3. Hydrology

3.1 General Features of Meteorology in Sri Lanka

3.1.1 Rainfall in Sri Lanka is generally divided into two. The one is Maha rainfall brought by the North East Monsoon and the other is Yala rainfall brought about by the South West Monsoon.

Flg. 3-1-1-1 Map of air masses



As shown in Fig. 3.1.1.1 . The former has its origin in going Southwards from the polar continental air mass during the winter season, and the latter originates in going Northwards of the tropical maritime air mass from the Southern Hemisphere in summer season. Each of them changes its course a little to the east and the west respectively being deflected by the earth rotation and by the interference of the mountainous region of South India and the hilly country of Ceylon, before it subsequetly brings rainfall to the Island of Ceylon.

In addition the shallow tropical lows, caused by the rising of the tropical maritime air mass towards the north, brings heavy showers to the island during April and May.

Generally speaking the North East Monsoon is dry but in Sri Lanka it has enough humidity due to passing through the Bay of Bengal and this

phenomenon is similar to the heavy snowfall in the coast of the Japan Sea in the winter season.

On the other hand, the South West Monsoon is humid by reason of its origin but is remarkably relieved of its moisture after reaching the land. That is why the Dry Zone of Sri Lanka cannot get enough rainfall in summer.

3.1.2 The outstanding characteristic of the rainfall given by the monsoons mentioned above, is their fluctuation as to both period and amount.

Here in Fig. 3.1.2.1 the fluctuation of the amount of rainfall at Dewahuwa and in addition in Colombo and Anuradhapura each being a typical example respectively of Wet Zone and Dry Zone are shown in terms of Maha and Yala basis through the past 30 years.

Here the annual rainfall is divided into two categories, i.e. Maha rainfall and Yala rainfall as follows:-

Maha = 6 months from September of current year to February of the next.

Yala = 6 months from March to August.

From now on in this chapter the rainfall data are dealt with as given above.

Additionally Frequency Distribution of Maha and Yala rainfall of 30 years' basis in Colombo, Anuradhapura and Dewahuwa is shown in Fig.3.1.2.2. In the Fig. Sy means Standard Deviation and each of them has a remarkably big value. For example Maha rainfall at Dewahuwa is,

Maha rainfall in 30 years M = 42.1 in.

Sy = 13.3 in.

$M \pm 2\,Sy = 42.1 \pm 2 \times 13.3 = 68.7$ in. or 15.5 in.

i.e. Maha rainfall at Dewahuwa fluctuates for 68.7 in. with about 5% error range.

Thus it is sensible that in region like Sri Lanka where both summer rainfall and winter rainfall originates from the monsoons the statistical study on meteorology should be done rather from the view point of its fluctuation than its average.

Fig. 3-1-2-1 Results of Maha & Yala Rainfall (30 years)
Dewahuwa, Colombo, Anuradhapura

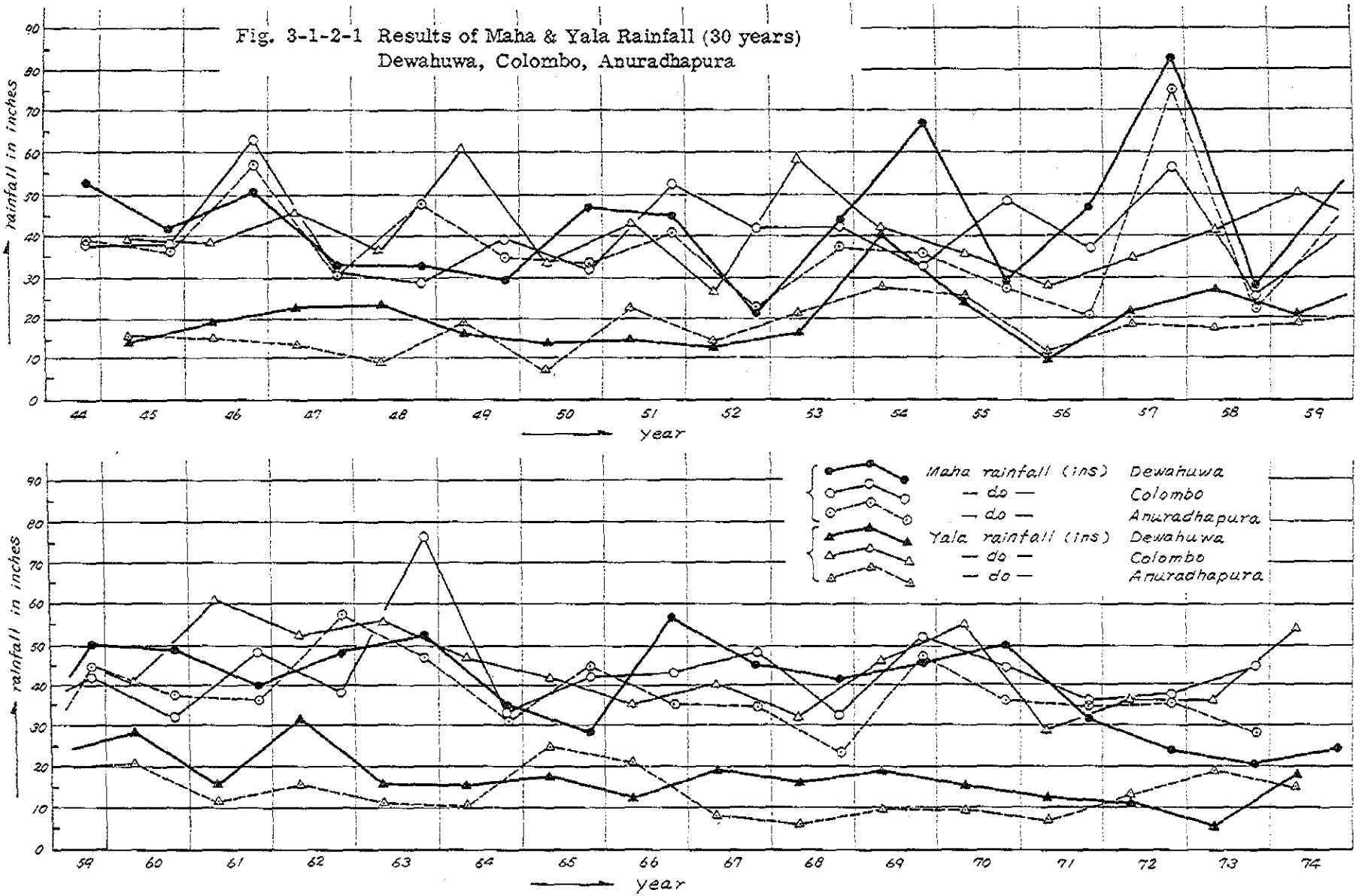
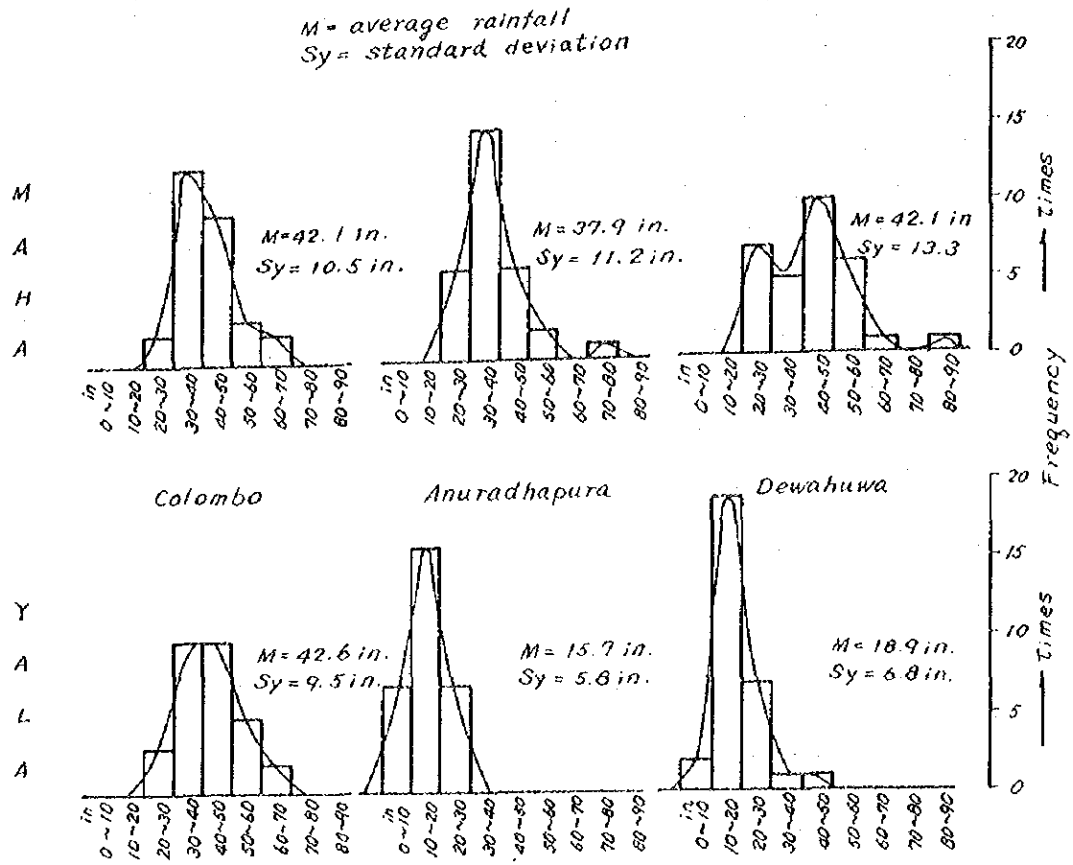


Fig. 3-1-2-2 Frequency Distribution of Maha & Yala Rainfall (30 years)



3.2 The present condition of Paddy Cultivation in Sri Lanka in relation to Water Condition.

Here relation between paddy cultivation and water condition is studied on an island wide scale based on recent 7 years' data. (1967/68 Maha - 1974 Yala).

3.2.1 At first the 22 districts of Sri Lanka are classified into 4 zones in respect of rainfall as shown in Fig. 3.2.1.1.

That is
- Dry Zon
- Dry cum Wet Zone
- Mid Zone
- Wet Zone

and from now in this chapter all data will be classified and calculated on a zone basis.

The recent 7 years average of Maha and Yala rainfall in each zone is shown in Table 3.2.1.1. (Season by season data are shown later is

Fig. 3-2-1-1 Map of Meteorological Classification

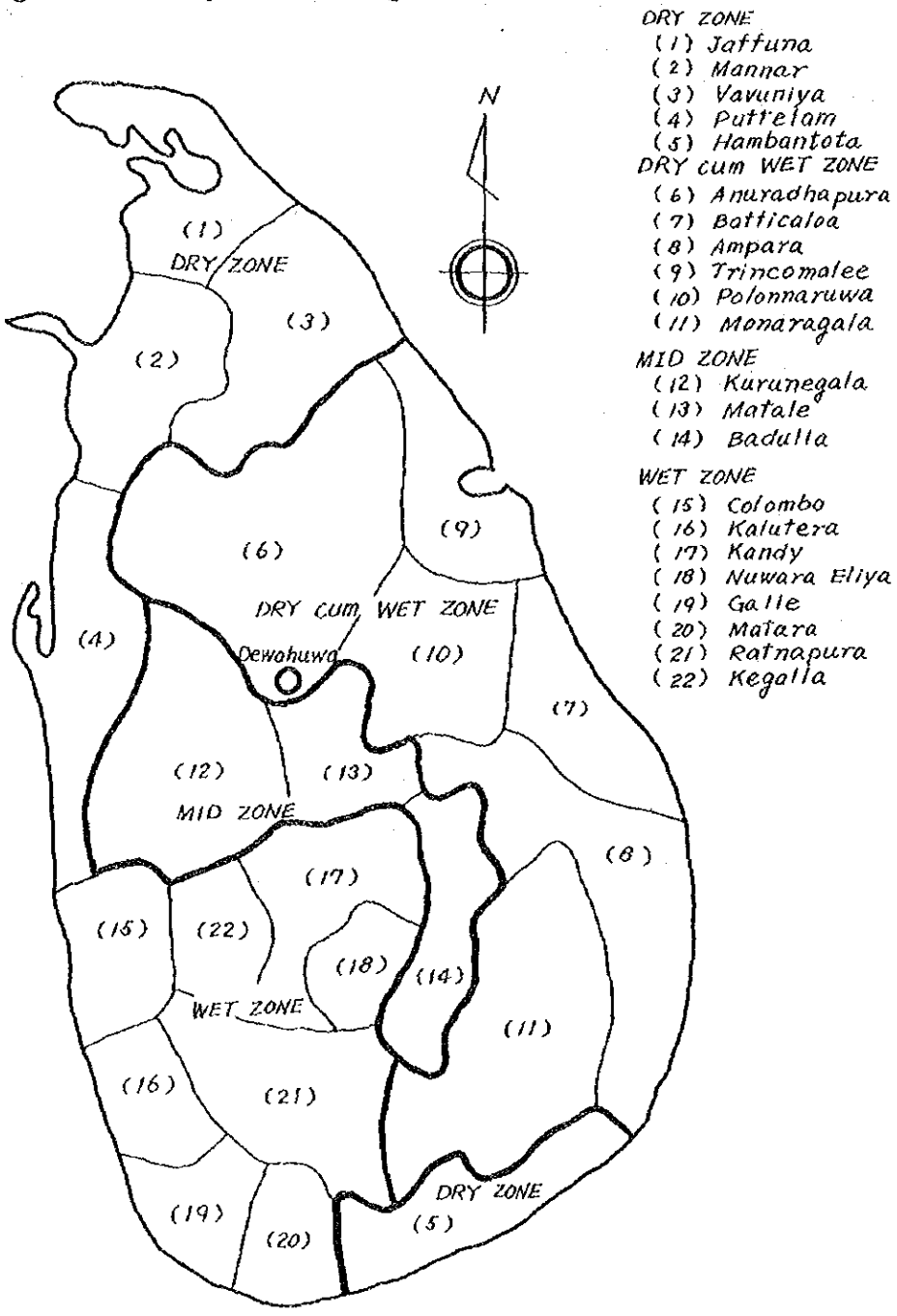


Table 3.2.3.1.) taken from "Report on the Colombo Observatory" and the latest data). By Table 3.2.1.1. it is understood that annual rainfall gets increased from Dry Zone to Wet Zone and in some seasons Maha rainfall in Dry cum Wet Zone (D.W. Zone) over that in the Wet Zone.

That is the annual difference of rainfall in each zone varies according to the amount of Yala rainfall.

TABLE 3-2-1-1

7 Year Average of Rainfall (1967/68 Maha - 74 Yala)

	Maha	Yala	Annual
Dry Zone	33.99 in.	13.94 in.	47.93 in.
Dry cum Wet Zone	46.38	12.03	58.41
Mid Zone	48.02	32.51	80.53
Wet Zone	45.50	39.18	84.68

3.2.2 Subsequently the recent 5 years' average of irrigated ratio in each zone is shown in Table 3.2.2.1. by using the percentage of Major, Minor, and Rainfed Scheme acreage. (taken from "Paddy Statistical Extents sown and Harvested and Average Yield" by Department of Census and Statistics).

This table means the 5 years average of irrigated ratio in each zone from 1970 Yala to 1974 Yala and since the fluctuations of ratio is so big year by year the average only is shown here.

Following points are indicated from this table.

1) In Wet Zone and Mid Zone irrigated ratio is low so that about half of shown acreage is fed by rainfall only. Conversely in Dry Zone and D.W. Zone the ratio is high and especially in Yala season the rainfed cultivation comes to nearly zero.

2) Although there is no big difference of sown acreage between Maha and Yala cultivation in the Wet Zone and Mid Zone, in the Dry Zone and D.W. Zone the sown acreage of Yala cultivation is reduced to 1/3 of that of Maha.

3) In addition to the above 2, the greater part of the sown acreage is concetrated on Major Schemes and yet only $62\% \frac{(57 \times 0.72 + 186 \times 0.85)}{(243 \times 0.38 + 436 \times 0.53)}$ of Mojor Scheme area compared to Maha seasonis able to be cultivated in Yala in Dry Zone and D.W. Zone.

TABLE 3-2-2-1

5 Year Average of Major, Minor Scheme and Rainfed (1970 Yala - 74 Maha)

	Maha				Yala				Annual			
	Gross sown 1,000ac	Classification			Gross sown 1,000ac	Classification			Gross sown 1,000ac	Classification		
		Ma	Mi	R. F		Ma	Mi	R. F		Ma	Mi	R. F
Dry Zone	243	38%	24%	38%	57	72%	21%	7%	300	45%	24%	31%
Dry cum Wet Zone	436	53	20	27	186	85	12	3	622	63	18	19
Mid Zone	199	17	42	41	126	17	40	43	325	17	41	42
Wet Zone	338	10	26	64	288	10	24	66	626	10	25	65
Average	1,216	32	26	42	657	38	23	39	1,873	34	25	41

* Ma : Major scheme (over 1,000ac)
Mi : Minor " (below 1,000ac)
R. F : Rainfed

Incidentally this irrigated ratio is studied once again later.

3.2.3 Based on the above mentioned rainfall tendency and the irrigated ratio of each zone 'zonal and seasonal results of paddy cultivation in recent 7 years' is shown in the following Table 3.2.3.1. (taken from "Annual Implementation Programme - Targets and Achievement paddy" by Ministry of Agriculture and Lands).

TABLE 3-2-3-1

Zonal & Seasonal Results of Paddy Cultivation

		Dry zone								Dry cum wet zone										
		Rainfall	Gross sown acreage	Net harvested acreage	Harvested ratio	Production (million bushel)	Yield per acre	Use of improved variety	Use of fertilizer	Rainfall	Gross sown acreage	Net harvested acreage	Harvested ratio	Production (million bushel)	Yield per acre	Use of improved variety	Use of fertilizer	Rainfall	Gross sown acreage	Net harvested acreage
		in.	ac 1,000	ac 1,000	%	10^6 bu.	bu.	%	Kg/ ac	in.	ac 1,000	ac 1,000	%	10^6 bu.	bu.	%	Kg/ ac	in.	ac 1,000	ac 1,000
MAHA	67/68	42.0	228	170	77	8.0	45	85	16	49.3	403	327	81	16.8	51	79	15	42.0	208	168
	68/69	22.3	233	149	64	6.1	41	74	21	27.6	417	326	78	17.2	53	80	15	43.6	213	176
	69/70	47.9	227	148	65	7.3	49	78	21	66.2	433	349	81	20.5	59	91	15	52.3	211	177
	70/71	31.0	233	157	67	7.5	48	79	20	47.7	404	324	80	16.1	50	65	15	59.5	191	154
	71/72	26.4	232	159	69	6.6	41	83	27	44.4	430	311	72	16.5	53	85	17	40.4	197	143
	72/73	36.5	235	182	77	8.0	44	85	23	47.9	414	321	78	16.4	51	86	19	59.4	211	154
	73/74	30.9	237	217	80	9.8	45	85	30	41.8	476	397	83	20.3	51	89	26	38.8	208	173
	Average	34.0	237	170	72	7.6	45	81	23	46.4	425	336	79	17.7	53	82	18	48.0	206	164
YALA	68	12.2	46	35	76	2.0	57	94	22	10.6	181	140	77	6.4	46	76	12	27.2	93	74
	69	15.5	30	23	77	1.7	74	100	23	8.1	137	114	83	6.4	56	79	16	34.9	90	55
	70	15.2	65	47	72	2.8	60	80	28	14.9	220	185	84	11.3	61	74	15	29.7	122	101
	71	11.9	62	45	73	2.8	45	76	40	10.3	196	162	83	9.2	47	70	23	41.9	118	95
	72	15.0	49	36	73	1.7	47	92	31	13.1	164	132	80	6.4	48	86	23	35.8	125	75
	73	17.2	47	37	79	2.3	62	70	38	16.4	152	126	83	7.5	60	49	25	27.6	121	87
	74	10.6	62	49	79	2.5	51	92	31	10.9	176	138	78	5.9	43	85	23	30.6	144	116
	Average	13.9	52	39	75	2.3	57	81	31	12.0	175	142	81	7.6	52	72	20	32.5	116	86
Annual average		47.9	289	209	72	9.9	102	81	54	58.4	600	478	80	25.3	105	79	38	80.5	322	250

Mid zone					Wet zone								Island							
Harvested ratio	Production (million bushel)	Yield per acre	Use of improved variety	Use of fertilizer	Rainfall	Gross sown acreage	Net harvested acreage	Harvested ratio	Production (million bushel)	Yield per acre	Use of improved variety	Use of fertilizer	Rainfall	Gross sown acreage	Net harvested acreage	Harvested ratio	Production (million bushel)	Yield per acre	Use of improved variety	Use of fertilizer
%	10^6 bu.	bu.	%	Kg/ ac	in.	ac 1,000	ac 1,000	%	10^6 bu.	bu.	%	Kg/ ac	in	ac 1,000	ac 1,000	%	10^6 bu.	bu.	%	Kg/ ac
81	7.7	46	62	16	48.5	308	245	80	11.0	45	48	17	45.7	1,147	716	80	43.6	47	69	16
83	9.0	51	63	15	39.8	319	264	83	13.1	50	52	21	33.3	1,182	915	77	45.4	50	68	18
84	9.4	53	69	15	54.8	322	245	76	12.0	49	55	20	56.2	1,193	919	77	49.2	54	75	17
81	6.6	43	79	13	43.2	321	256	80	11.3	44	49	18	45.4	1,149	891	78	41.5	47	66	16
73	6.7	47	69	19	45.4	328	271	83	11.9	44	55	18	39.2	1,187	884	74	41.7	47	74	20
73	7.0	45	67	20	47.4	330	265	80	10.6	40	56	22	47.8	1,190	922	77	42.0	46	74	21
83	7.8	45	73	28	39.8	348	294	84	13.3	45	63	26	37.8	1,302	1,081	83	51.2	47	78	27
80	7.7	47	68	18	45.5	235	263	81	11.9	45	54	20	43.5	1,193	933	78	44.9	48	72	20
80	3.6	49	89	13	34.8	277	224	81	8.9	40	43	14	21.2	597	473	79	20.9	44	68	14
61	2.2	40	74	16	38.2	269	199	74	8.6	43	48	16	24.2	526	391	74	18.9	48	64	17
83	4.5	45	54	11	40.9	277	235	85	9.4	40	49	17	25.2	684	568	83	28.0	49	61	17
81	4.3	36	56	17	37.1	271	224	83	9.0	40	45	16	25.3	647	526	81	25.3	39	57	21
60	3.0	40	56	16	34.7	270	229	85	8.4	37	46	17	24.7	608	472	78	19.5	41	63	20
72	3.7	43	40	23	36.7	294	241	82	9.4	39	37	24	24.5	614	491	80	22.9	47	43	25
81	4.7	41	86	21	51.7	322	262	81	10.2	39	57	21	26.0	704	565	80	23.3	41	73	22
74	3.7	42	62	17	39.2	283	231	82	9.1	40	47	18	24.4	626	498	80	22.7	44	59	19
78	11.4	89	66	35	84.7	608	494	81	21.0	85	51	38	67.9	1,819	1,431	79	67.6	92	68	39

Out of Table 3.2.3.1 some reasons are pointed out as having remarkable tendency as follows.

69/70 Maha -Island wide high rainfall season and good harvest.

71/72 -do- -Slight drought condition covered the Island, and especially in the Wet Zone and the Mid Zone considerable rainfall in early Maha so that it was unusable in paddy field due to preparation not done in time. The outcome was a rather poor harvest throughout the Island.

73/74 -do- -Inspite of drought throughout the Island the total yield was good. The reason given is that as the rainfall was unusually delayed there was enough time for field preparation so that the outstanding extent of sown acreage covered the decrease of unit yield per acre-basis.

70 Yala - Slight high rainfall season. And as monthly distribution of rainfall was ideal so the resulting harvest was satisfactory.

71 -do- - Slight drought condition covered the Island and in addition rainfall distribution was unstable both monthly and zonally, so that yield per acre-basis was poor, but extended sown acreage covered the total yield.

72 -do- - Approximately standard rainfall season. But monthly rainfall in February and March was extremely poor, so that the time for sowing might have been lost, and as a result sown acreage was reduced. Finally, both unit yield and total yield was poor.

Incidentally zonal and monthly rainfall records are shown in appendix Table 3.2.3.1. As general features of Table 3.2.3.1, following items may be pointed out.

1) In the Dry Zone a rather high propotion of fertilizer and the improved varieties of paddy are used and this results in rather high yield of paddy per unit and conversely in the Wet Zone.

2) In the Dry Zone unproductive ratio against sown acreage is high, i.e. 72% of harvested acreage in the Dry Zone as an average 7 years' Maha cultivation means that 100 - (72+15)=13% is commonly

unproductive acreage against sown in the Dry Zone.

Note : 15% is occupied acreage by ridges etc., in other words the difference between the gross harvested acreage and the net harvested acreage.

3) Increase Dry Zone acreage and the use of fertilizer in these 7 years is shown in Table 3.2.3.2. Particularly the increase in use of fertilizer is worth noting.

TABLE 3-2-3-2

Increase of Sown Acreage, Fertilizer Use and Paddy Production in these 7 years (Islandwide base)

	Sown acreage	Fertilizer use	Total production
Total from 1967 to 1969	3,456 x1,000 ac	65 Kg/Ac	128.7 x 10^6 bush.
Total from 1972 to 1974	3,810	95	139.4
Total Increased Rate	10.4 %	46.2 %	8.3 %

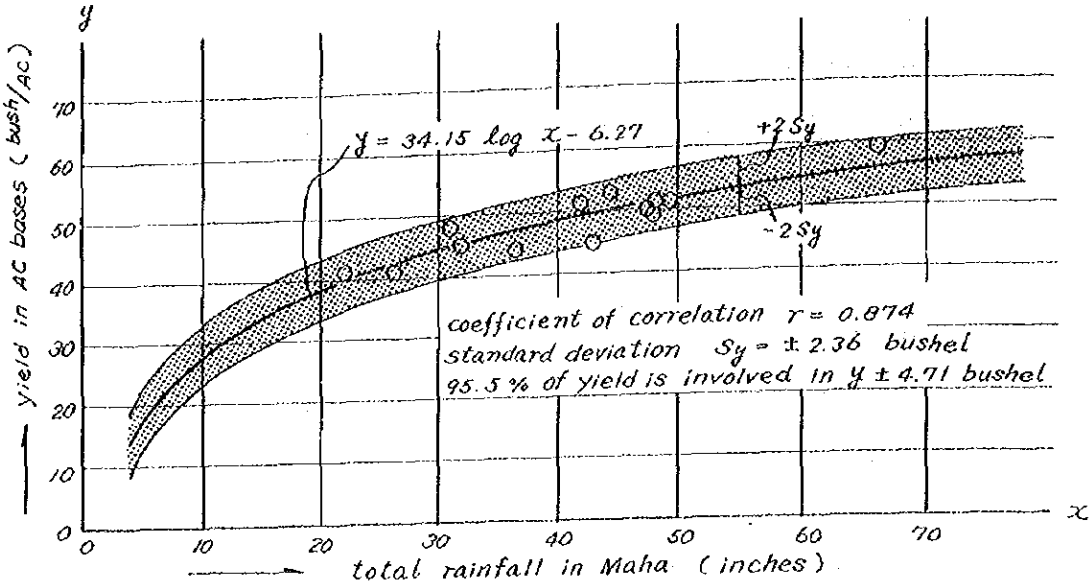
Results of the study on correlation between rainfall and unit yield of paddy from Table 3.2.3.1. are shown below.

1) In the Wet Zone and the Mid Zone correlation between rainfall and unit yield of paddy is rather low. (Coefficient of correlation r=0.59) The reason for that is infered from the fact that in these zones it is not the amount rainfall that counts but other factors, e.g. duration of rainfall and its distribution etc., which may effectively influence the unit yield of paddy, because the amount of rainfall is usually enough to paddy necessity in these zones.

2) The same study on Yala cultivation in the Dry Zone and D.W. Zone should be excluded here for the cultivation can be done in rather small and special (i.e. especially stabilized) area in these zones at Yala.

3) The same study on Maha cultivation in the Dry Zone and D.W. Zone gets high correlation as shown in Fig. 3.2.3.1.

Fig. 3-2-3-1 Relation Between Paddy Yield & Maha Rainfall in Dry Cum Wet & Dry Zone
(based on the data of 1968/69 - 1973/74 Maha)



The Fig. means that when total rainfall in Maha season is 40 inches, the unit yield of paddy can be inferred as from 44 bush. /AC to 53 bush/AC with about 5% error range.

Since this inference is led by collected data of the Dry Zone and the D.W. Zone, it cannot be used in each scheme separately.

Subsequently, since we can assume that stable irrigation facilities may bring a stable harvest, to make this assumption quantitative the relation between each scheme (Major, Minor and rainfed) and the harvested ratio should be considered so conversely the unproductive ratio, is shown in Table 3.2.3.3. as an average of the recent 5 years. (taken from "Paddy Statistics, Extents sown and harvested and Average Yield" by Department of Census and Statistics).

According to this Table it is noticeable that in any zone except the Wet Zone the stability is the highest in Major Scheme and there is about 10% high risk of unproductivity both in Minor and Rainfed Schemes. In this sense the Minor Scheme e.g. village tank-fed, may be said to have about the same risk of unproductivity to the Rainfed Scheme and if it is so investment to small facilities like village tanks might not be effective from an economical view point.

Incidentally the risk of unproductivity in the Wet Zone shows

about the same in Major, Minor and Rainfed Scheme. It means the unproductivity in the Wet Zone may be brought about not by drought but by other factors such as insects or flood for instance.

TABLE 3-2-3-3

Unproductive Ratio against Sown Acreage

	Maha			Yala			Annual		
	Ma.	Mi	R. F	Ma.	Mi.	R. F.	Ma.	Mi.	R. F
Dry Zone	3 %	9 %	14 %	3 %	14 %	-	3 %	10 %	-
D & W Zone	3	10	11	2	6	-	3	9	-
Mid Zone	2	6	8	3	13	13	2	9	10
Wet Zone	6	7	3	5	3	4	5	5	3
Average	3	8	8	3	7	6	3	8	7

Note: Yala cultivation by Rainfed in the Dry Zone and the D. W. Zone is excluded from here due to small acreage.

3.2.4 Based on the above stated Table 3.2.1.1. to Table 3.2.3.3. and their meanings, the present condition of paddy cultivation in relation to water condition and its wholescale view may be grasped comprehensively as follows:-

1) In theWet Zone and the Mid Zone paddy cultivation is not influenced very much by annual fluctuation of rainfall so that it still remains at a low stage as seem in less use of fertilizer or improved varieties of paddy, or in poor installation of irrigation facilities.

2) Conversely in the Dry Zone and the D.W.Zone there is intensive correlation between paddy cultivation and rainfall. In other words in these zones without irrigation paddy cultivation can barely take place. Accordingly the combination of intensive use of fertilizer, improved varieties of paddy and irrigation facilities bring these zones to those having a developed paddy cultivation stage.

3) Table 3.2.4.1. is shown below in order to know which zone is most economical in its input to paddy cultivation compared to its output. With regards to input the costs fertilizing and ploughing are used, and as output: production of paddy is used. Incidentaly in the table Major Scheme ratio is also shown for reference.

TABLE 3-2-4-1

7 Year Average of Recovery Ratio to Investment for Paddy Cultivation

	Maha				Yala				Annual			
	Sown acreage	Ferti-lizer	Produc-tion	Maj. Scheme	Sown acreage	Ferti-lizer	Produc-tion	Maj. Sch.	Sown acreage	Ferti-lizer	Produc-tion	Maj. Sch.
Dry Zone	20 %	23.5%	17 %	38 %	8.5 %	13.5%	10.5 %	72 %	16 %	20 %	14.5 %	45 %
D&W Zone	36	32.5	39.5	53	28	28	33.5	85	33	31	37.5	63
Mid Zone	17	16	17	17	18.5	16.5	16	17	17.5	16	17	17
Wet Zone	27	28	26.5	10	45	42	40	10	33.5	33	31	10
Total	100	100	100	-	100	100	100	-	100	100	100	-

For example in the D.W. Zone compared to the input (i.e. ploughing goes 33% shares and fertilizing goes 31% shares in the island respectively), the output (i.e. production goes 37.5% shares in the island) in the highest of all, and conversely in the Dry Zone.

Thus the order from the economical view point is as follows:- from the highest to the lowest. 1) The D.W. Zone 2) The Mid Zone 3) The Wet Zone 4) The Dry Zone.

Explaining the economical order mentioned above.

4) The highest economy in the D.W. Zone may have been brought about by the intensive installation of irrigation facilities as shown in the high ration of Major Scheme area.

5) The lowest economy in the Dry Zone may be due to lack of water inspite of the combination of fertilizer, improved varieties of paddy and irrigation facilities after all.

Accordingly expective direction of cultivation in the Dry Zone, including some area of the D.W.Zone, is (a) getting additional water brought by newly planned irrigation like Mahaweli or (b) transfer the cultivating crops from paddy to other subsidiary crops in the field where water supply is notoriously unstable.

6) Although the paddy cultivation in the Wet Zone and the Mid Zone still remains many undeveloped factors as stated above. The output is not so bad relatively due to sufficient rainfall.

Therefore, the object of new investment in these zones in the future must not be irrigation system but the more improved varieties of

paddy etc. (Extension work of high-yield paddy cultivation like in present day Japan should rather be done in the Wet Zone).

7) The movement of cultivation capital, which has been invested to the unstably irrigated area of the Dry Zone and the D.W. Zone, to the Wet Zone and the Mid Zone will be the most suitable way to increase the island wide cost-benefit ratio regarding, paddy cultivation. And in other words it may mean a matter of 'the right crops in the right area' in Sri Lanka.

3.3 Hydrological Condition at Dewahuwa

In the above, the environment for paddy cultivation throughout the island and the role of water supply has been described. So keeping, the above mentioned point in mind, herein the water condition at Dewahuwa will be described from the view point of hydrology based on the field investigations and their analyses.

3.3.1 Rainfall condition at Dewahuwa during the past 30 years was shown in Fig. 3.1.2.1. and its frequency distribution was also shown in Fig. 3.1.2.2.

Although the mean rainfall at Dewahuwa during these 30 years is 42.1 in. in Maha, 18.9 in. in Yala and 61.0 in. in annual, after 1971 both Maha and Yala rainfall is far from the mean value as shown in Fig. 3.1.2.1. and a remarkable drought condition has been continuing. This poor rainfall condition is a general tendency in the Dry Zone and the D.W.Zone and the tendency is especially noticeable in Maha rainfall brought by the North East Monsoon.

As seen in Fig. 3.1.2.1. there has never been such a continuous and severe drought at Dewahuwa since 1944.

The influence of this consistently poor rainfall to the hydrological condition of the area will be described later, but for reference it is mentioned that in the past drought years (although it was not continuous like the present condition), e.g. 52/53 Maha (rainfall 21.7 in.) and 58/59 Maha (rainfall 28.7 in.), the paddy cultivation had been abandoned at Dewahuwa.

Hereafter, the relationship between rainfall inflow, runoff coefficient and so on at Dewahuwa Tank is studied one by one based on data of "Annual statement of replenishment and behaviour of Dewahuwa Tank" and field

investigation of runoff at the catchment area of Dewahuwa Tank etc.

3.3.2 Tank Loss(evaporation from reservoir surface and seepage from tank bund).

Evaporation from reservoir surface and seepage from tank bund should be studied separately, but here they are dealt with together as Tank Loss since it was difficult to obtain the necessary data to separated them.

From daily data of the above mentioned annual statement all periods whenever there is no rainfall or slight rainfall and simultaneously there is no issue of water at tank sluice were picked up in Table 3.3.2.1 in order to infer the tank loss from the depression of tank surface in each period.

TABLE 3-3-2-1

Tank Loss Daily

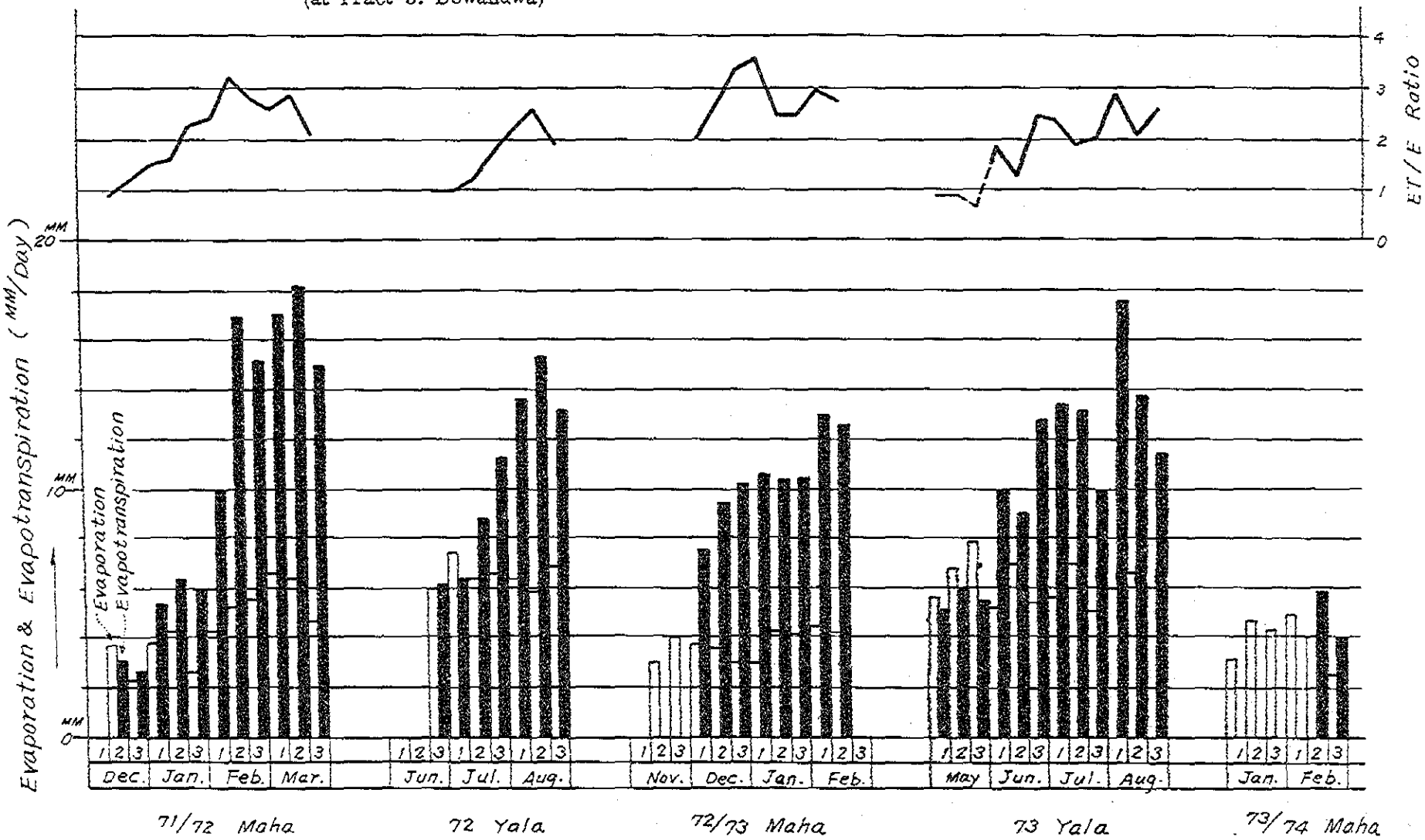
Period	Days	Loss	Water depth	Surface acreage	Rainfall in period	Loss per day
62.8.21-8.31	11	67 ac/ft	25.1 ft	850 AC	- in.	0.09 in.
65.7.21-7.31	11	141	18.8	500	-	0.31
65.9.11-9.26	10	84	17.4	440	-	0.23
66.5.21-8.10	82	228	13.8	310	1.20	0.12
68.8.11-9.20	42	201	13.8	310	0.28	0.19
74.8.11-8.20	10	22	11.7	260	-	0.11
Average						0.16 in/day

Although each period shown in the table is of Yala season and it is supposed that in a period of mid rainfall season of Maha the evaporation from reservior surface may become less. But on the other hand the seepage from the tank bund may increase because of high water level in mid Maha compared to Yala season.

Therefore, Tank Loss = 0.16 in./day is adopted here as an annual average.

In addition Evaporation and Evapotranspiration measured by a Lisymeter and an Evaporation Pan at Dewahuwa are shown in Fig.3.3.2.1. These field investigations have been continued at Tract - 3, center of Dewahuwa Project area. According to the Fig. the average of evaporation from the pan is 0.16 in./day in Maha and 0.24 in./day in Yala. Since the evaporation from the reservoir surface is generally less than that of the evaporation pan, the above given 0.16 in./day in annual may be a resonable value.

Fig. 3-3-2-1 Results of Investication with Lisymeter & Evaporation Pan
(at Tract-3. Dewahuwa)



Incidently the result of field survey on evaporation and evapo-transpirations shown in the Fig. have been done in short periods, i.e. from 71/72 Maha to 73/74 Maha, and the difference in each other is rather marked. Meanwhile the same survey is quite common in Sri Lanka (like at Mahailluppallama in long duration). So in this respect the results at Dewahuwa are, just shown in Fig. 3.3.2.1. without any analysis.

3.3.3 Next Table 3.3.3.1. is also taken from the daily data of the annual statement of Dewahuwa Tank. From the data all periods whenever the necessary factors are filled in each column they have been collected over a continuous period. This purpose is to know inflow from the catchment area by means of calculation of balance among change of tank storage, issue at sluice, spill from spillway and tank loss in each period, and subsequently to know runoff coefficient from the catchment area to the tank reservoir by means of comparing the inflow to the rainfall during the period.

That is:-

Inflow = Change of Tank Storage + (Issue at Sluice + Spill + Loss)

Runoff coefficient = Inflow / Total amount of Rainfall to the Catchment Area.

From Table 3.3.3.1. seasonal and annual averages of inflow loss, spill and runoff coefficient for the past years are calculated and shown in Table 3.3.3.2.

TABLE 3-3-3-2

Average of Past Data

	Maha	Yala	Annual
Inflow	22038 Ac. Ft	6553	28611
Loss	1216 Ac. Ft	957	2173
Spill	5589 Ac. Ft	1778	7367
Usable Water	15253 Ac. Ft	3818	19071
Runoff Coefficient	36.1 %	19.7	30.7

TABLE 3-3-3-1

Relation among Inflow, Outflow and Rainfall of each Season at Dewahuwa Tank

Season	Period	Days	Mean water depth	Lost storage	Issue from sluice	Spill from spillway
		Days	FT	AC. FT	AC. FT	AC. FT
MAHA	53.10.10 - 54.2.28	142	18.4	886	6,323	5,744
	62.9.1 - 62.12.31	122	23.4	1,174	12,364	-
	65.9.1 - 66.2.28	181	21.4	1,459	9,715	11,827
	66.9.1 - 67.2.28	181	22.2	1,553	18,864	7,310
	67.9.1 - 68.2.29	182	18.5	1,148	13,275	15,701
	68.9.1 - 68.12.31	122	16.0	611	8,422	-
	69.9.1 - 70.2.28	181	21.9	1,506	17,157	5,550
	72.10.11 - 72.12.31	82	15.4	390	11,289	-
	73.11.1 - 74.2.28	120	17.8	702	5,930	-
	74.9.1 - 75.2.28	181	12.2	612	505	-
	Total & Average	1,494		10,041		46,132
YALA	54.3.1 - 54.8.31	184	17.7	1,076	6,531	13,342
	55.3.11 - 55.4.30	51	19.3	345	2,627	-
	62.3.11 - 62.8.31	174	23.0	1,606	4,532	-
	65.7.11 - 65.8.31	52	18.7	338	0	-
	66.3.1 - 66.8.31	184	13.5	718	3,316	-
	67.3.1 - 67.8.31	184	16.8	994	5,372	-
	68.3.1 - 68.8.31	184	13.7	730	3,620	-
	69.3.1 - 69.8.31	184	12.3	622	3,398	-
	74.3.1 - 74.8.31	184	14.0	754	7,573	-
	Total & Average	1,381		7,183		
		2,875		17,224		13,342

Note ; Catchment area of Dewahuwa Tank is 26 sv miles = 16,638 AC

Lost storage = 0.16 in./day x Days x Surface acreage of Tank

Change of storage during the period	Inflow from catchment	Rainfall	Total amount of water by the rainfall	Runoff coeffi-cient	Remarks
AC. FT	AC. FT	Inch	AC. FT	%	
+ 4,416	17,369	51.17	70,947	24.5	Some part of Maha
- 798	12,740	35.51	49,235	25.9	- do -
- 252	22,749	35.10	48,666	46.7	
+ 3,722	31,449	56.38	78,171	40.2	
+ 2,976	33,100	45.08	62,503	53.0	
+ 2,101	11,134	31.86	44,174	25.2	- do -
+ 6,666	30,879	54.45	75,495	40.9	
- 1,430	10,249	13.92	19,300	53.1	- do -
+ 3,838	10,470	16.09	22,309	46.9	- do -
+ 813	1,930	24.09	32,967	5.9	
	182,069	÷	503,767	36.1	
- 3,438	17,511	40.18	55,710	31.4	
+ 368	3,840	11.99	16,624	23.1	Same part of Yala
+ 4,507	10,645	31.78	44,063	24.2	- do -
- 570	(- 232)	5.43	7,529	0	- do -
- 1,536	2,498	13.88	19,245	13.0	
- 4,814	1,552	20.48	28,396	5.5	
- 1,672	3,620	16.86	23,376	15.5	
+ 79	4,099	21.14	29,311	14.0	
- 2,906	5,421	18.80	26,066	20.8	
	49,186	÷	250,320	19.7	
	231,255	÷	754,087	30.7	

However as seem in Table 3.3.3.1. there are periods in which the data of some part of Maha or Yala are available. Therefore Table 3.3.3.2. was made by adjusting the period of time. For example as to Maha there are 181 days from 1st September to 28th February, and on the other hand the Maha days picked up in Table 3.3.3.1. are 1494 days altogether. So in Table 3.3.3.2. the averages of each factor in Maha are adjusted by using the ratio 181/1494. Same as in Yala and annual.

By the result of this, in concept of the past total average on water balance, the usable water from Dewahuwa Tank is:-

15253 AC. FT in Maha + 3818 AC. FT in Yala = 19071 AC. FT annually.

It means that if the water necessity at sluice is 6.3 FT/AC for Maha cultivation and 7.1 FT/AC for Yala cultivation (See the chapter of Water Management and annexed report "Study on Water use in the Dry Zone") out of 2335 AC. of benifited area of Dewahuwa Tank 100% of Maha cultivation and 25% of Yala cultivation $\frac{(19071 - 6.3 \times 2335)}{7.1}$ = 614 AC ÷(25%) should have been possible in the past years.

But the actual situation of Dewahuwa in the past 25 years after the renovation of Dewahuwa Tank has been quite different from the above assumption. That is as indicated in no successful example of Yala cultivation and having three abondoned Maha cultivation. (in 52/53, 58/59 and 74/75 Maha) the fluctuation of the rainfall in aspects of its amount, arrival and distribution has interrupted the realization of so called calculated expectancy as given above.

In this regard the target in the Feasibility Report of Dewahuwa Special Project might be said to be too high as a result because it had never been calculated on the basis of rainfall fluctuation but had been based on the regular rainfall expectancy although it was reduced to 75% of the past average of rainfall amount.

Subsequently since the runoff coefficients in Table 3.3.3 2.are distributed in high range an average of them means just a standard. But for reference, according to "Water Resources of Ceylon" written by S. Arumugam runoff coefficients from streams of the Dry Zone and the D.W. Zone distribute between 10% to 50% and out of about 90 streams of these zones in about 10 of them the runoff coefficient is lower than 20%.

Tentatively calculating runoff coefficients of streams having

about some scale as those at Dewahuwa by using the book mentioned earier they are shown in Table 3.3.3.3. and they are a little higher than 30.1% of that of Dewahuwa.

TABLE 3-3-3-3

Runoff Coefficient of Each Station

Name	Annual rainfall in average	Area in sq. miles	Annual yield	Runoff coefficient
Karagan Oya	44 in.	22.5 mile	20 x 1000 Ac. Ft	37.9 %
Embilikala Oya	43	23	19	36.1
Bampawe Area	37.5	31	26	42.0

In Table 3.3.3.1. it is noticeable that the inflow from 72/73 Maha to 74/75 Maha have been continously low. Although total inflow of each in 72/73 Maha and 73/74 Maha cannot be known precisely because of lack of necessary data from 73.1.1. to 73.2.28. and from 73.9.1. to 73.10.31. in each, the additional inflow in these periods when no data were available is assumed to be low since the rainfall in these period were 0.8 in. and 4.89 in. respectively.

Anyhow both in 72/73 Maha and 73/74 Maha the inflow from the catchment to the tank was undoubtedly lower than the water necessity for Maha cultivation, i.e. 6.3 FT/ACx2335AC ≒ 15000 AC.FT. As to 74/75 Maha the inflow was beside the point. (i.e. 1930AC.FT.)

Generally speaking when severe drought continues it is supposed that not only rainfall shortage but also reduction of runoff will occur. In other words under continous drought condition the combined demerit of decreased rainfall and reduced runoff will have adverse affect.
But here this supposition was not proved quantitatively, so it is not sure whether the extraacordinarily poor inflow in 74/75 Maha is due to a result of the above mentioned combined demerit caused by the three year continaous drought or not.

Although high correlation between the rainfall and the runoff coefficient is not found by analysis of Table 3.3.3.1, it is supposed to be rather

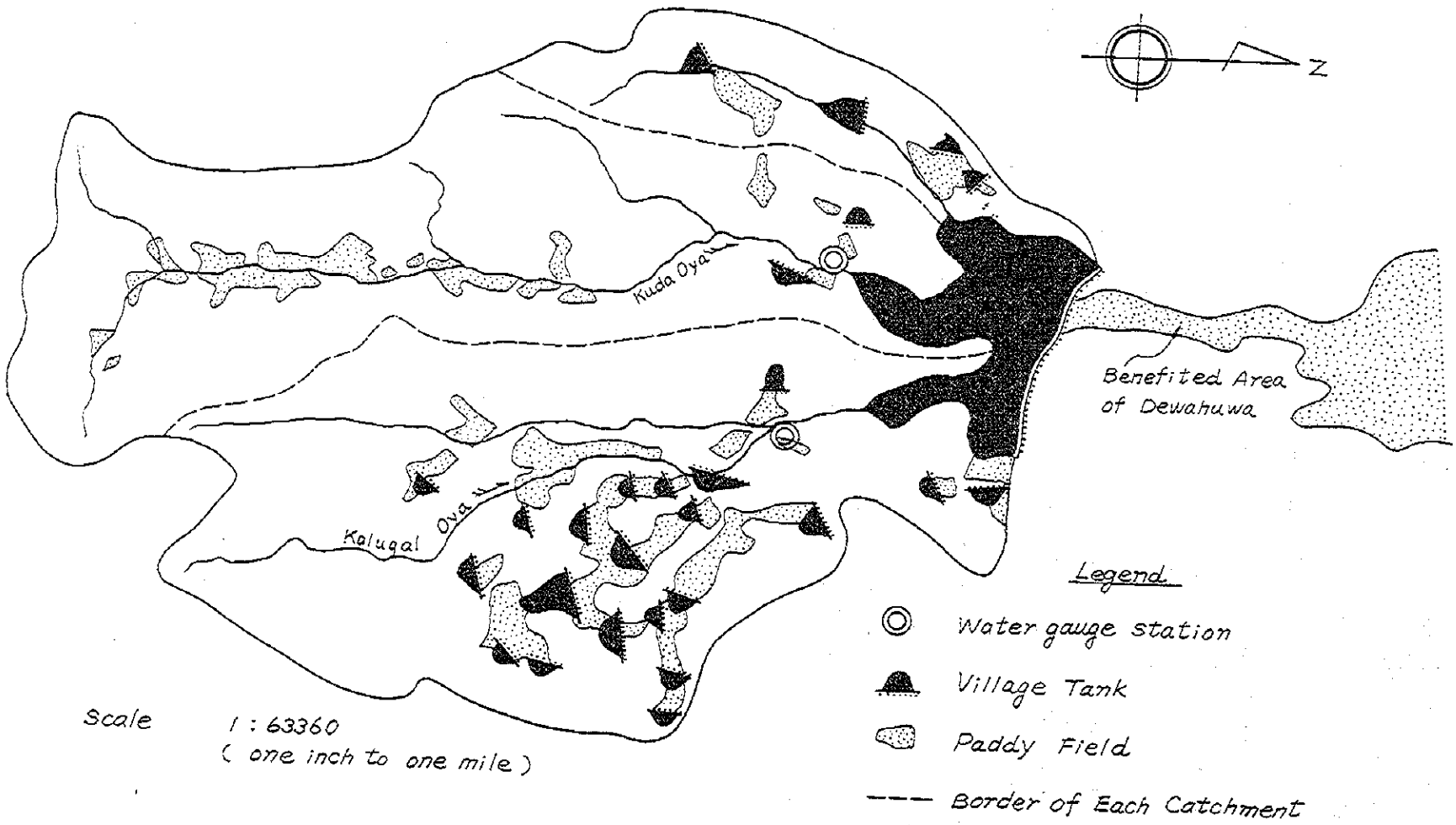
reasonable. Because nature of runoff not only depends on rainfall amount but also depends on its pattern including rainfall frequency, amount of one instance to rainfall and intensity etc.

This inference will be proved quantitavely by following data which have been obtained through the measurement of runoff at the catchment area of Dewahuwa Tank.

3.3.4 Fig. 3.3.4.1. is a map of the catchment area of Dewahuwa Tank. In the area of 26 sq. miles three streams flow into the tank, but out of these three Kuda Oya and Kulugal Oya functions as water resources of Dewahuwa Tank and the third which has no name, is assumed that the role of this stream as water resource in negligible because of its narrow catchment area and owing to its running through village tanks before reaching Dewahuwa Tank.

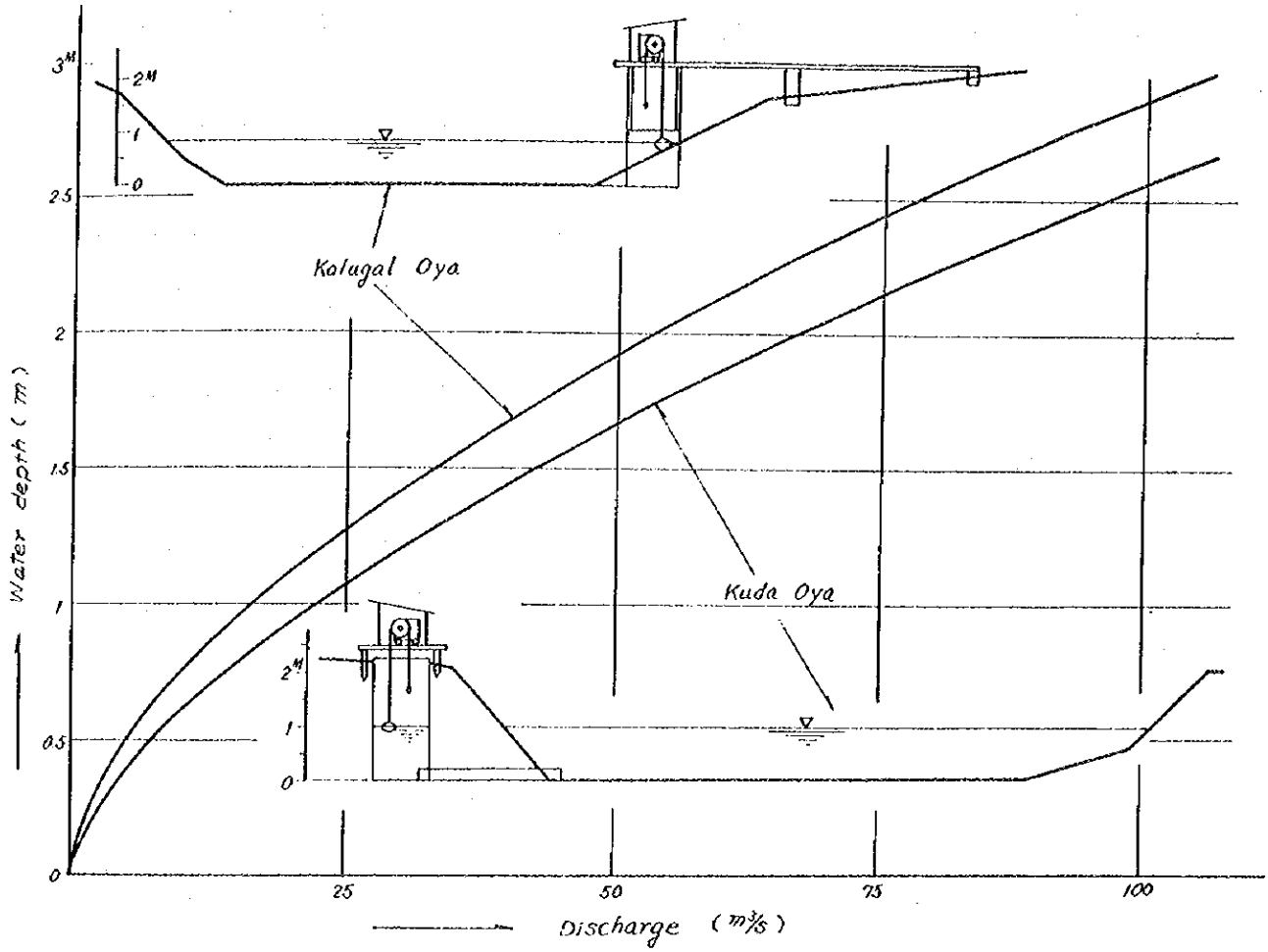
So the project installed water gauges at Kuda Oya and Kalugal oya as shown in the map and commenced the running from November 1974.

Fig. 3-3-4-1 Catchment of Dewahuwa tank



Incidentally the installed guages are the one month winding automatic ones and since they were installed permanently as shown in Fig.3.3.4.2 so even after the project measurement ends will continue.

Fig. 3-3-4-2 Discharge - Water depth Curve of Kuda Oya and Kalugal Oya (Dewahuwa Catchment)



Before measurement commenced cross sections and gradients of stream bed were surveyed at the water guage sites of Kuda Oya and Kalugal Oya and output survey also was done at same sites by using a current meter. Based on these preliminary survey Discharge - water Depth Curve was decided as shown in Fig. 3.3.4.2.

Here I, gradient of stream bed is 1/200 and n. roughness coefficient, is 0.029 to 0.035 depending on water depth considering condition of the vegetation of the stream bank.

Although only 8 months data from November 1974 to June 1975

are available now for the purpose of hydrological analysis, out of these data two typical rainfall patterns and hydrographs of runoff at each rainfall are shown in Fig. 3.3.4.3.

The one is 68.5 mm rainfall during 74.12.27 to 74.12.31 and it is an example of 'continued less severe rainfall' in which the rainfall peak is not clear, and other is 115 mm rainfall during 75.5.28 as an examle of 'short time intensive rainfall'.

These rainfall measurements are not of Dewahuwa but of Galewela which is sited in the catchment area of Dewahuwa Tank.

In the rainfall in December 1974 the runoff peaks appear 60 to 70 hours later after rainfall commences at both streams and their summits are not clearly defined.

On the other hand in the rainfall in May 1975 the peaks appear within 8 hours after the rainfall in both streams and their summits are very marked. In this respect both rainfall and runoff are in contrast to each other.

The runoff amounts, accordingly the inflow amounts to Dewahuwa Tank, caused by these two rainfalls are shown in Table 3.3.4.1. by means of calculation using Fig. 3.3.4.2.

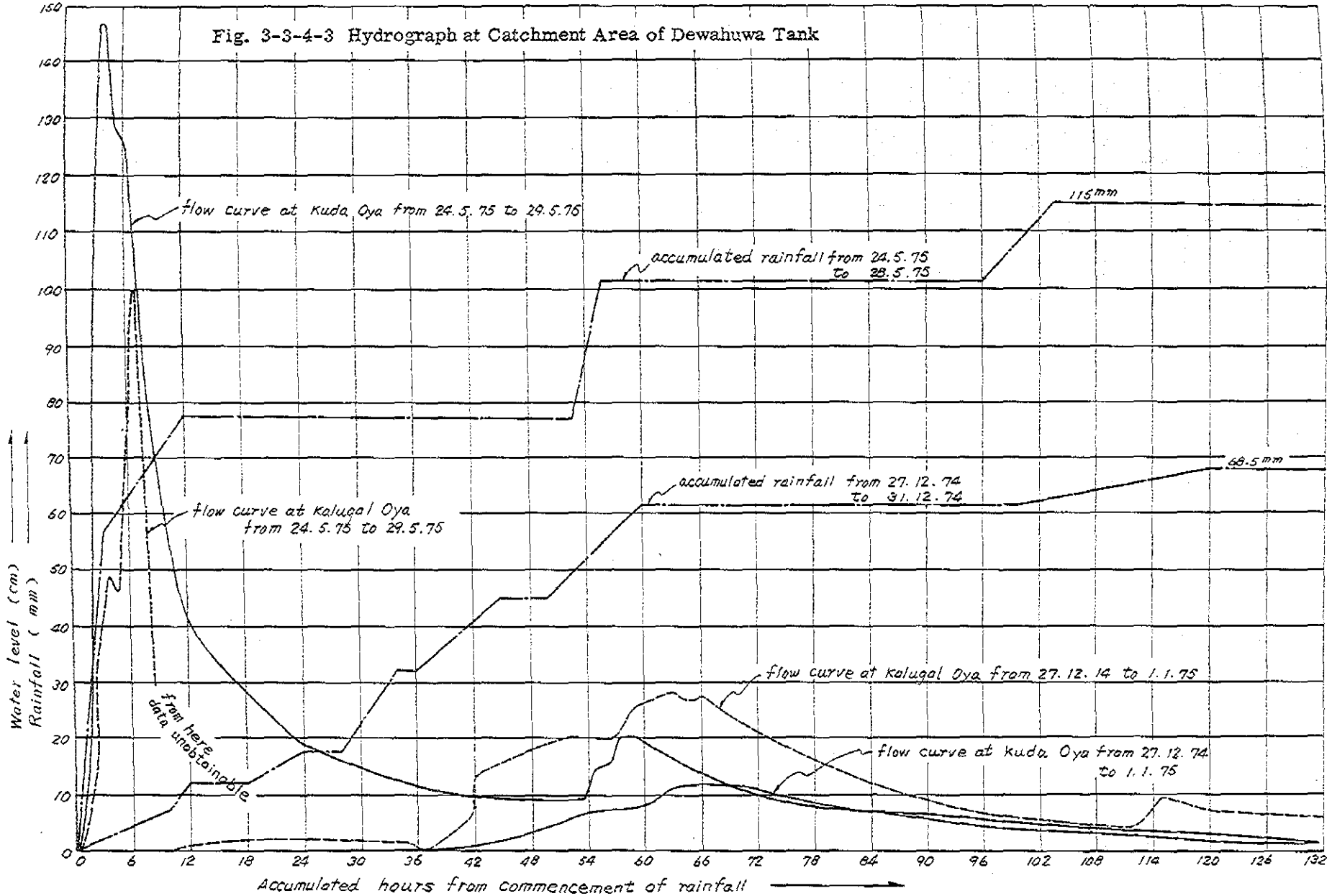
As seen in Fig. 3.3.4.3. and Table 3.3.4.1. there are remarkable differences between the two runoffs regarding time lag between rainfall and runoff, shape of runoff peak and its duration, runoff coefficient and accordingly its amount, and these differences are supposed to be brought about by each amount and intensity of rainfall.

TABLE 3-3-4-1

Yield by Different Rainfall Pattern

	68.5 mm rainfall from 27.12.74 to 31.12.74	115 mm rainfall from 24.5.75 to 28.5.75
Kalugal Oya	18.5 Ac. Ft	194 Ac. Ft.
Kuda Oya	70	846
Total	255	1,040
Runoff Coefficient	7.7 %	16.6 %

Fig. 3-3-4-3 Hydrograph at Catchment Area of Dewahuwa Tank



Generally an area which gets rainfall has its own 'surface retention capacity' in accordance with its topography, soil and vegetation, and until moisture balance of the area is broken through the surface retention capacity by the rainfall runoff does not happen.

Therefore, hypothetically speaking whenever a rainfall period is long and whenever a rainfall total is plentiful if the surface retention after deducting soil moisture by evaporation and movement to ground water table is not broken through this rainfall is completely meaningless for runoff.

In this respect if rainfall amounts are same in two types of rainfall it can be said the shorter and the more intensive the better for runoff. Meanwhile even though a rainfall has typical pattern of the short-intensive type if its amount is too small to overcome a surface retention capacity of an area it is also useless for runoff. Accordingly either intensity of rainfall or amount of rainfall are both important in contributing towards runoff.

Fig. 3.3.4.3. and Table 3.3.4.1. indicate the phenomenon as mentioned here very clearly.

Next Table 3.3.4.2. shows as to whether each rainfall after November 1974 is recorded as a runoff peak in chart papers of the automatic water guages or not.

According to the table out of 620 mm = 2 FT rainfall during November 1974 to May 1975 about half (i.e. about 1 FT) of rainfall does not have runoff mark.

Suppose the effective rainfall to runoff is roughly 1 FT and runoff coefficient is about 10% infering from Table 3.3.4.1. in the above given period, then total runoff from the catchment area (26 sq. Miles = 16638 AC) is as follows:-

(Effective Rainfall 1 FT)x(Runoff Coefficient 10%)x(Catchment Area 16638AC) = Total Runoff 1700 AC.FT.

This amount is roughly near to 1930 AC.FT. of the inflow from the catchment to Dewahuwa Tank. In 1974/75 Maha season shown in Table 3.3.3.1. so it may be useful to explain why the inflow to the Tank in 1974/75 Maha was extraordinarly small. As mentioned earlier in order to know the runoff amount, rainfall must be studied not only with regard to its

TABLE 3-3-4-2

Relation between Rainfall Pattern and Runoff during Nov. 1974 to May 1975

Date	Rainfall per day	Hour of Rainfall	Rainfall Intensity	Whether there was Runoff?	
				Kuda Oya	Kalugal Oya
74.11.7	25.5 mm	7 hours	3.6 mm/min.	Yes	No
11.14	46	8	5.8	Yes	No
11.23	12	19	0.6	No	No
11.24	21	3	7.0	No	No
12.6	1.5	5	0.3	No	No
12.8	19.5	8.5	2.3	No	No
12.9	1.5	0	1.5	No	No
12.10	2	0	2.0	No	No
12.22	1.5	7	0.2	No	No
12.23	5	16	0.3	No	No
12.24	5.5	18	0.3	No	No
12.25	33	12.5	2.6	No	No
12.27	17.5	12	0.8	No	No
12.28	27.5	19	1.4	Yes	Yes
12.29	16.5	12	1.4	Yes	Yes
12.31	6.5	18	0.4	No	Yes
75.1.2	1.5	0	1.5	No	-
1.17	8.5	18	0.5	No	-
1.18	7.5	7.5	1.0	Yes	-
1.20	4	2.5	1.6	Yes	-
2.23	26	14	1.9	No	-
2.28	14	0	14	No	-
3.1	6.5	0	6.5	No	-
3.3	1.5	0	1.5	No	-
3.4	25	0	25	No	-
3.5	70	-	-	Yes	No
3.6	15	-	-	Yes	Yes
4.10	30	"	-	Yes	No
4.13	9	0	9	Yes	No
4.27	45	-	-	Yes	Yes
5.24	77.5	77.5	10.3	Yes	-
5.26	24	2	12	Yes	-
5.28	13.5	7	1.9	No	-

amount but also to its characteristics i.e. intensity, frequency etc.

3.3.5 Of course, as to the study on the correlation between rainfall and runoff, 'long period survey' and accumulated data are indispensable to gain authentic results.

However, at this point some inference based on the data after November 1974 and their analysis may be shown as follows:-

1) There is no runoff if single rainfall is less than 1 in.

2) There is no runoff if intensity of rainfall is less than 0.2 in./hour.

3) Inspite of the above 1) and 2), if total rainfall in one week or ten days is more than about 2 in. to 3 in. there may be a runoff.

Note 1 : The above inferences are based on investigation made at the catchment area of Dewahuwa Tank, and each area has its own surface retention capacity. Therefore, these inferences cannot be used in other areas without separate investigations being made for them.

Note 2 : The above inference have been based on investigation made from November 1974 to June 1975, and this period is before the three year long spell of drought. Therefore, the inferences might be more severe in normal times.

Finally in order to supplement the earlier descriptions a further study is added below:-

As mentioned, if its amount is fixed, rainfall in catchment area can be said to be better for unable runoff if it is shorter and more intensive, but on the other hand rainfall in paddy field is considered better for effective use in field if rainfall is longer and less severe; because of water storage capacity of field (both from soil moisture and physical condition of liyaddas) and of water necessity from physiological point.

From these two conflicting aspects and in addition to artificial demand in respect of field prepation connected with commecement of rainfall season, which kind of rainfall pattern would be most suitable for field cultivation?

This problem can be solved only when necessary data regarding rainfall, runoff, and crop yield are collected.

When relations between each rainfall pattern, its frequency, each runoff and crop yield are analysed clearly by using accumulated data on the

given factors, then targets on how to improve farming environment will become more meaningful from the side of either irrigation or agronomy, e.g. transfer among crops, supplemental irrigation facilities, improvement of water management etc.

It means the approach to "Minimum investment v.s. Maximum benefit", will meet through the basic study so far mentioned.

So we hope that the study and investigation mentioned in this chapter will be continued further in this country.

4. Irrigation

4.1 Irrigation Facilities

4.1.1 Summary

In this chapter, the type of work and construction schedule etc. are reported regarding paddy field irrigation facilities. Some consideration is also given to the reasons for employing these methods in the project planning.

As for the paddy field irrigation facilities, partial renovation on a small scale such as improvement of outlets etc. had been planned based on the judgement that radical major renovation would not be necessary.

There was a little difficulty in the initial construction schedule itself, and we could somehow complete the works estimated, barely in the last year of the project.

Channel facility became far better than what it used to be before the project started. Each improved point gives the expected benefits.

The total imvestment*1 in this part was Rs.658,800 (576,000) including Rs.245,300 (132,900) of foreign currency for imported materials.*2

*1 : up to 1974, including drainage and road improvement

*2 : supposed 1 Re. = 50 Yen in average

This investiment works out to Rs.43/- (38) per meter of the main channel and Rs.280/- (250) per 1 ac. of irrigated area.

(in each case, cost of construction machines imported is not included. In ( ) is figure of original plan).

Befoe the special project started, 1900 thousand Rs. had been spent for the construction; upto 1952, 1700 thousand in 1954 and 1955 160 thousand. (Water resources of Ceylon, Administration Reports). This will be approximately 5000 thousand Rs. in present value.

So unit investment is Rs.2100 per Ac. Then improvement works of this time is about 1/8 of that.

Total investment per acre of this scheme is a little bigger than other scheme (reference data 1).

Here we would like to emphasize what we strongly felt through our experience. Whether it is a new reclamation project or rehabilitation scheme, when we make a plan of an irrigation scheme, we can not examine too closely the following two points.

(1) to make a plan of a facility which is just suitable for the purpose based on a proper forsight of the way of use depending on all local conditions including cultivation and irrigation methods, socio-economic circumstances without being biased.

(2) If we make a renovation (=change) in a system which is now balanced at a certain level, the effect of the change (sometimes it is a negative reaction) will spread over the whole system.

On the other hand, we have to find out and establish a new way of using the system, though this sounds contrary to the previous observation, according to the restriction of the newly renovated facility.

Otherwise, it is of no use improving a facility. That is to say, persons concerned must be well aware of the relation between the facility and its user.

4.1.2 Construction Schedule

4.1.2.1 Kinds of work

Kinds of work and construction schedule (plan and result) is shown in table 4.1.

As is shown in the preface "outline till the start of the project", it was judged that the fundamental renovation such as augmentation of the tank or re-formation of channel system was not necessary.

The contents of renovation work for paddy field irrigation facilities are summarized as follows:

1) Improvement of the maintenance roads which had been left without repairs since the beginning of the colonization and which were hardly usable for vehicles.

2) Restoration and maintenance of water cross section of the main channel and big branch channels which had also been left as it was so that the capacity had been reduced to half.

3) Improvement of outlets and check gates (regulating gates)which aimed at the control of distribution by quantitative operation, and also aimed at the prevention of leakage.

4) Water observation facilities such as parchall flume.

5) Improvement of drainage

As particular works belong to item 2,

i) Desilting of the channel, and (ii) slope protection were planned.

At planning these items, of course their necessity and cost had been considered carefully, but the consideration of their benefits and possibility of its expansion seemed to have been insufficient.

Item No. 1 and No. 2 are only normal maintenance work which should have been done annually.

In item No.3, 4, onsideration on following two points was insufficient.

i) Reaction(bad effect)to the whole system by the partial change.

ii) Balance with present facility on the whole.

And in item No.2, the permanent counter-measure was missing.

Observations on these matters will be shown in particulars (4.1.3).

4.1.2.2 Construction schedule

There was a significant difficulty and defect in project schedule.

The relation between each section on the time schedule to get the final target as a whole project was not examined sufficiently.

As for construction works of irrigation facilities, there was a big delay compared to the original schedule (table 4.1).

The reasons are summarized within the following two points.

(1) Annual providing schedule of materials

(2) Local circumstances in this country

Regarding (1), we would like to propose the following two matters for future progress.

1) To have an adjusting term of 1 - 2 years before project actually starts, to be able to proceed with supplementary and detailed investigations and to make adjustments between the two countries concerned; so that the project could be carried on smoothly. And to make a materials' providing schedule in which main construction materials are to be imported in the first year.

2) To be free to spend sufficient finance to meet the changes in plan according to circumstances.

Regarding (2)

Supplementary construction materials such as cement, timber, aggregate were to be supplied locally. Collections of these materials, (as well as finding the skilful labourers) exhausted time and labour of the officials concerned.

In this project, T.A's themselves had to do everything from estimation to collecting materials and recruiting labour and making payments.

Usually they had to go as far as Anuradhapura for some of this procedure and as far as Colombo to buy minor materials. And many days were wasted on these matters.

And that there are so severe restrictions such as availability in market and priorities that we must say we were lucky when we got expected quantities though it was delayed.

Under these circumstances the progress speed of the construction works in Dewahuwa project can not be said to be slow, though it was slower than scheduled in "D.P".

Unless a special means of administration and finance is arranged, it is unreasonable to expect special speed.

4.1.2.3 Particular works

As for improvement of irrigation scheme, we must make a plan with a target, the quality of which users, farmers and the maintenance body need and can maintain financially, technically and morally.

Each part should be planned, examining the balance of degree of quality to the whole system so that each part can work in mutual relation to get a result of simplification of operation and saving water over the whole system.

For example, even though we made outlet gates water proof, we can not get good results in saving water if seepage from the bank is high.

On the other hand the necessity for improvement of outlet gates is little though there is leakage from there, if we can control the distribution based on that leakage.

From these points, here we would like to make a simple progress report first, and then give some proposals to overcome what is thought to have been insufficient.

I. Works to recover and protect the original cross section of the channel.

This work has been done mostly by domestic budget and has been finished according to the plan.

I-1. Contents of work

i. Desilting

The main channel made more than 20 years ago has not had proper

maintenance work after construction so that some points have only half of the designed capacity because of silting caused by collapse of the slope and entrance of sand from high land.

Therefore this urgent restoration had to be done before discussing water management and saving.

This work was finished mostly in the first year treating 14,300 m^3 (5051 cube) of earth by total 6600 labour days.

From the second year minor works belonging to normal maintenance work have been done annually.

The unit quantity and cost were 0.84 m^3/meter (0.09 cube/ft) Rs.2.3/meter (Rs.0.70/ft), in the first year, and 550 m^3 (194 cube), ¥120,000 (Rs.3000) annually by the budget for maintenance work.

Therefore even after the big work in the first year annual maintenance work is not negligible.

ii. Slope protection

Retaining walls of randam rubble masonry with mortar coating were constructed at very badly eroded sections. More than expected quantity was performed.

For this work, 1500 m^3 (530 cube) of rubble was used but unfortunately we could not use jack hammers which were expected to be used to get rubble, till the end of the project.

This work itself is said to be a permanent construction. But collapse at the untreated sections will start from now on, so that the item can be considered one of imperfect planning, too.

The height of the wall was between 6 and 8 feet from the bottom of the channel, and unit cost was Rs.30 per foot in average.

iii. Others

A few inlet works were done for the run off water from the upland as one kind of drainage improvement.

I-2. Problems and subject to be examined more in the future.

The work that we have done under this item was of merely an emergency measure.

The most advanced method would be pipe line system or concrete flume channel with cover. But of course these are not practicable here. Therefore, radical examination is necessary for "shape of cross section", "treatment run

off inlet", "treatment of cattle and people" as shown in the attached report.

II. Facilitate control discharge of distribution

Improvement of outlet gates and check gates to control the water level in the main channel belong to this item.

We could not start till '73 due to late arrival of materials and other local reasons.

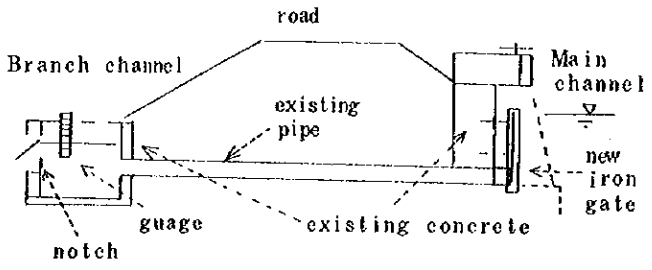
Gates and other metal materials were imported; all other costs were met by local budget

II-1 Detail of work

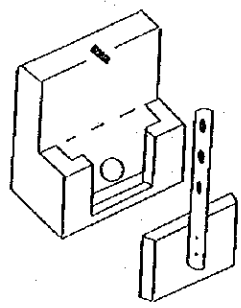
i. Improvement work of outlet gates and check gates

Wooden slide gates had been fixed at each existing outlet and could be moved only to certain positions. But not only because of its age but also because of the structural faults, seepage was high.

This time, water tight iron gate with a screw operation was fixed and at the downstream side of outlets rectangular notches were set to carry on quantitative operation.



new facility



existing gate

Now, practically there is no leakage at all.

And we can decide on the opening noticing the distributed discharge.

13 outlets to allotments which were located at the uppermost section of T-3 big branch channel, and had freely enjoyed ample water, were unified into 3 outlets.

From the experience gained through agricultural development carried out in various parts of South-east Asia, it is generally accepted that the minimum unit of water management should consist of 20 to 25 farm households or cover a farmland area of 25 to 125 Ac. This unit is to be covered by one outlet.

"Dr. Fukuda, Report of the Japanese Technical Guidance Team for Dewahuwa Rural Development Project, Sri Lanka."

ii. Check structure

Check structures, as well known are made

1) to keep the water head enough for every outlet between two structures, while the discharge of water is little, and,

2) to have a capacity to keep constant water level regardless of the discharge of water and keeping the gate closed.

Check structures or regulators are not new ideas on principle, and there had already existed at point of some big outlet. The points we took into consideration on construction of new structures are -

to set at necessary points based on the study of water surface slope in the whole channel

We actually constructed 5, instead of 8 which had been estimated in the "D.P", after re-examining the longitudinal slope of the channel.

By the way, with the help of the official concerned in the survey department, on carrying out the levelling, we could find only one bench mark out of 6 shown in the records of the department. Others were undetected or broken. Better maintenance and consideration on recording is desired.

II-2 Subject to be considered

i. As for outlet gate

The newly fixed gate is good for its "watertight quality", "Easiness of operation" and "Easiness of fixing work and getting good profits", but it is so expensive that it is hardly expected to be used widely.

The price of 6" gate, which is most abundant (for 2 - 3 allotments, 9.7 - 16.8 Ac., 0.344 - 0.596 cusec) was Rs.1400 in '73 and fixing cost was Rs.200. Therefore investment is Rs.165 - 95 per acre.

The peculiar points of this gate are -

1) It is tight between the two faces of the gate surface and receiver surface of the pipeside

2) Spring device to ensure it being watertight

3) Screw type of rods to operate the gate against the pressure of springs.

We have manufactured on trial, the same type of slide gate (ϕ 10") in Colombo and found it to be a practically usable one at a cheaper price.

We can expect that such gates will be manufactured because the Irrigation Dept. is trying to make an amended type to meet local conditions based on Dewahuwa type.

ii. As for the water measuring device -

Ground slope is rather steep in this project, and the main channel runs along the highest contour line of the area.

Therefore most of the outlets have sufficient water head to fix notches. But it is supposed that many outlets may not have enough water head to adopt notch-measuring.

However, good result will be got by notching a gauge based on measuring several times at a short flume section made just after the outlet, because figures of present discharge seem to range from 1 to 3 times of the plan.

III. Check structure

The purpose of a check structure is shown in II.1.ii.

This time we designed to keep the variations in the level of water surface in the upstream within 15 to 25 cm. when the gate is closed.

Here, problems are shown regarding the planning of the structure.

1. Loss rate

The loss rate increases remarkably when water is checked up at the time of little discharge. This must be taken into consideration carefully in planning the water issue.

2. Relation with rotation

A check structure has a function only when the discharge in the main channel is low. Therefore it has no purpose under a rotation issue of the main channel itself, when there is either full flow or no flow. So the locations of structures in T-3, T-7, T-8 have been decided for the sake of convenience of rotation issue.

3. Problem on operation

Shown in the chapter of water management.

IV. Facilities for water measurement

2 parshall flumes with automatic water level recording meter have been constructed at the beginning point of the main channel and at the end of the upstream area.

At the beginning of two big branches in T-3 and T-5, simple flume sections have been made for the convenience of measuring.

Two measuring stations have been made at two main inflowing streams.

With these facilities we have been able to notice the water condition in the area, and to practise quantitative management.

IV-1 Problems and matters to be examined

i. Although a parshall flume does not need a big head loss, generally, it is difficult to get enough head when we construct it in an already existing channel.

ii. High accuracy cannot be expected on construction.

iii. Secular change of the co-efficient of roughness of the mortar surface can not be negligible.

iv. The automatic water measuring meter is so costly that it is recommended to be set only at remote unapproachable points.

v. It should have been set at Havanella Oya, the main drainage.

vi. There have been small faults in construction such as height and size of connecting pipe.

V. Facilities for maintenance

Three bridges have been made. 5.0 miles of maintenance reads-cum-farm road have been improved.

V-1 Detail of work

i. Bridges

We made one permanent bridge using imported prefabricated materials. This costed Rs.19000 (Rs.1160/ft.) including materials. While unit cost per foot of one causeway using steel plates, corrugated pipes were Rs.420/foot. And unit cost of common bridge is estimated as Rs.500 to 600/foot.

Now we have 6 permanent bridges including one foot bridge or we have 1 set/3783 feet or 1 set/128 Ac. of paddy field in the project area.

The investment becomes Rs.14200/mile in present cost.

$$\frac{(19000 \times 1 + 10,000 \times 4 + 2,200)}{4.3}$$

There are 18 temporary bridges too. Therefore there is one crossing point in each 946 feet.

Natural drainage streams make up 10 lines and their total length is 6.7 miles excluding Havanella Oya, but there is only one crossing point for vehicles which is a causeway that we made.

ii. Improvement of roads

It should be appreciated that roads for vehicles had been made along each channel.

But maintenance was not good enough to keep conditions good for vehicles.

In the first two years, all roads were improved and had a good result on the project activity.

The quantity of work was 28,000 feet spending Rs.70,000.

This investment is Rs.2.5/foot, Rs.30/Acre and Rs.150/one household.

After the third year Rs.3000 have been spent annually for normal maintenance work.

The density of road for vehicles in the project is now about 70 feet/Ac. or 53 meter/ha.

V-2 Problems and matters to be discussed later

1) A new maintenance road had been proposed in "D.P". But this idea was abandoned at a subcommittee in its early stage.

This is very regrettable,because this irrigation system itself shows the ideas that the distribution of water is the only concern.

Thereafter how it is used is neglected.

Although one of the big theme is the control of wastage to the Oya, now we can not even approach the Oya.

2) Generally speaking, because of difficulty of expectation of condition of using new roads at planning, many farm roads are not used enough and not maintained.

It is proposed to make embankment of minimum necessity, to make a turning point at the end of each road, or to connect it to other roads and, if possible, to make roads along drainage in the tail end parts of the area.

3) Crossing points of cattle are 43 other than bridges, and these points become the cause of erosion. Therefore fundamental countermeasure is necessary as shown in the attached report of "On shape of cross section of channels".

VI. Drainage improvement

VI-1 Contents of work

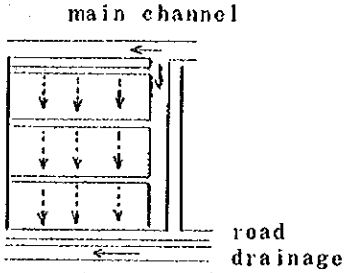
In the "D.P" improvement of 6600 feet was estimated with 6 inlet improvement.

Topography shows fairly steep, its ground slope being 1/100.
Therefore there is no problem about drainage except few blocks. Under this item 8 anicuts have been made to use water in the drainages.
Because of topographic condition, that average distance between the main channel and the main drainage stream is only 600 meter, this anicut scheme is not so feasible and only 30 acres are irrigated by these 8 anicuts. But, the preciousness of water is demonstrated by this to the farmers.

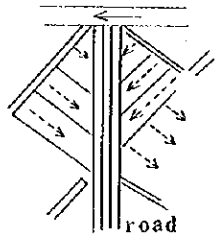
VI-2 Problems and proposals.

i. In this scheme about half of the issued water flows in the main drainage. It is of course necessary to reduce ineffective flow, but under the over-levee irrigation of Paddy field, some quantity of ineffective spill is unavoidable.

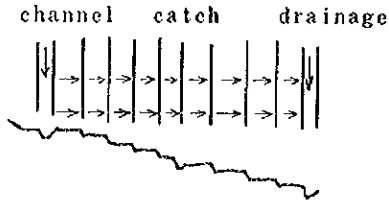
Therefore it is also necessary to consider the way of re-using drainage water. Following are examples of B.O.P. (Blocking Out Plan) expecting re-use of water.



distribution channel cum drainage



roads along drainage cum distributor channel



cath channel

ii. It is also proposed to examine to arrange roads along the drainage, and to organize C.C. (Cultivation Committee) based on the drainage block.

4.1.3 Findings and proposals

I. i. to make a plan for an irrigation system suitable for planned cultivation and irrigation method.

It is necessary to examine the rule of estimating surplus water for operation which necessity depends on the ability of the user (not only gate operator himself but also farmers concerned) and the inevitable surplus water caused by the allowances made in the constructions as for example, pipes and gates of the same diameter are used for the outlets to fields of 5 to 10 acres, in addition to physical conveyance loss. Those estimations must be based on actual investigations. It is also necessary to examine the whole irrigation system based on

expected cultivation methods such as method and period of ploughing, and irrigation methods such as necessity of rotation issue.

ii. too long main channel

The length of Dewahuwa main channel is 9.7 miles for 2340 Acres. It takes 8.5 hours with designed velocity for the flow to reach the end. Sometimes it takes more than 24 hours due to weed growth and dried up condition at the beginning of the issue.

This time lag is so great that we can not make a proper water issue schedule especially under the rotation issue.

The speed conveying the effect of operation of check gates and big outlets in the upstream is so slow that it causes confusion in the downstream.

It is desirable as a principle to have regulating ponds along the main channel. Or the system of small tanks supplied with water from big main reservoirs like the Gal Oya scheme.

If there is only one long main channel to irrigate each field, it is practically impossible to close the main sluice gate even during rain and we cannot expect effective use of rainfall.

iii. B.O.P. laying emphasis on drainage control

It is very important, from the view point of water management, to control water flowing away ineffectively to the drainage.

Therefore it is necessary to make a B.O.P. so that "c.c." can be organised in the unit of drainage groups and water in the drainage can be re-used.

iv. To adopt a consistent idea about protection of channel facilities.

It is desirable to adopt following recommendations which are shown in attached report "On the shape of the channel section".

1) to give a gentle slope to the cross section
2) to make a shoulder ditch
3) to set crossing points for cattle and to close with fence and hedges other parts.

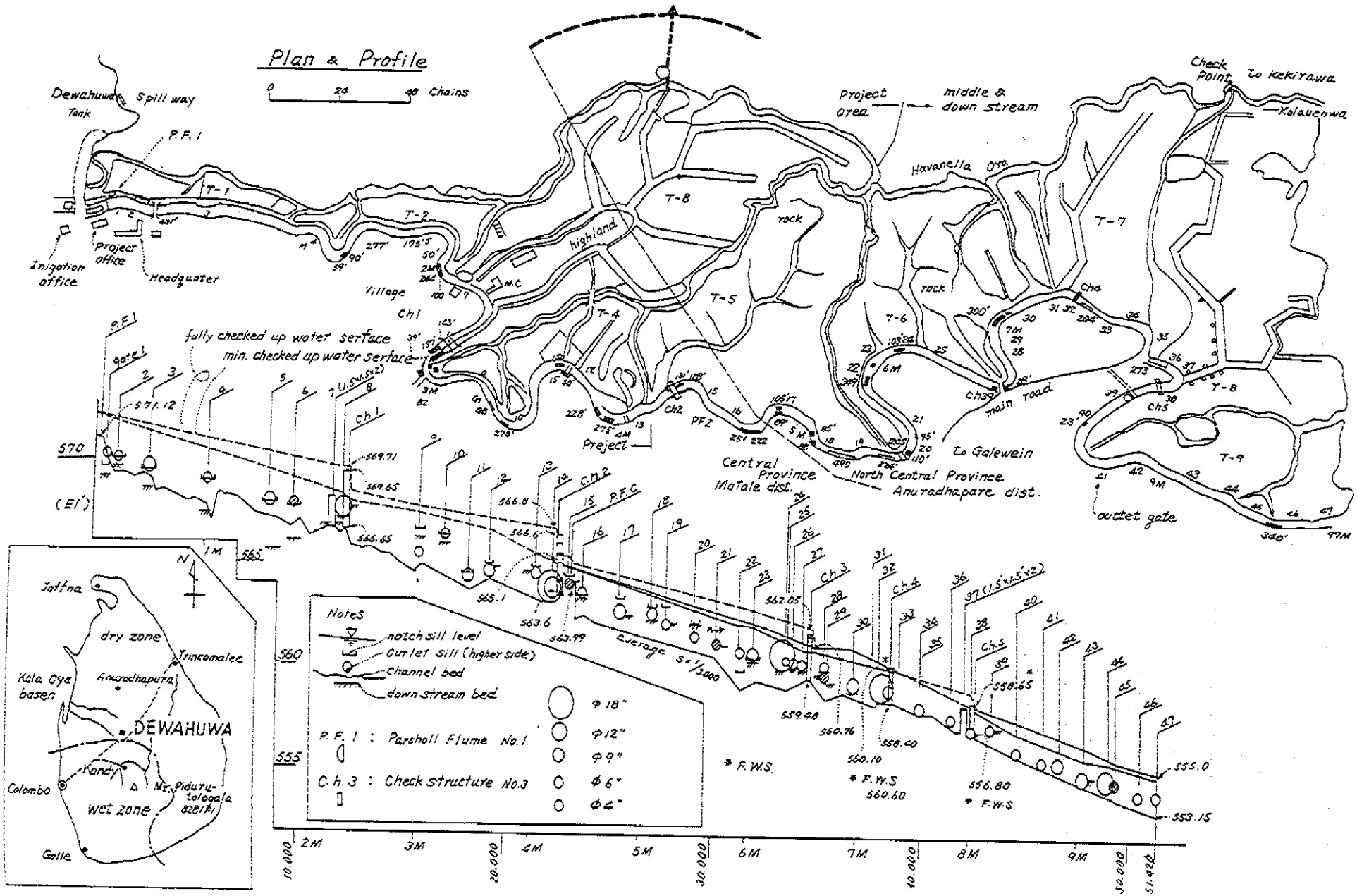
II. As for the co-operation of the two countries in the field of management,

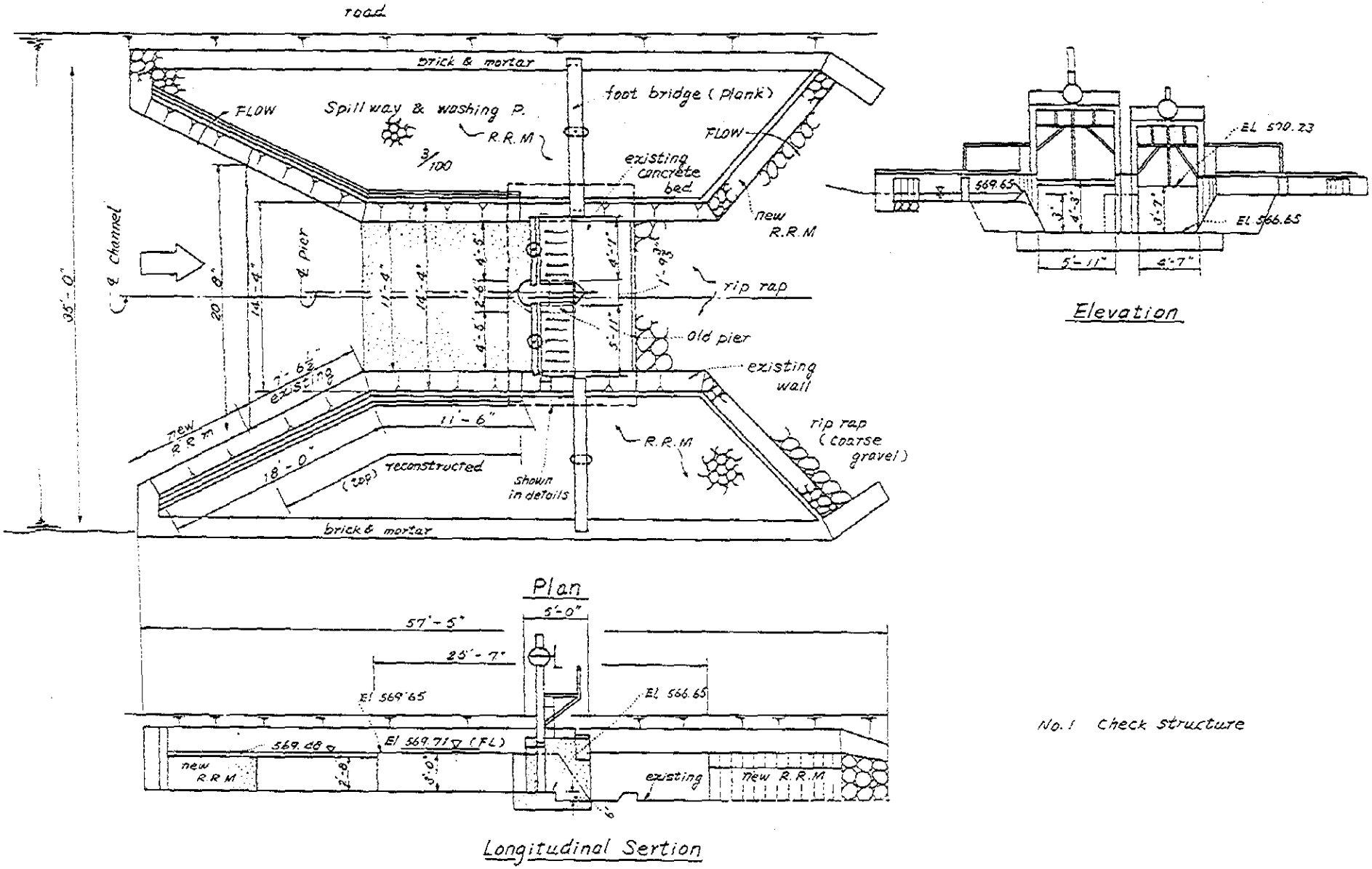
i. to have a preparing term for the supplementary investigation and all other arrangements.

ii. to make a rule of sending all construction materials and machinery in the earliest stage of the project.

iii. to establish system to meet the change of situation in the course of time.

iv. to take a special step including making of ordinances if necessary to carry out the project shedule.

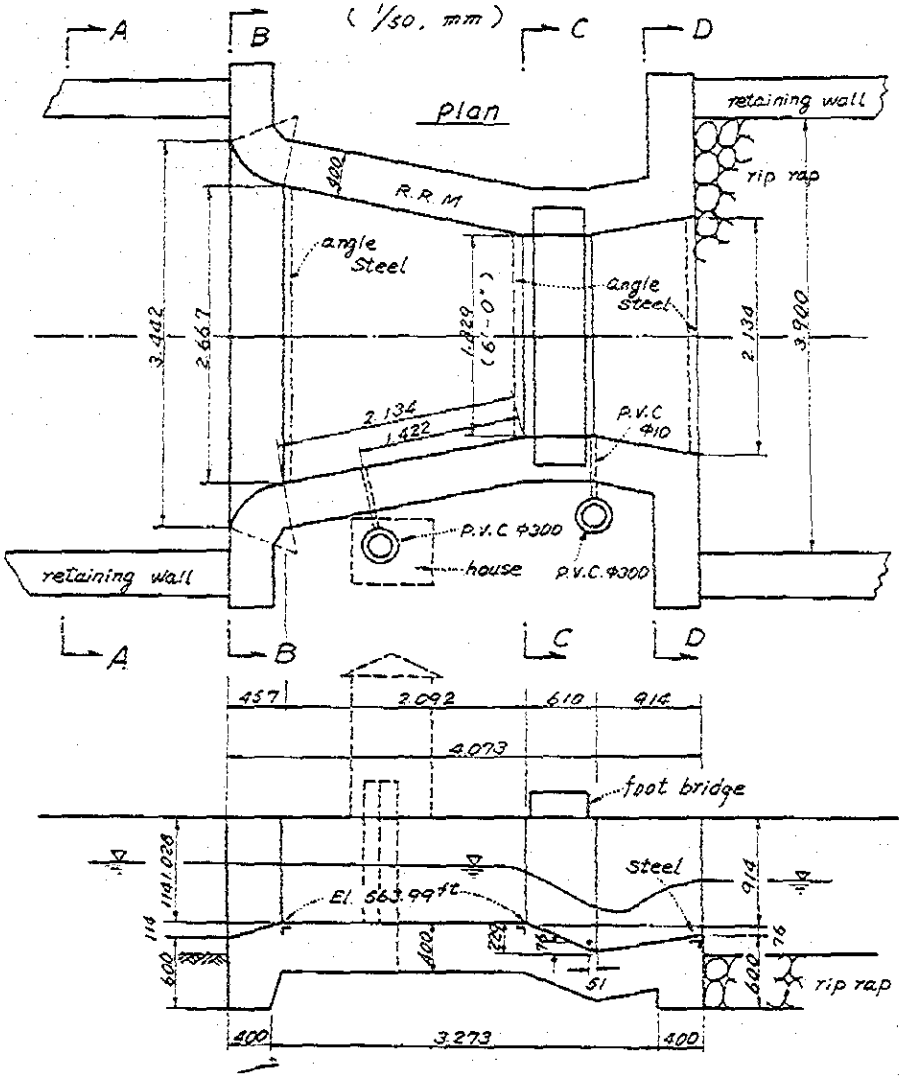

Plan & Profile
0 24 48 Chains
Dewahuwa Tank
Spill way
P.F. 1
Irrigation office
Project office
Headquater
Village
highland
rock
Project area
middle & down Stream
Havanella Oya
Check Point
to Kekirawa
Kalawewa
T-1
T-2
T-4
T-5
T-6
T-7
T-8
T-9
Ch1
Ch2
Ch3
Ch4
Ch5
Ch6
fully checked up water serface
min. checked up water serface
Project
main road
to Galewein
Central Province
Matale dist.
North Central Province
Anuradhapare dist.
outlet gate
570
565
560
555
(El')
569.71
569.65
566.65
566.8
566.6
565.1
563.6
563.99
562.05
559.48
560.76
560.10
558.40
558.65
556.80
555.0
553.15
average S=1/3000
F.W.S
Notes
notch sill level
Outlet Sill (higher side)
Channel bed
down stream bed
P.F. 1 : Parshall Flume No.1
C.h. 3 : Check Structure No.3
φ 18"
φ12"
φ 9"
φ 6"
φ 4"
Jaffna
dry zone
Trincomalee
Kala Oya basen
Anuradhapura
DEWAHUWA
Kandy
Colombo
Mt. Piduru-talagala 8281 Ft.
wet zone
Galle
N
1M
2M
3M
4M
5M
6M
7M
8M
9M
10.000
20.000
30.000
40.000
50.000
51.420



No. 1 Check Structure

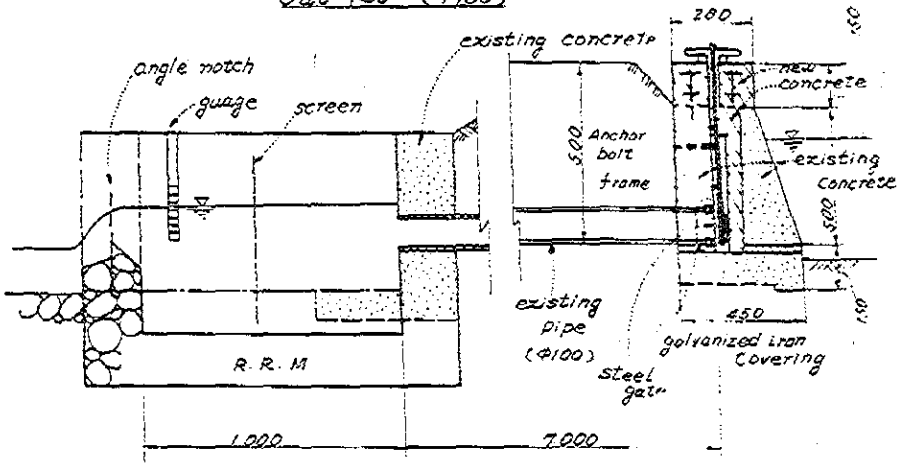
Parshall Flume No.2

(1/50, mm)



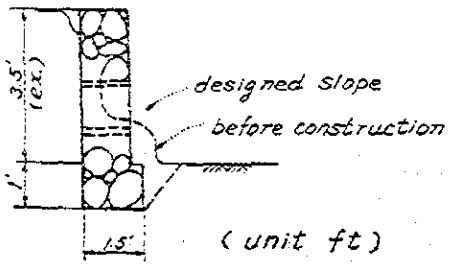
Longitudinal Section

Out let (Φ100)

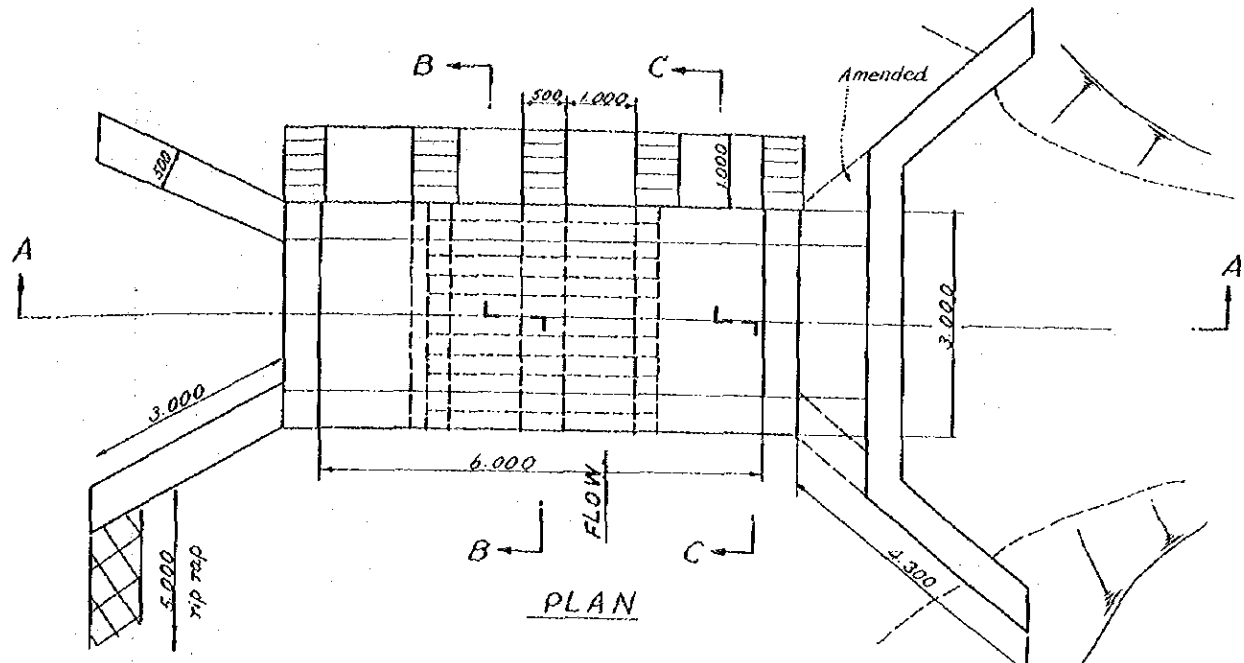


(Unit mm)

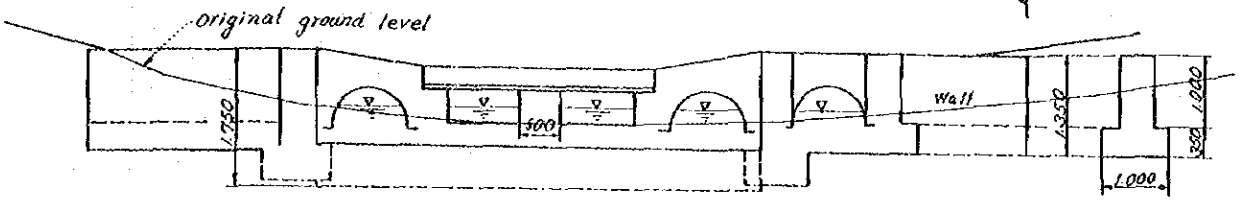
Retaining Wall



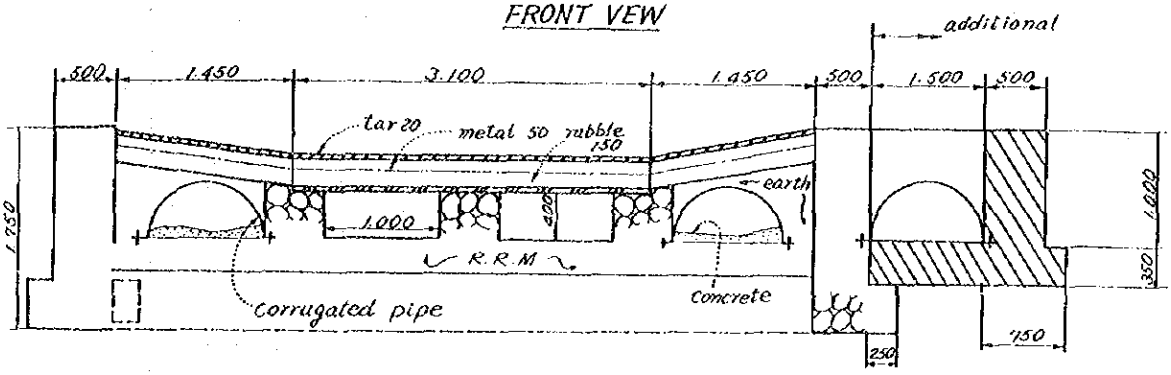
(unit ft)



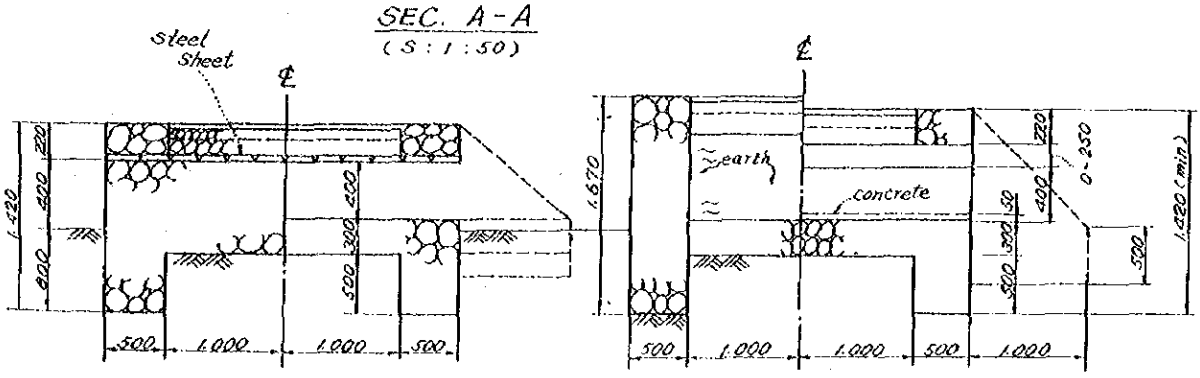
PLAN



FRONT VEW



SEC. A-A
(S : 1 : 50)



SEC B-B
(S : 1 : 50)

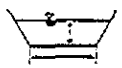
SEC. C-C
(S : 1 : 50)

Cause Way

unit : mm

31/July/75
data from Mr. Buddhactasa

Name of schemes	New of rehabilitation	Irrigable acreage	Water resources	Main channel: Max. discharge	Length	Section: B D M meters	Slope	Slope face	Constructions (Nos) (ft): Parshall flumes	Regulators	Bridges	Outlets	Drainage culverts	Spills	Retaining walls	Village tank improvements	Original	Cost x10^3 RS	
				cusec	miles						(5)		(8)*			(4)			
Dewahuwa	r.	2,340	Tank	96	9.7	4.1 0.65 0.5	1/3,000	earth	2	5	2	47			6,000				
Mahaweli stage 2																			
Kalawewa L.B.	new	18,000	Tank	430	17.5	10 1.7 2	1/4,000	earth	2	5	7	11	3	12	-	3		32,000	
"" R.B.	"	r. 23,000 n. 39,000	"	1,260	29.0	14 2.3 2	"	"	12	7	15	19	15	-	-	4		78,000	
Kandalama R.B.	"	8,000	"	200	22.0	7 1.5 2	"	"	5	4	3	12	10	1	-	3		16,000	
Wahalkadawewa	"	2,000	"	60	5.5	2 0.75 2	"	"	1	8	2	17	8	3	-	-		1,737	
				cusec/Ac	ft/Ac				mil	(1/L21)	mil								
Dewahuwa				0.0410	21.9				1/4.85	1/1.94	1/1.39	1/0.21	1/						
Kalawewa L.B.				0.0239	5.1				1/8.75	1/3.5	1/2.50	1/1.59	1/5.83	1/1.46		1/6,000		1,778 RS/AC	*Plan
" R.B.				0.0208	2.5				1/2.4	1/4.1	1/1.93	1/1.53	1/1.9			1/15,500		2,000 "	
Kandalama R.B.				0.0250	14.5				1/4.4	1/5.5	1/7.33	1/1.83	1/20	1/22		1/2,667		1,258 "	
Wahalkadawewa				0.0300	14.5				1/5.5	1/0.69	1/2.75	1/0.32	1/0.69	1/1.83				870 "	



4.2 Land Consolidation Work

4.2.1 The Meaning of Land Consolidation Work in Developing Countries

In present day Japan distribution ratio of irrigation facilities in paddy field is about 100% besides with well improved farming techniques the unit yield of paddy is remarkably high compared to other Asian countries.

But at the same time the cost of labour involved in paddy cultivation has been rising steadily and has created a new problem, that is how to maintain the high yield of paddy permanently while cutting down on labour costs.

Therefore in order to overcome this problem, l and Consolidation Work has been one of the main tasks connected with the agricultural infrastructure improvement project recently undertaken in Japan.

In other words the land consolidation work in present day Japan has to maintain the high yield of paddy under reduced l abour cots, so its role as the way to increase paddy production is rather little.

However in proper consideration the meaning of land consolidation work should not be prescribed as that in present day Japan but should be considered more systematically from its results as follows. (taken from "The engineering on agricultural land" written by Dr. F. Yamazaki).

1) Improvement of productivity of agricultural land: i.e. as a way to increase efficient use of water for agricultural purpose in paddy field by means of land rearrangement, unification of inlets liyadda, soil dressing, underdrainage and subsoil compacting etc.
2) Improvement of productivity of labour input: i.e. as a way to increase labour efficiency including mechanical energy by means of extension of liyaddas size, improvement of road condition etc.
3) Improvement of conservation of agricultural land: i.e. as a way to stabilize land permanently by means of modification of land gradient, strengthening of border and inlets liyadda to liyadda etc.

According to this when land consolidation work is to be carried out in Asian countries suitable selection should be done. That is which kind of job should be included in the land consolidation work. This should be done carefully from the systematic view points mentioned earlier.

For reference some examples of land consolidation work in Asian countries are shown in Table 4.2.1, 1. They are now being carried out with Japanese technical cooperation in each country, but their choice of necessary jobs in land consolidation work may not always be suitable for conditions in those countries, i.e. it seems there is easy adoption of land consolidation work according to Japanese methods just by lowering the quality in order to cheapen costs.

TABLE 4.2.1.1

LAND CONSOLIDATION WORK IN ASIAN COUNTRIES

State	SRI-LANKA	INDIA		INDONESIA	LAOS
Project	Dewahuwa	Dandakaraniya	Khopoli	Lampung	Tha Ngone
Total Acreage	771ac	1060ac	175ac	265ac	1980ac
Proposed Acreage for L.C.W.	applicants only 435ac	705ac	175ac	265ac	1980ac
Performance by 1974	289ac	705ac	175ac	90ac	1600ac
Contents of Work	P.F. rearrangement supplemental road, chl, etc	same as the left	same as the left	same as the left	land reclamation
Unit Price	Rs. 650-1000 except depreciation	Rs. 1300 except depreciation	Rs. 850 except depreciation	Rs. 1300 except depreciation	?
Cost Allocation	Rs. 800 by farmer	all by State	40% by farmer 60% by State	all by State	all by foreign aid
No. of Machinery	D-50 3nos D-20 1nos	D-60 2nos D-30S 1nos	all left now	D-60 1nos D-50 1nos D-30S 1nos	D-80 etc 5 - 6nos
Topo-Condition	1/30 - 1/100	1/100 - 1/300	1/100	1/30 - 1/280	1/500 - 1/1000
Expansion of Liyadda			no change	0.03ac - 1/2	newly reclaimed

Meanwhile in some Asian countries there has been the severe problem of enormous increase in population which means food production must be stepped up as rapidly and as cheaply as possible. Here there is one standard set by the Asian Development Bank (A.D.B.) on cost-benefit of each investment to agricultural infrastructure improvement as shown below, i.e.

1) Land reclamation U.S. $333/ton paddy,

2) Construction of irrigation facilities except land reclamation U.S. $200/ton paddy,

3) Improvement of supplemental irrigation facilities (construction of field channel, drainage etc). U.S. $125/ton paddy.

It means that in order to produce one ton of paddy newly in unit acreage of field the cost-benefit ratio is the highest in 3). (i.e. U.S. $125/ton paddy).

And in addition the target of improvement of supplemental irrigation facilities is said to be 50m/ha of channel, drainage and road from the main source to the end.

Taking into consideration the above mentioned points, i.e. what is land consolidation work if taken systematically and what is the most urgent demand for agricultural infrastructure improvement in developing countries, the land consolidation work at Dewahuwa Special Project is given here.

4.2.2 Deliberations regarding land consolidation work at Dewahuwa, leading to a final decision.

When the Dewahuwa Project commenced as a colonization scheme of the Sri Lanka Government after its tank renovation in 1950, the condition of the agricultural infrastructure was as follows:-

distribution of irrigation channel (including Main channel to the end).
16733m/771AC = 53.7m/ha.

distribution of drainage from almost natural streams
15568m/771AC = 50.0m/ha.

distribution of road (including Main road to the end)
19251m/771AC = 61.8m/ha.

Accordingly the distribution density of channel, drainage and road may be said to be adequate in its quantity from the commencement of the scheme in comparison with the standard of A.D.B.

(Note:- the above 771AC is the upper stream acreage of Dewahuwa Tank benefit).

Meanwhile, the paddy fields at Dewahuwa are known to be in a bad condition, for each allotment has been reclaimed mainly by manual labour.

The Sri Lanka Japan Project area (from tract 1 to tract 4) has 771AC and it is divided into 14,000 liyaddas. It means, 14,000 liyaddas/771AC = 18 liyaddas/AC. 14,000 liyaddas/153 house holds = 90 liyaddas/house hold.

or 771AC/14,000 liyaddas = 0.055AC/liyaddas or 2.2 a/liyaddas.

Accordingly at Dewahuwa paddy cultivation has been carried out under very poor field conditions as mentioned here after 1950.

The reason for this is due to manual reclamation, but basically due to the topographical condition of the Dewahuwa area. i.e. the standard gradient of paddy field at Dewahuwa is about 1/30 to 1/100 and it is almost like, "Terraced paddy field".

In addition borders and inlets of liyaddas too, are earthmade, crude and lack stability against heavy rainfall and also the necessary permeability for water storage.

Summary . The quantity of irrigation and drainage facilities is enough (but improvement in quality is necessary see the chapter on Improvement of Infrastructure).

. It is necessary to improve the condition of the paddy field. i.e. the improvement of supplementary facilities based on A.D.B. standard will be restricted in the improvement of the paddy field condition from the quantitative view point.

Subsequently basing on the present condition of the infra-structure at Dewahuwa the question, 'What kind of tasks must be done in Land Consolidation Work?' should be considered in connection with the multiple purpose of the Project.

The final target of the Project is of course the improvement of the standard rural life, and increase of income by means of increased agricultural production.

Accordingly the land consolidation work at Dewahuwa can be considered as relief work to better farming which aims at the increase of agricultural production. Therefore, the demand for better farming and the effect of the land consolidation work must co-incide systematically as follows:- i.e.

To improve the productivity of land -----. land rearrangement to enable effective transplanting etc.

.unification of inlets liyaddas to liyadda to enable effective use of water etc.

To improve the productivity of labour input ------. extension of liyadda size to enable effective use of agro-machinery etc.

. reinforcement of field road to enable effective transportation of necessary materials etc.

To improve the conservation of land -----. extension of liyadda to modify land gradient etc.

. strengthening of border and inlets, liyadda to liyadda to stabilize land permanently.

As mentioned the necessary tasks in the land consolidation work at Dewahuwa have been deliberated, but concretely. 'What kind of construction job must be done?' and 'What should be its cost ?' are problems to be solved.

In this respect investment for the work is generally decided in connection with its return, and as regards land consolidation work since its durability is to be so long as 50 to 100 years its return should also be considered in terms of its total benefit which is brought by improvement of land productivity, labour input and land conservation.

However as mentioned, in developing countries such a long term benefit may not be noticeable owing to reasons of social back ground, and any project may have to be based on a rather short term benefit.

Therefore, in the Dewahuwa Project, too, the benefit of land consolidation work was studied from the view points of its function as the relief work for increased agricultural production by means of better farming including intensive input of agromachinery and improved water management. (i.e. it may be said reversely that if not the multiple purpose, particularly better farming aimed at increase of agricultural production, will be disturbed.

On this basis the benefit of the land consolidation work was assumed to be Rs.5600/AC/year. At its commencement in 1972. On the other hand compared to the result of the tentative work in 1971 Yala (for 27AC. the cost was Rs. 1025/AC including depreciation cost). The following decision was done in April, 1972.

i.e. The unit cost of the land consolidation work Rs.800/AC. (the actual cost and nominal interest only excluding depreciation cost) and at the same time it was also decided that signing an agreement with the farmer is essential to proceed with the work.

(As to the cost analysis, see the annexed report "Justification of the land consolidation work" in February. 1972)

As a result the following items were decided for the land consolidation at Dewahuwa guided by the results of the experimental work done in 1971.

i.e.

1) Extension of liyadds size from about 1/2 AC to 1/4 AC.
2) Reduction of inlet numbers to about 1/5 to 1/10 compared to what it was.
3) Reinforcement of field road at the rate of one road for every other allotment.
4) Installation of concrete inlets from liyadda to liyadda and widened border compacted by use of heavy machines.

In addition as a result of study on field gradient and construction cost.

5) The remaining 'liyadda to liyadda irrigation system' in principle (since there is a possibility that water loss might be encouraged conversely by making field channel along liyaddas because if farmers do not manage the irrigated water if would run directly from distributing channel to drainage without entering liyaddas).

4.2.3 Results of the implementation of land consolidation work

The land consolidation work at Dewahuwa has been carried out from 1971 Yala to 1975 Yala (5 seasons). And the general feature of its implementation is shown in Table 4.2.3.1.

Incidentally the specification of the used machinery is shown in Table 4.2.3.2.

The yearly performance in acre basis is as follows:-

Table 4-2-3-1
Performance of Land Consolidation Work

Items \ Period	1971 Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	1972 Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	1973 Jan.	Feb.	Mar.	Apr.	May.
D-50A			hrs. 45	212	170	} hrs						hrs 139	191	184		55	59	24					hrs 93	212
D-50A Lipper		not yet from Japan											220	200		134	33		} 1841 hrs					
D-50P Swamp			- do -										151	186			171	98						168
D-20A			16	99	216	} 331 hrs						70	208	126		11	47		} 462 hrs				36	
D-30 Shovel																								
Soil Movement			3AC	13	11	} 27AC						6.5AC	26.5	27										
Ridge Making			1.5AC	8	17.5							5AC	26	18		2	9		} 60AC				10AC	29
Inlet Making					18.5AC	} 18.5AC										68.5AC								
Leveling					18.5AC											8.5AC	38	22	} 68.5AC					
Farm Road						} 805 m													} 276 m					
Field channel																								
Field Drainage																								
Other Works															under drainage				} 1.5AC					
Expenditure					Rs. 39270												Rs. 66375							

Items \ Period	1973 Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	1974 Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	1975 Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.
D-50A	hrs 230	209	234	210	147	127	166	56	}					hrs 87		17	85	}											
D-50A Lipper		173	252	237	134	132	193	60	} 881hrs									} 1175hrs				hrs 7261		1200hrs	{	1200hrs			
D-50P Swamp	100	181	164	174	84	30		62				hrs 30	34	197	226	174	133												
D-20A	54	185	98	65	32	60			} 953hrs						101	81	129	}				hrs 2584		300hrs	{	300hrs			
D-30 Shovel															214	79	184	} 708hrs											
Soil Movement	28AC	29	37	27								1.5AC	15	8.5	10	10	2									18AC	20	13	
Ridge Making		40AC	65	50					} 155AC						15AC	20	12									15AC	23	13	
Inlet Making		40AC	55	40	20										6.5AC	20	20.5	} 47AC				289AC		51AC	{				
Leveling					40AC	(50)	(105)	(30)	} 125AC				6AC	12	7	6	16									23AC	28		
Farm Road									} 140m									} 1125m				259AC		81AC	{	8AC	20	23	30
Field Channel									} 120m									} 230m				3696m		1200m	{				
Field Drainage																						660m		120m	{				
Other Works				soildressing					fertilizing													120m and others							
Expenditure							Rs. 112780										Rs. 79000						Rs. 40,000						

Total Performance From 71 Yala to 74 Yala

		Weight cum attachment	Horse Power	Max Pull capacity	Width of Blade	Width of Trackshoe
1971 Yala	27AC.	D-50A	11 ton	90 HP	10.34ton	3.35 m	0.4 m
1972 Yala	60	D-50A	11	90	10.34	3.35	0.4
1973 Yala	155	D-50P	12.3	90	10.34	3.35	0.8
1974 Yala	47	D-20A	2.95	35	3.21	2.3	0.3
1975 Yala	51	D-30S	6.8	55	5.2	1.7	0.3

Total ... 340AC ----- achievement 78% against applied acreage and 44% against total acreage of the project area.

As shown in Table 4.2.3.1. not only land rearrangement but also supplementary facilities in field have been improved through the land consolidation work as follows:-

	in 1970		in 1975
Irrigation channel	53.7m/ha	-----	56.2m/ha.
Drainage	50.0m/ha	-----	50.3m/ha
Road	61.8m/ha	-----	77.5m/ha

Besides other miscellaneous jobs. e.g. 1.5 AC of under-drainage, 6 AC of soil dressing and 93 AC of fertilizing, have been done.

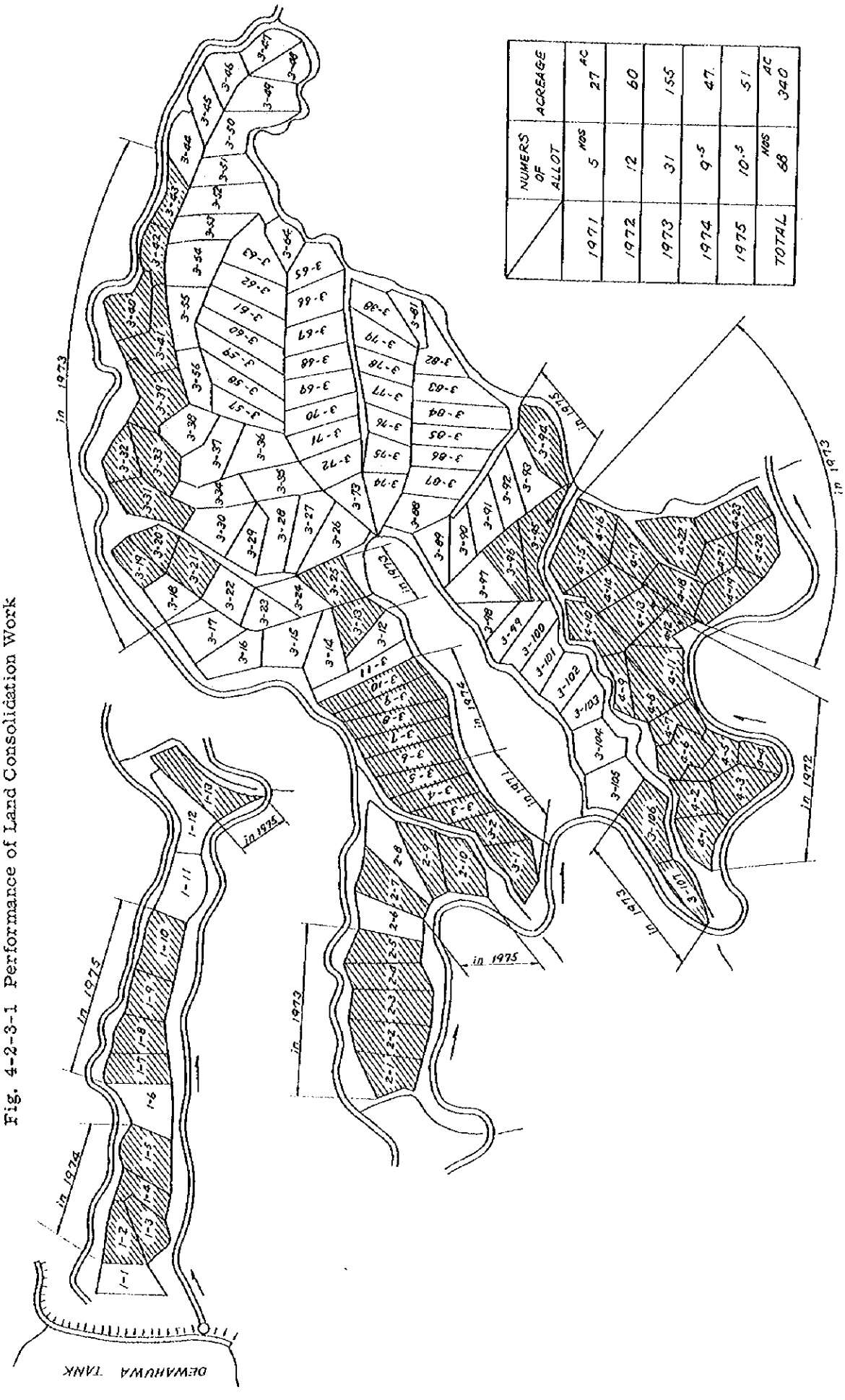
As to the construction cost, see Table 4.2.3.1. But the yearly expenditure shown in the table include the total construction costs, materials and labour cost which are involved in 'Paddy Field Rearrangement' and Farm Road' by reason of the budget, so that the actual cost of the land consolidation work is not assumed by the amounts shown in the table.

As to the actual construction costs year by year, refer to the annexed yearly reports on the land consolidation work.

The yearly consolidated area is shown in Fig. 4.2.3.1. and generally the order of consolidation among the applied allotments has been decided from the allotments in which the land gradient is rather steep because of their narrow liyaddas and consequent water loss.

Incidentally as to what kind of job has taken place in the land consolidation work is shown in Fig. 4.2.3.2. (extension of liyaddas) and in Fig. 4.2.3.3. (reinforcement of border and inlet)in each.

The efficiency per unit work of machinery and manual labour, and the detail costs etc. are shown in the separate 'Manual on the Land



	NUMBERS OF ALLOT	ACREAGE
1971	5 NOS	27 AC
1972	12	60
1973	31	155
1974	9·5	47.
1975	10·5	51
TOTAL	68 NOS	340 AC

Fig. 4-2-3-1 Performance of Land Consolidation Work

Fig. 4-2-3-2 Example of Land Consolidation at Track 4

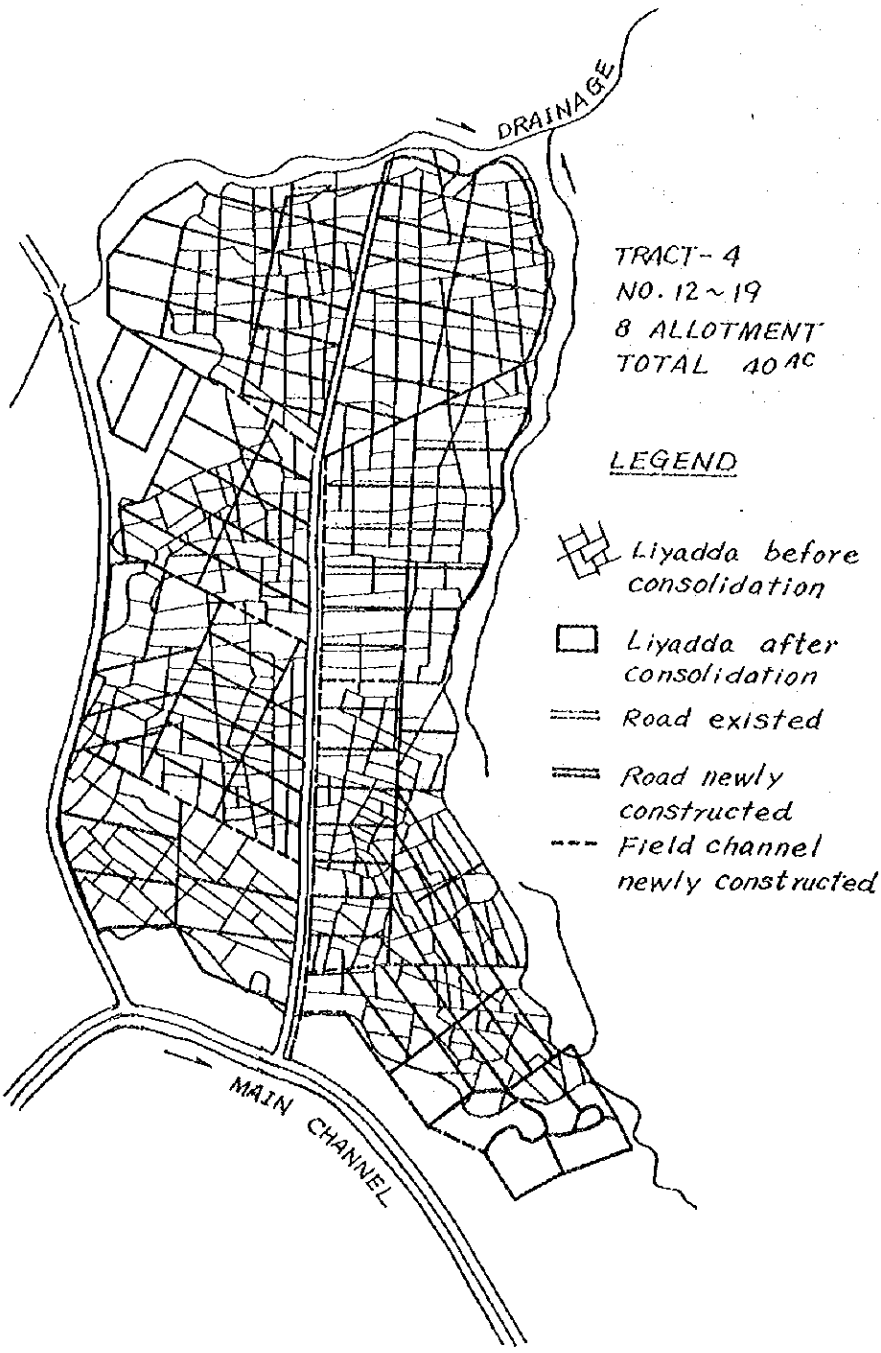
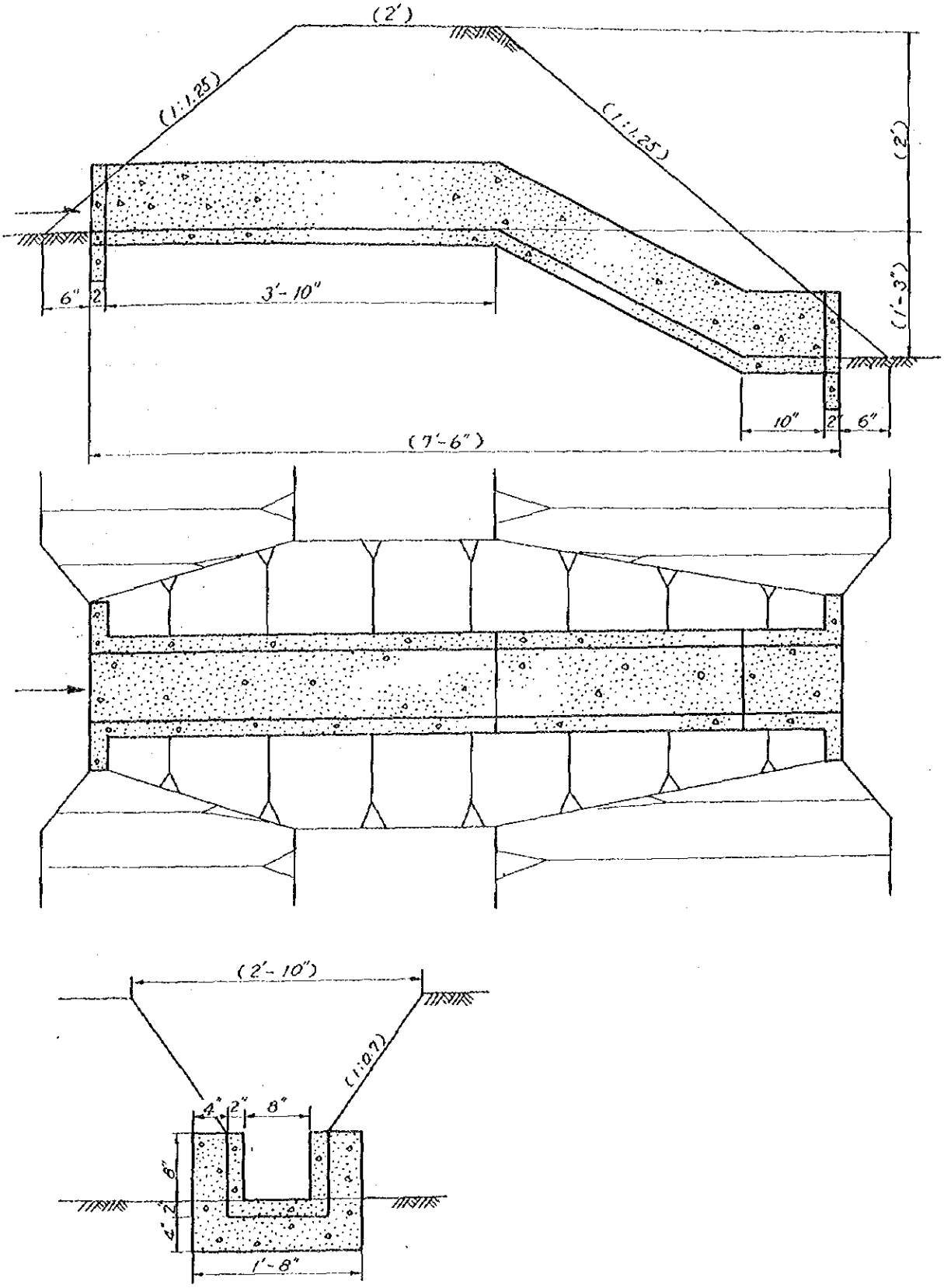


Fig. 4-2-3-3 Reinforcement of Border and Inlet



Consolidation Work'.

4.2.4 Problems and Possibility in the future on the land consolidation work

Problems which have been noticed through the land consolidation work at Dewahuwa are pointed out as follows:-

1) The application from farmers for the work

Mainly from technical necessity, to improve the agricultural infrastructure of Dewahuwa area, both efficiently and systematically some allotments should necessarily have been consolidated.

e.g. Tract 3 No.99 to No.105 as seen in Fig. 4.2.3.1.

But since the application from farmers was adopted at the commencement of the work, the Project could not perform the necessary work against the unapplied allotments but for the Project area itself because those allotments will still remain in poor field condition and it will disturb the systematic functioning of irrigation facilities, agro machinery, labour input and so on.

According to reports from farmers the reason that some applications were not submitted for allotments inspite of technical necessity for land consolidation work, is supposed to be due to the following three points.

a) Lack of confidence to return Rs.800 per AC basis of the construction cost in the future when those allotments will be released to farmers for payment.

b) Temporary increase of investment for paddy cultivation just after consolidation. e.g. labour increase to repair insufficient levelling condition of liyaddas, increase of fertilizer use to supplement lost fertility in top soil etc.

c) Difficulty of re-allocation of one allotment to several cultivators in connection with water adjustment due to extended liyaddas and to decreased number of inlets liyadda to liyadda after work.

Of course these reasons given by farmers are not always reasonable but whether they be or not if some farmer does not apply to the land consolidation work and it disturbs the systematic function of irrigation facilities of the area then the application system in the work might have to be considered.

2) Tendency for contrary effects in short term

In connection with the problem 1)-(b) productivity of agricultural land tends

to be impoverished by reason of lost fertility in top soil and productivity of labour input also has tendency to become ineffective by reason of insufficient levelling condition to liyaddas in short term after the land consolidation work

Those tendencies may be temporary but recovered soon. However in the meantime efforts to achieve better farming in the area cannot wait for the recovery of productivity both in land and labour input after the land consolidation work, because there has been only 5 seasons from 70/71 Maha to 74/75 Maha to realize the target of the better farming (i.e. the targets to obtain 90 bushels per acre basis in Maha cultivation and so on.)

Accordingly the greater the performance of land consolidation work the more difficult the establishment of the target of better farming in short term contest.

It is an ironical phenomenon caused by the method to proceed with the works of the project simultaneously including the improvement of infrastructure towards better living.

Therefore in the future any projects should be done side by side with a time-lag. i.e. after finishing the improvement of infrastructure, the targets of the better farming and others should be pursued.

3) Difficulty of implementation of construction work by using heavy machinery overseas

The land consolidation work at Dewahuwa has been done these 5 years by using the heavy machinery shown in the former Table 4.2.3.2. and as a tangible result the performance of the work has been in proportion to the number of usable machines as shown in Table 4.2.3.1.

Accordingly each heavy machine must be always in working condition in order to promote the work efficiently. Meanwhile forecasting of machine trouble, i.e. when and at which part it happens, is not possible.

In Japan when machines break down at the construction site it is possible to obtain the necessary spare parts or send alternative machines without delay because the machines (Komatsu bulldozer) is commonly used. But at Dewahuwa obtaining necessary spare parts or renting alternative machines have both been difficult due to non-availability and to financial reasons.

As seen in Table 4.2.3.1. the low performance in '74 Yala and '75 Yala is an example of this.

Subsequently as to technical evaluation on the land consolidation work the present situation is as follows:-

Table 4.2.4.1. is the proposed survey to measure the effect of the work quantitatively from comprehensive view points of input material for paddy cultivation (e.g. seed paddy, fertilizer etc.). Nature of soil (physically and chemically), used condition of agro-machinery water consumption, labour input and paddy yield as a result in comparison with the consolidated and unconsolidated allotments (at 6 allotments in total).

The measurement of the table was planned for 74/75 Maha season, but unfortunately could not be carried out due to the abandonment of paddy cultivation owing to severe drought.

This kind of survey is very necessary to realise the effect of the land consolidation work, or in other words without this kind of survey no analysis should be done quantitatively, so that the survey it is hoped will be undertaken in the area using the table mentioned above.

However from qualitative view points some effects of the land consolidation work may be roughly inferred as follows:-

According to the field investigation on efficiency of agromachinery in between the consolidated and non-consolidated allotments in October (1972 there was 30% difference of the efficiency between the two, i.e. by using Iseki two wheel tractor (6 HP) 1.3 AC/day of ploughing was the performance at Tract 3 No.2 and No.3 which were consolidated in 1971 Yala and on the other hand 1.0 AC/day of ploughing, was the average efficiency in the area in the season.

Meanwhile the necessary ploughing days for the whole acreage 2340 AC are estimated at about 20 days, (see the chapter on Water Management) and issued water in the period is about 110AC. FT./day. So the assumed saving water by increased efficiency of agro-machinery accompanied by 340 AC's land consolidation work is calculated as follows:-

$$110\text{AC}\cdot\text{FT/day} \times \left(20\text{ days} - \frac{20\text{ days}}{1+0.3}\right) \times \frac{340\text{ AC}}{2340\text{ AC}} = 80\text{AC}\cdot\text{FT/season}$$

In addition decreased seepage water through border of liyaddas after reinforcement of it by the land consolidation work is roughly assumed to be 3mm/day, so in season.

3mm x 110 days x 340 AC = 365 AC.FT/season

TABLE 4-2-4-1

Necessary Field Investigation on Benefits Brought through Land Consolidation Work

Item	What's it ?	How many ?	When ?	Remarks
Pre-survey	Field condition of each allotment including topo-gradient	6 allotments	Before Maha	
Miscellaneous improvement of field structure	Inlets & outlets	15 nos	- do -	Cost about Rs. 100
Survey on material, invested	Seed paddy fertilizer weedicide inssecticide	Quantity, quality & period, distributed	After Maha	
Soil survey	Permeability test	3 points per allotment 18 points	Before	At field
- do -	fertility test	- do -	Before Maha	By specimen
Survey on used condition of agro-machinery	Working hour fuel consumption frequency of turning	About I Ac per allotment - 6 Ac x 2 times	During Maha	4 wheel tractor to 3 - 21 & 22
Survey on water use	Inflow & outflow at each allotment	15 points everyday, whenever water is issued	During Maha	
Survey on labour investment	Amount of manual labourers, who were occupied to ridge making, water central, ect.	Daily records	During Maha	According to attached table
Survey on yield	Paddy & other crops	Unit yield & total yield of allotment	After Maha	

Notes Communication with each farmer on this cultivation schedule is indispensable to get chance on time for each item above mentioned.

is assumed to be saved by 340 AC's land consolidation work.

Accordingly at least regarding water saving, 80 + 365 = 445 AC.FT is the merit of land consolidation work up to now. It is about 3% of saving against the total consumption of tank water, 15000 AC.FT, at the whole area of Dewahuwa. Since the necessary water issued at tank sluice for Maha paddy is assumed to be 6.3 FT/AC (see the chapter on Water Management) the mentioned 445 AC/FT meets the necessary water for 445/6.3 = 71 AC of paddy field. Supposing unit yield of paddy in acre basis is 70 bushels, price of paddy is Rs.33/bush. and net income ratio of paddy cultivation is about 65% of gross income.

Then $\frac{71\ \text{AC} \times 70\ \text{bush.} \times \text{Rs.}\ 33}{340\ \text{AC}} \times 0.65 \fallingdotseq \text{Rs.}315/\text{AC/season}$ is the net benefit of the land consolidation work regarding the saved water.

That is, the cost of the land consolidation work will be recovered within only three seasons and as the durability of the work is generally said to be 50 to 100 years the work is fully economical and to be recommended.

Generally the land consolidation work is considered as a way to improve infrastructural environment mainly for 'relieved cultivation' and not for 'profitable cultivation', so it is also considered to be rather unsuitable to the developing countries where food increase by means of quick and cheap methods is the most urgent them. But whether the consideration is correct or not it may have to be precisely studied further, case by case.

For instance there are three examples of land consolidation work or the similar work in this country, i.e. at Dewahuwa as explained in the chapter, at Kalawewa as an example of easy consolidation work in flat area just removing borders by using two wheel tractors and manual labour, and at Uda Walawe as an example of large-scale work using heavy machinery to make paddy field (note: the cost is about Rs.800 - Rs.1200/AC). The contents of work in each Project are remarkably different because each demand and back ground for the work varies.

Anyhow we think that if plans for new land consolidation work are studied carefully enough technical, economical and sociological view points the work would be useful and suitable in each developing country.

4.2.5 Manual on the land consolidation work

See annexed brief report.

4.3 Upland Field Irrigation

4.3.1 History of the work

Originally the upland field irrigation work was to be constructed in May 1971 and to be completed in March 1973. But after commencement of the Dewahuwa Project it got very much delayed mainly due to a doubt whether the water source was enough from Havanella Oya (main drainage of the Project area) in both Maha and Yala seasons or not, and due to objection from proposed benefited farmers regarding the content of the work.

In the Definite Plan Report the content of the work consisted of upland irrigation to about 100 AC's home garden in Maha season and about half acre in Yala season and of domestic water supply to the farmers of Dewahuwa (466 households in total of the upstream middle and lowerstream) in both seasons. In the plan 3.2 cusec for upland irrigation +0.3 cusec for domestic water = 3.5 cusec in Maha

and 1.6 cusec for upland irrigation+0.3 cusec for domestic water = 1.9 cusec in Yala.

of water source was expected from Havanella Oya.

But as a result of the survey carried out at the Oya in 1972 insufficiency of water especially in Yala season was proved so that the original plan was amended to give priority to the domestic water supply to the same beneficiaries mentioned above and to supplement the upland irrigation in Maha cultivation only.

The amended plan was made in December 1972 and was approved at the Joint Committee Meeting held in April, 1973, however it was rejected by the proposed benefited farmers at the meeting held in June, 1973 because their most serious demand had never been domestic water but sufficient water for the cultivation both in Maha and Yala during these 25 years after the commencement of the colonization scheme. Therefore the Project had to renew the plan to meet the demand of the beneficiaries and to use effectively the machinery and equipment already imported from Japan for lift irrigation.

Finally after long deliberation and study including field survey, hearing beneficiaries' views, designing and estimation, a definite plan was decided with the agreement of the farmers in May, 1975. It is shown below

and was implemented just after the final decision in June, 1975. Before the termination of the Dewahuwa Project in October, 1975 it is hoped that the main section of the work will be completed.

4.3.2 Nature of the work

Proposed benefited area is the left bank of Havanella Oya as shown in Fig.4.3.2.1. The area has been reserved for teak but it has been under chena cultivation by squatters for a long time, so before settlement of the new colonization scheme it is intended to be released from the Forest Department, to the new colonists, through the Land Commissioner's Department.

The area has about 160 AC' and is to be allocated to about 106 new colonists. It means one allotment of 1.5 AC per household.

The nature of the construction job is also shown in from Fig. 4.3.2.1. to Fig. 4.3.2.4.

and construction cost is shown in Table 4.3.2.1.

TABLE 4-3-2-1

Construction Cost (domestic only)

Item	Description	Amount	Remarks
Anicut	1 No (See Fig. 4.3.2.2)	Rs.1400x50%	50% from Japan in cement
Pumping Station	1 No (See Fig. 4.3.2.3)	Rs.15000x50%	-do-
Steel Pipe Line	1211FT (See Fig. 4.3.2.4)	Rs.8800	
Fore Bey	1 No	Rs.8800x50%	-do-
P.V.C. Pipe Line	4000FT	Rs.28000x50%	-do-
Field Channel	14600FT	Rs.175200 x50%	-do-
Access Road	1000FT	Rs.6000	
Crossing Bridge	1 No	Rs.9000	
Sub total		Rs.144300	
Contingencies	10%	Rs.14700	
Total		Rs.159000	
Cost of Electricity Facilities		Rs.101000	Rs.260000

Fig. 4-8-2-1 General Plan of Lift Irrigation

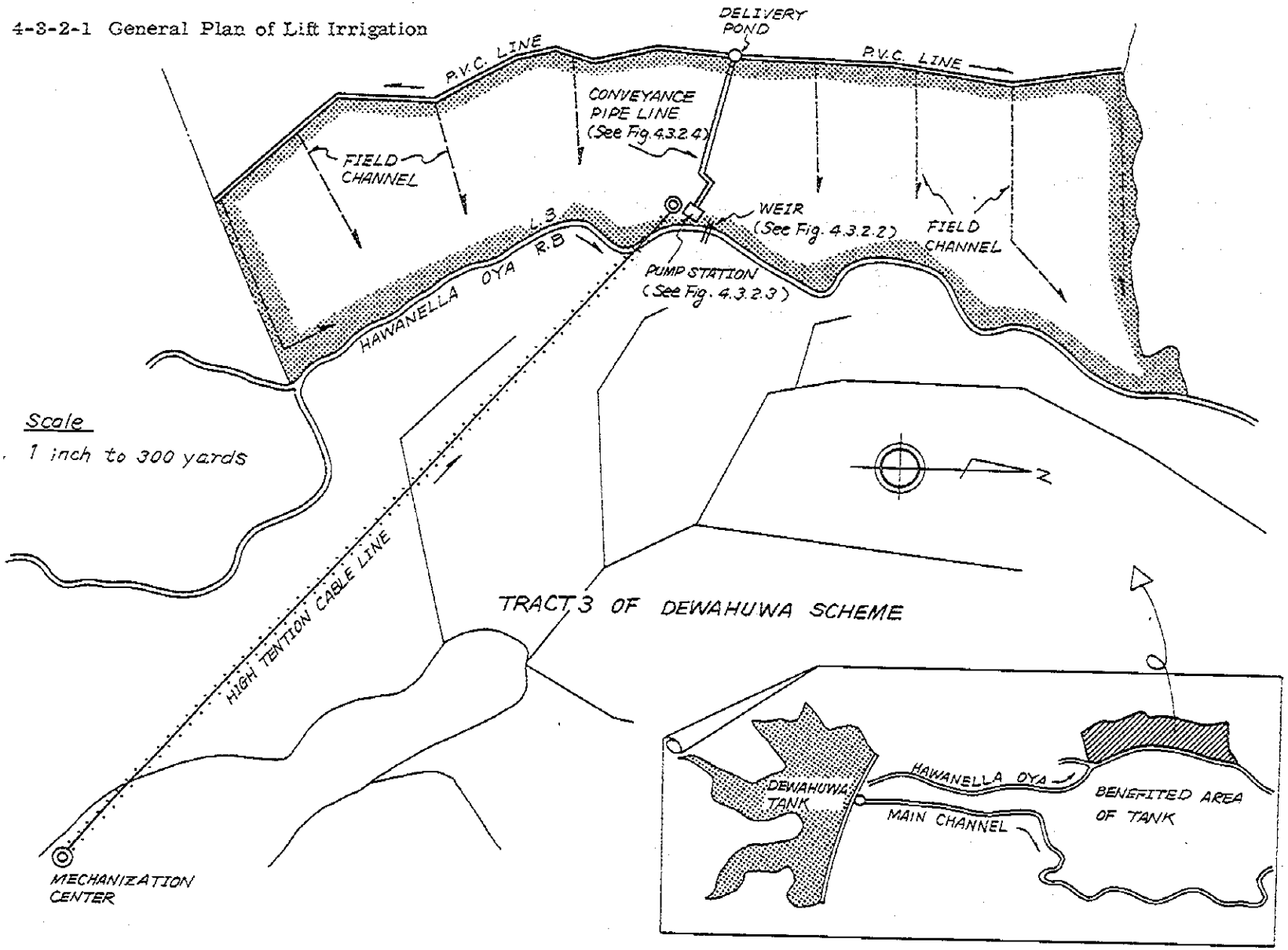


Fig. 4-3-2-2 Proposed Weir

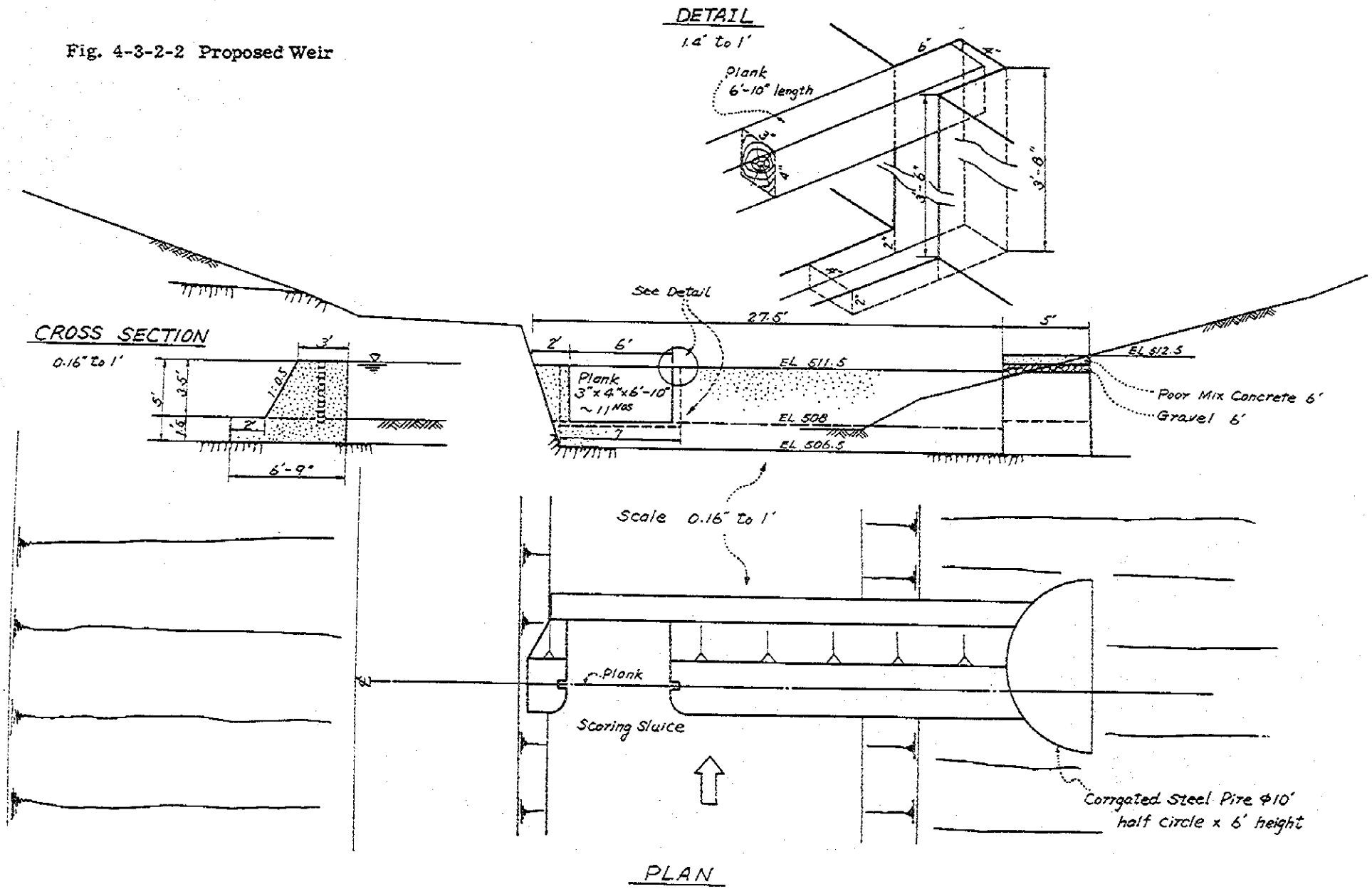


Fig. 4-3-2-3

Proposed Pumping Station

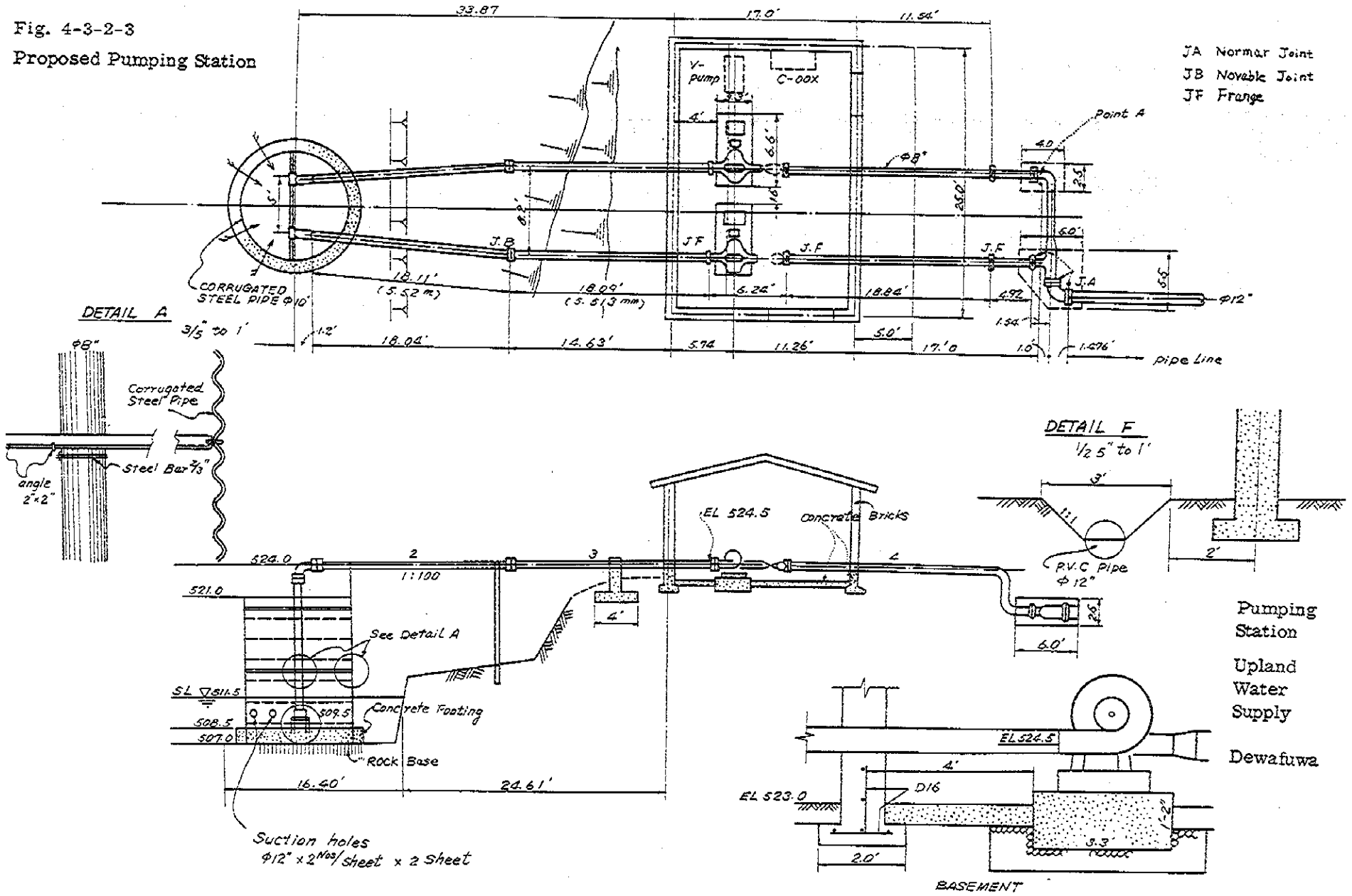
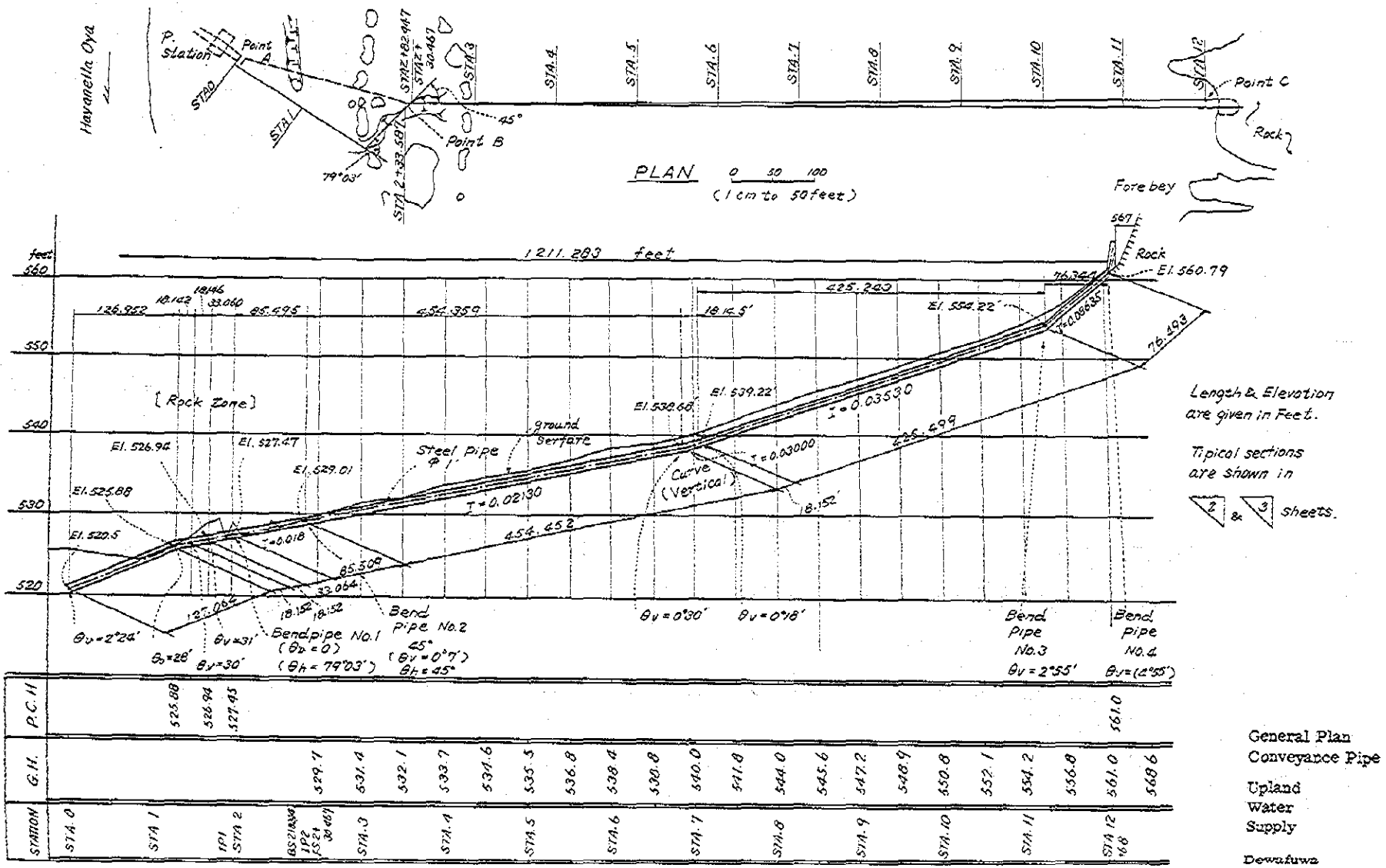


Fig. 4-3-2-4



Length & Elevation are given in Feet.

Typical sections are shown in 2 & 3 sheets.

General Plan
Conveyance Pipe

Upland
Water
Supply

Dewafuwa

4.3.3 Farming Plan

At the proposed area subisdiary crops have so far been cultivated in Maha season by using rainfed water. In the proposed plan farming pattern is to be changed to cultivate high-value crops by lift irrigation, i.e. from November to next January when the tank water will be issued to Dewahuwa area (R.B. of Havanella Oya) for Maha paddy cultivation a lot of water will get drained into the Havanella Oya. So this water from R.B. ould be re-used at L.B. of Havanella Oya by installation of pump equipment.

Benefit brought by the lift irrigation in connection with the proposed farming plan is shown below, in comparison with existing and proposed farming pattern.

Existing Sorghum 1AC x 1000 lb/AC x Rs.0.7/lb x 2/3 = Rs.465
Cowpea 1/2 x 750 lb/AC x Rs.1.5/lb x 2/3 = Rs.375
net income Rs.840/1.5 AC

Proposed Chilli 1/2AC x 500 lb/AC x Rs.8/lb x 1/2 = Rs.1000
Red Onion 1/2 AC x 1000 cwt./AC x Rs.100/cwt x 1/2 = Rs.2500
Cowpea 1/2 AC x 1000 lb/AC x Rs.1.5/lb x 2/3= Rs.500
net income Rs. 4000/1.5 AC.

Balance Rs.4000 - Rs.840 = Rs.3160/1.5 AC increased net income, i.e. An increase of Rs.3160 is expected per household as net income per season.

Accordingly Rs.3160/1.5 AC x $\frac{160\ AC}{1.5\ AC}$ = Rs.337,000 is the proposed benefit of lift irrigation, compared to the construction cost of the facilities (see Table 4.3.2.1), i.e. Rs.260,000, the above benefit is greater than the construction cost. It means the cost will be recovered in just one season, so the proposed work can be said to be highly economical and advantageous.

Incidentally since February, some subsidiary crops may be cultivated in the area partly through use of lift irrigation facility and partly through rainfed water but since this is uncertain the expectation of the additional benefit is ignored from the above mentioned estimate.

4.3.4 Pumping Plan

According to the Irrigation Standard prepared by Irrigation Department net duty of water for each crop is as follows.

For chilli 5mm/day x 150 days
For Red Onion 6.4mm/day x 72 days
} Weighted mean 5.5mm/day

Conveyance loss of water is to be 40%

Then gross duty of water is 5.5/0.6 = 9.2mm/day.

In the meanwhile out of two pumps (Double suction volute Dia.200mm x 150mm, Motor power 45KW.), one is to be kept as a spare, then the capacity of the single pump is calculated as follows.

$$Q = \frac{45KW \times 0.73}{0.163 \times 27m \times (1+0.125)} = 6.64\ m^3/min.\ or\ 3.91\ cusec.$$

whereas, Q : pump capacity

0.73 : pump efficiency

0.163:a constant

27 m : pump lift (actual head 17m + loss of head 10m)

0.125:allowance for the motor.

Therefore running hours of the pump per day, Hr is

$$Hr = \frac{160\ AC \times 4047\ m^3/AC \times 9.2mm/day}{6.64\ m^3/min \times 60min/hr} \fallingdotseq 15\ hrs/day.$$

However a period in which the pump must run 15 hours per day may be only during the latter half of January, because in the other period from November to January the pump is expected to reduce its running hours per day by reason of Maha rainfall.

Therefore the basic standard of pump running in the area is to be 12 hours per day except in the latter half of January.

Incidentally as to whether the above mentioned discharge, 3.91 cusec, is available from Havanella Oya or not in the season, field investigation which took place in 1973/74 Maha proved the availability of 3.91 cusec as shown in Table 4.3.4.1.

TABLE 4-3-4-1

Discharge through Havanella Oya in Maha Season (1973/74)

Date	at Tract-2 (beside No. 1)		at Tract-3 (beside No. 40)	
	in cusec	in m^3/sec.	in cuses	in m^3/sec.
24.12.73	not measured		37.8	1.07
31.12.73	-do-		14.8	0.42
1.1.74	-do-		11.3	0.32
4.1.74	-do-		7.8	0.22
10.1.74	-do-		14.8	0.42
15.1.74	11.9	0.34	15.0	0.43
21.1.74	12.6	0.36	16.1	0.46
28.1.74	11.0	0.31	15.3	0.43
4.2.74	10.5	0.30	14.6	0.41
11.2.74	7.5	0.21	11.3	0.32
18.2.74	6.8	0.19	11.3	0.32
24.2.74	6.1	0.17	10.8	0.31

4.3.5 Management Plan

As stated, the proposed area is now under chena cultivation by squatters. There are 56 squatters and out of them 13 are family members of the Dewahuwa colonists.

Therefore after settlement of the lift irrigation scheme these 56 may become legally approved colonists of the new scheme, and besides about 50 colonists may be additionally selected mainly from Young Farmers Club of Dewahuwa.

Consequently 56 + 50 = 106 new colonists will be given cultivation rights.

Each allotment is to be laid out at 1.5 AC per household and assessment for overhead expense is to be Rs.300 + Rs.80 (running cost of the pump Rs.0.2/KWHx60KWx12hrs/dayx90days/160AC) + Rs.20(Personal expenses) = Rs.400/AC/season, so that the payment to the Government is Rs.400x1.5 AC = Rs.600/household and net earning of a colonist will come to Rs.4000 - Rs.600 = Rs.3400/season.

5. Farm Management

5-1 Agronomic Extention

The main object of the project programme was to increase the average annual income of the farmers by 2.5 times after working out the programme for five years. The annual per capita income at the inception of the project was Rs. 3600/= and it was expected to increase to Rs.8120/= during the five years period. A 100% growth of this income was expected by doubling the paddy yields in Maha season from 45 bushels per acre at the inception of the project to 90 bushels per acre at the termination of the project, a further 50% increase was expected from Yala cultivations which have never been done in the past 20 years mostly due to water scarcity.

It was felt possible to save enough water for a Yala cultivation by introducing water saving techniques and devices during Maha, along with a farmer education programme.

5-1-1 1970/71 Maha Paddy Cultivation

1. Introduction

The Agreement on Dewahuwa Project between Sri Lanka and Japan was signed on the 19th of October 1970. Sri Lankan officers and three Japanese experts who had already arrived in the island set fourth to work at Dewahuwa on 3rd November 1970. However by this time the 1970/71 Maha paddy cultivation at Dewahuwa had already started with the first water issue on 20.10.1970. It was felt that there is no time for the project staff to enter into the cultivation in full preparedness.

This sudden out come was quite a surprise for the farmers who had long given up hopes about the birth of the project and as such they were not fully prepared to accept the new set up. There was hardly any time formal introductions and intimacy.

Under these circumstances it was felt impossible to guide the entire project area in the Maha 70/71 paddy cultivation and the project officers selected a 150 acre block of paddy fields, demarcated as the "Intensive Demonstration Area", where intensive agro extention work in ploughing, transplanting and fertilizing were conducted. Guided ploughing operations with two wheel tractors were also carried out in the rest of the project area in order to adhere to the cultivation calender according to which transplanting had to be finished before the middle of January.

2. Achievements

(i) Role played by the two wheel tractors

23 two wheel tractors arrived in the project in October 1970 and 40 young men were selected out of those who had already been organized in February 1970 to form a farming group. They were given a weeks training on the operation of two wheel tractors and sent out to the field from 16.11.1970 for actual ploughing with the Japanese two wheel tractors.

Land preparation was completed in the 150 acres of the "Intensive Demonstration Area" and 605 acres of the remaining project area by the 24th of December 1970. 47%(70 acres) of the former and 26% (160 acres) of the latter was done by two wheel tractors. In spite of the newly trained operators 30% of the entire project area was ploughed by two wheel tractors. As a result the target of completing transplanting and broadcasting by early January was attained with the exception of 10% of the fields which got delayed till the end of January due to various reasons.

The conventional method of land preparation by using buffalos takes a long time. Four wheel tractors no doubt have an advantage of ploughing a bigger acreage within a short period, but farmers have to wait for a long time to get its services on their fields from the Government tractor station. Land preparation with four wheel tractors with the commonly used tine tiller attachment in Sri Lanka results in uneven depth and surface and it leaves big clods after the operation. The four corners of the usually small paddy fields are largely left unploughed. Therefore these fields will require a couple of ploughing, levelling and pudding work with buffalos before the fields are ready for transplanting or broadcasting.

On the other hand quolity of ploughing by two wheel tractors prooved to be far superior to the four wheel tractors in the prominent small paddy fields at Dewahuwa. Even and smooth ploughing at proper depths throughout the fields was possible and clods were never formed. Some fields of good soil condition required only one rotorvation before transplanting. Plots covered by knee high weeds due to fallow seasons were also ploughed in proper time by two wheel tractors.

(ii) Renewal of seed paddy.

In 1969/70 Maha, before the inception of the project 150 bushels of certified seed of the Department of Agriculture, Sri Lanka had been sold to the farmers through the Multipurpose Co-operative society. These seeds were from the widely recommended varieties H 4, H 8 and IR 8. 80% of the project area was planted under these varieties.

In 1970/71 Maha farmers had already prepared their seed paddy requirements from the harvests of the previous season or they had burrowed it from the neighbours. 40 bushels of certified H 4 seed was used in the "intensive Demonstration Area". 95% of the project area was under the recommended varieties H4, H8 and IR8.

(iii) Planting pattern

Planting pattern and fertilizer application are two decisive factors in yield determination. The following table shows the results of crop cuttings in the project area in 1969/70 Maha season.

Table 5-1 (1) Planting pattern and yield differences

	Broadcasting	Random transplanting	Raw transplanting
Fertilized fields	160%	185%	215%
Non fertilized fields	* 100%	125%	130%

* Broadcasted non fertilized fields yielded 40 bushels per acre and it has been indicated as 100% in the table.

Transplanting generally brings about higher yields than broadcasting, but within the same transplanting there is difference between row transplanting and random transplanting. The superiority of the former to the latter was made very clear by the 15% yield increase of the former over the latter. This was possible due to the easiness weeding, fertilizing and plant protection operations in the case of row transplanting. The ratio of row transplanting to random transplanting in general and in the intensive demonstration area are 5.9 :94.1 and 18.8 : 81.2 respectively.

Although the transplanted acreage fell below 50% the ratio of row transplanting to random transplanting improved to a considerable extent in the intensive demonstration area and in the project area in general. Special mention should be made of the young women in the project area who were recruited for row transplanting work in groups. Their devoted joint effort gave none-the-less impact on their parents and neighbours, helping minimize the drainage of wages to outside areas.

(iv) Application of fertilizer.

During 1969/1970 Maha season fertilizer was simply sold to the farmers through the MPCS without adequate guidance on its usage. There were instances where yields decreased due to lodging, caused by over fertilization. Farmers were in a depressed mood due to the delay in the signing of the project agreement. Due to these reasons the amount of fertilizer ordered by the farmers from the MPCS fell to 1/3 that of the previous season.

Project officers emphasized the advantages of using fertilizer to all the farmers and specially to those in the " Intensive Demonstration Area and managed to imrpve the fertilizer usage to 2/3 of the previous season. The importance of top dressing, its timing and the dosages were also explained to the farmers during 13 neighbourhood meetings held from February 1971. Importance of controlled irrigation to prevent loss of fertilizer and weed growth and to minimize wastage of water was also explained to the farmers.

(v) Yield

1970/71 season ended under a well guided programme although the entire staff simply crashed into the season at the beginning. The average yield obtained was the same as that of the previous season and the average yields of the " Intensive Demonstration Area ", rest of the project area and the entire project area were 58, 52 and 53 bushels per acre respectively.

Harvesting coincided with the rains in April. Government announced an island wide curfew from 6.00PM to 6.00 AM which sometimes extended even during daytime. The rain and the curfew delayed the harvesting, threshing and winnowing operations. There was considerable amount of spoilage of shedded grains due to the rain and the delay in harvesting.

If not for these damages the average yield in 1970/71 Maha season would have been better than that of the previous season. Results of this season, specially the fertilizer and transplanting combination became very useful for the planning of the next Maha season.

5-1-2 1971/72 Maha Paddy Cultivation

1. Objectives

The main objective of the 71/72 Maha paddy cultivation was to maximize yields by strengthening the co-operation and ties with the farmers and their organizations, the cultivation committee and the M.P.C.S. The 1971/72 Maha programma was constructed up on three gigantic pillars, namely -

(1) Rural Indebtedness Liquidation Programme

(2) Expanded Credit System and

(3) Intensive Agronomic Extension cum Supervision Drive.

Agro-extension programme of the season was prepared by project officers and later explained to the farmers. It was intended to create full confidence on this Maha cultivation in the minds of the farmers as well as the local officers who guided them.

Harvesting was completed before Sinhala New Year in April 1972 with an average yield of 66 bushels per acre, an increase of 25% over the last season.

2. Preparations.

(1) Project implementation programme for Maha 71/72 and Yala 72 was forwarded to the government of Sri Lanka in June 1971. Following suggestions were also made in order to achieve the objective already mentioned.

(i) Entire acreage should come under improved varieties BG 11-11, a high yielding $4\frac{1}{2}$ month variety recommended by the Department of Agriculture this year to be introduced for transplanting under proper fertilizing practices.

(ii) Increase the transplanted acreage to cover 60% of the project area with at least 10% under row transplanting. Only 42% was under transplanting last season.

(iii) Adaptation of Agriculture Department's fertilizer recommendations for dry zone paddy which ensures 80 and 60 bushels per acre under transplanting and broadcasting respectively.

(2) Preparation of cultivation loans.

(i) On August 20th Rs.67,326/- were approved as cultivation loans for 65 farmers who were eligible under the normal credit scheme of the Government.

(ii) A survey conducted by the Expert on rural institutions revealed that 40% of the farmers were not creditworthy under the normal government credit scheme. Half of these farmers had lost the cultivation rights of their fields due to private indebtendness. Another 20% of the colonists neither had money for the cultivation nor were they interested in it. With special permission from the Secretary, Ministry of Agriculture and Lands, the loan defaulters were provided with special production loans and services under an expanded credit system. The cultivation rights of the indebted farmers were also restored by giving them a special loan to liquidate their indebtedness. This was provided through the Multi-purpose Co-operative Society. Uninterested farmers were visited individually to influence them to change their way of thinking.

Finally, in the latter part of September, it was possible to provide all farmers with funds and materials required for 1971/72 Maha cultivation. It should be sepecially mentioned here that unlike in the past these loans were given in kind and services under very strict supervision and control of all farming operations.

(3) Preparation of the Agronomic Extension Programme.

Productivity maximization based on the combination of Rural indebtedness liquidation loan, Expanded credit system and Intensive agro-extension cum supervision drive was explained to the colonists at a general meeting of the farmers held on the 24th of August 1971. They were also requested to forward applications through cultivation committee members for inputs and services required for 71/72 Maha paddy cultivation. Farmer education classes on varieties, fertilizer and improved cultural techniques were also conducted in September. Table 5-1(2) illustrates the final cultivation plan and application for inputs and services.

It was the duty of the project agronomy team to build up from the figures appearing on the application forms a well balanced scheme of sweed paddy, planting pattern, fertilizer and agro-chemicals in quantitative forms. Agronomists job was an elaborate time consuming one which involves numerous enquiries and confirmation with each and every colonist, in the course of finalizing the extension programme. Optimum dosage of fertilizer required was calculated which would maximize paddy yields through the combination of variety and planting pattern.

The farm machinery team prepared a ploughing programme for their 40 two wheel tractors.

(4) A meeting of the young men and women in the project area was held to solicit their co-operation in Maha 71/72 paddy cultivation. The boys were requested to operate and maintain the two wheel tractors and girls co-operation was requested in increasing the transplanted acreage.

3. Various stages and achievements of 71/72 Maha paddy cultivation.

(1) Water issue commenced on the 24th of September with a tank full of water.

(2) 40 two wheel tractors operated by colonists' sons were deployed for ploughing from the 28th of September. Primary ploughing of 638 acres (85% of total area) was completed in exactly one month. Secondary ploughing commenced on the 27th of October and went on for 25 days. Only 296 acres (38%) were done by two wheel tractors since farmers used buffaloes mostly for secondary ploughing and levelling.

Table 5-1 (2)

Application Form : Maha Paddy Cultivation

August 1971 Dewahuwa Special Project

N a m e	Tract	Field No.	Co-op Member No.

1. Ploughing

Time	By Project 2 Wheeler	By Private 4 Wheeler	By Buffaloes	Total
Primary				
Secondary				

2. Seed Paddy

Variety	Own	Purchase from Co-operative	Total
BG11-11	bu	bu	bu
H 4			
H 8			

3. Planting Pattern and Variety

Pattern / Variety	Row Transplanting		Random Trans-planting	Broad-casting	Total
	By Girls	Own			
BG11-11	Ac	Ac	Ac	Ac	Ac
H 4					
H 8					
Total					

4. Fertilizer

Time	Basal	Topdressing	
Kinds and Amount	V 1	Urea	TDM-2
	pkt	pkt	pkt

5. Rotary Weeder

Own	Purchase from Project
Unit	Unit

6. Paddy Transportation

By Project 4 Wheeler	By Private 4 Wheeler	By Oxcart

Date: Signature:

(3) Broadcasting scheduled to be completed on the 20th of November was delayed by 5 days. 249.25 acres (33.2% of the total area) were broadcasted and 2/3 of this acreage received V 1, the basal paddy fertilizer. Transplanting was scheduled to complete on November 25th and it got extended upto December 10th, with a performance of 405 acres (53.8% of total acreage) under random transplanting and 99 acres (13%) under row trnsplanting. Thus 66.8% of the total acreage was transplanted. The achievements have surpassed the target by 6.8%. 90% of this transplanted acreage received basal fertilizer. 62 acres were row transplanted by three groups of young girls who were supported by the ladies of adjoining villages.

(4) Renewal of seed paddy: Unlike in the last season it was possible to distribute a large quantity of certified seed paddy due to propaganda and the expanded credit system. Only 40 bushels of seed paddy had been sold during the provious season. 56% (536 bushels) of the seed paddy utilized this season were certified seed produced by the Department of Agriculture. Varietal break down is as follows (199 bushels of BG 11-11, 240 bushels of H4 and 112 bushels of H8. 98.6 % of the total acreage was under recommended varieties and was above the target.

(5) Fertilizer.

V 1 (N:P:K = 2.7% : 27% : 13%) was used as the basal mixture for 1971/72 Maha paddy cultivation. To ensure optimal input of V 1 mixture it was ploughed in to the soil at the time of the secondary ploughing, by 2-wheel tractors. Tractor operators were ordered to transport fertilizer from MPCS stores to the respective fields prior to the commencing of ploughing operations. The farmers who were allowed to ride these tractors spread the basal fertilizer on their fields before ploughing started. 38% of the total acreage received adequate quantities of the basal mixture under this new system of tractor deployment.

Those farmers who used buffaloes for the secondary ploughing operation were provided with free transport facilities to deliver the basal mixture to their fields. (324.5 cwt. for 261.25 acres were distributed under this system).

As for the top dressing of urea adequate quantity and time of application was notified to the farmers through A.E.W. a week before the date of application. In this case too urea was transported to the farmers fields when requested, by using project vehicles free of charge.

Consequently, 114 farmers (74.5%) applied the basal fertilizer and 118 farmers (77%) applied the top dressing.

* Defaulter Table 5-1 (3) Intensive Extention-cum-Supervision 1972/73 Maha Figures in ( ) denotes Acreage, Bushels and Number of Packets of V 1 and cwt. of Urea achieved

(i) Recommendation on Pattern of Planting, Seedpaddy & Fertilizers

Tract	Field No.	N a m e	Row Transplanting by Girls	Row Transplanting Own	Random Transplanting	Broadcasting	Total	Seedpaddy (from M.P.C.S.) (bu) H 4	Seedpaddy (from M.P.C.S.) (bu) H 8	Seedpaddy (from M.P.C.S.) (bu) BG11-11	Seedpaddy (from M.P.C.S.) (bu) IR 8	Fertilizer V 1 (pk)	Fertilizer Urea (cwt)
			Ac	Ac	Ac	Ac	Ac						
3	33	A.G.MANIKERALA	1		3 (2½)	1 (1½)	5	4 (10)		2 (2)		14 (14)	6 (6)
	34	A.G.HERATHAMY			(1½)	5 (3½)	5	5				10 -	4 -
	35	T.G.SILIL WEERA SINGHA	2	3 (2½)	(2½)		5	5 (4)		5 (6)		15 (15)	9 (8)
*	36	A.G.KALU MANIKE			(5)	5	5					10 -	5 -
*	37	B.APPUHAMY			2 (5)	2½	5	8		(6)		13 (15)	9 (9)
*	38	P.NUDIYANSE			2 (2)	2½	5	4 (6)		4 (2)		13 (10)	7 (8)
	39	M.A.PUNCHI BANDA			2 (4)	2	4	2	3	1 (2)		10 (12)	7 (4)
	40	L.K.PUNCHIRALA	1		2½ (3)	(½)	3½			1		11 -	5 -
*	41	R.A.PUNCHIRALA	1	3	1 (5)		5		4 (4)	2 (2)		15 (15)	7 (5)
	42	A.G.MUDARIHAMY	1		1 (3)	2	3	3	3			10 (8)	4 (4)
	43	W.G.KARUNAWATHIE	½	(½)	½ (2½)	2½ (½)	3½	5		2 (4)		8 (9)	7 (5)
*	44	W.G.UNGI	½		3 (3½)	1½ -	5	(2)	(4)	2		14 (12)	5 (4)
	45	Y.G.HARMANIS	½		1½ (3)	1- (2)	5			1 (2)		16 (10)	7 (7)
	46	W.G.BODA	1 (¾)	1	3 (4¼)		5			2 (2)		15 (15)	6 (6)
*	47	T.G.HEENKIRIYA	1 (2¾)	2	1 (2¼)		5			1 (2)	1 2	15 (15)	7 (6)
	48	U.G.HEENMUTHUWA	½		1½	2 (5)	5	4	4	1		15 (14)	5 -
	49	D.G.SOPIA	1		4 (5)		5	(6)	4	1		15 (15)	6 (3)
	50	M.G.LAPAYA			2 (4)	3 (1)	5	5	2	1		12 -	5 -
	51	A.G.APPUWA	1		2 (5)		5	(2)	(2)	2 (2)		15 (15)	6 (3)
	52	D.S.SIRIWARDANA	2 (2)	3 (3)			5			5 (5)		15 (15)	9 (6)
*	53	R.D.JAYATHIRAKA	½	(2)	3½ (3)	1	5		(6)	2 (2)		14 (14)	7 (5)
	54	W.G.SOMAWATHI		(1)	3 (3)	3 (1)	5	6		2		13 (15)	5 (5)
*	55	W.G.PEMAWATHI / W.G.KARUNADEWA	1	(1)	4 (2½)	(1½)	5		4	2 (2)		15 (14)	7 (8)

A Packet of V 1 ½ cwt.

* Defaulter

Table 5-1 (3) Intensive Extention-cum-Supervision 1971-72 Maha

(ii) Pattern of planting and Ploughing-In of Basal Fertilizer (Figures in ( ) Denote Dates, Acreage and Number of Packets of V 1 achieved)

Tract	Field No.	N a m e	Plan of Farmers				2nd Ploughing						Delivery of Fertilizer at Liyadda					
			Broadcasting		Transplanting		Broadcasting			Transplanting			Broadcasting			Transplanting		
			Ac	Date	Ac	Date	Date	Two whl Ac	Buffalo Ac	Date	Two whl Ac	Buffalo Ac	Date	Ac	V 1(pk)	Date	Ac	V 1(pk)
3	33	A.G.MANIKERALA	1	11.10	4	11.16			(1)	(11. 4)	(4)		(11. 4)	1	(2)	(11. 4)	4	(12)
	34	A.G.HERATHAMY	5	11. 2									11. 1	5	10			
	35	T.G.SILIL WEERA SINGHA	-		5	11.16				(11. 9)	(3)	(2)				(11. 9)	5	(15)
*	36	A.G.KALU MANIKE	4	11. 2	1	11.11							11. 1	4	8	11. 6	1	3
*	37	B.APPUHAMY	-		5	11.17						(5)				(11.10)	5	(15)
*	38	P.MUDIYANSE	3	11.10	2	11.16			(3)			(2)	(11.12)	3	(4)	(11.12)	2	(6)
	39	M.A.PUNCH BANDA	2	11. 4	2	11.15			(2)			(2)	(11.13)	2	(5)	(11.13)	2	(7)
	40	L.K.PUNCHIRALA	½	11.13	3	11.14							11. 6	½	1	11. 6	3	9
*	41	R.A.PUNCHIRALA	2		3	11.14	(11. 4)	(2)		(11. 6)	(3)		(11. 4)	2	(5)	(11. 6)	3	(10)
	42	A.G.MUDARIHAMY	1	11. 8	2	11.13			(1)			(2)	(11. 6)	1	(2)	(11.13)	2	(6)
	43	W.G.KARUNAWATHIE	½		3½	11.13	(11.10)	(½)		(11. 9)	(1)	(2)	(11.10)	½	(1)	(11.10)	3½	(9)
*	44	W.G.UNGI	1½	11. 5	3½	11.18			(1½)	(11.12)	(2½)	(1)	(11.10)	1½	(3)	(11.14)	3½	(11)
	45	Y.G.HARMANIS	3	11. 8	2	11.18			(2)	(11.14)	(3)		(11.14)	2	(4)	(11.14)	2	(5)
	46	W.G.BODA	-		5	11.16				(11. 8)	(5)					(11.10)	5	(15)
*	47	T.G.HEENKIRIYA	-		5	11.15				(11. 8)	(5)					(11. 8)	5	(15)
	48	U.G.HEENMUTHUWA	5	11. 8									(11. 4)	5	(14)			
	49	D.G.SOPIYA	-		5	11.12						(5)				(11.13)	5	(15)
	50	M.G.LAPAYA	-		5	11.16				(11.11)	(2)					11. 8	5	15
	51	A.G.APPUWA	-		5	11.16				(11.16)	(5)					(11.18)	5	(15)
	52	D.S.SIRIWARDANA	-		5	11.14				(11. 8)	(2½)					(11. 8)	5	(9)
*	53	R.D.JAYATHIRAKA	3		2	11.13	(11. 3)	(3)		(11. 8)	(2)		(11. 3)	3	(7)	(11. 8)	2	(7)
	54	W.G.SOMAWATHI	1		4	11.13			(1)			4	(11. 8)	1	(2)	(11. 8)	4	(13)
*	55	W.G.PEMAWATHI	-		2½	11.13				(11. 4)	2½			1	(2)	(11. 4)	2½	(7)
		W.G.KARUNADEWA	11	11. 5	1½	11.13				11. 4		2½		1	(2)	(22. 4)	1½	(5)

Table 5-1 (3) Intensive Extention-cum-Supervision 1971/72 Maha (Figures in ( ) denote Number of Packets of Urea applied)

(iii) Topdressing Programme for each Farmer and Its Achievement

Tract	Field No.	N a m e	Applied V 1 (pkt)	Recommended Dosage Urea (pkt)	Transplanting										Broadcasting						
					Planting Date	BG11 11	H4 and H8	First Top-dressing Date	Urea (pkt)	Second Top-dressing Date	Urea (pkt)	Third Top-dressing Date	Urea (pkt)	Sowing Date	BG11- 11	H4 and H8	First Top-dressing Date	Urea (pkt)	Second Top-dressing Date	Urea (pkt)
3	33	A.G.MANIKERALA	14	6	11/19 11/20-11/23	1	2½	12/5 -12/10 12/7 -12/11	(½) (½)	12/20-12/22 1/20- 1/21	(½) (2)	1/20- 1/21	(½)	11/11-11/12		1½	11/26- 12/1	(½)	1/22- 1/26	(1)
	33	A.G.HERATHAMY	0	4	11/18-11/19									11/8 -11/11 11/18-11/19		3½ 1½	11/25-11/29 12/5 -12/9	(½) (½)	1/18- 1/23 1/28- 2/1	1½ ½
	35	T.G.SIRIL WEERASINGHA	15	9	11/22-11/26 11/26-12/4	2½ 2½		12/7 12/16	(1½) (1½)	12/21-12/25 12/30- 1/3	(1½) (1½)	1/21- 1/24 1/29- 1/30	(1½) (1½)							
	36	A.G.KALU MANIKE	0	5	11/15 11/11-11/13		1 4	12/9 12/9	¼ ¾	1/10- 1/13 1/10- 1/13	¾ 2¼									
	37	B.APPUHAMY	15	8	11/13-11/15 11/17-11/24	2½ 2½		11/29-12/1 12/8	(1½) (1½)	12/13-12/16 12/22-12/23	(1¼) (1½)	1/10- 1/15 1/19- 1/20	(1¼) (1½)							
	38	P.MUDIYANSE	10	8	11/22-11/24	2		12/9	(1)	12/22-12/25	(1)	1/29- 1/22	(1)	11/21-11/22		3	12/6 -12/12	1	1/31- 2/2	(1)
	39	M.A.PUNCH BANDA	12	5	11/20-11/22 11/24-11/30	2	2	12/13 12/13-12/15	(1) (1)	12/20-12/25 1/26- 1/28	(1) (1)	1/22- 1/23	(1)							
	40	L.K.PUNCHRALA	14	4	11/23-11/25		3	12/9 -12/12	¾	1/22- 1/25	2			11/13		½	11/27-12/2	½	1/22- 1/25	(½)
	41	R.A.PUNCHRALA	15	5	11/17-11/19 11/20-11/25	3	2	12/5 -12/8 12/9 -12/11	(1½) (½)	12/20-12/22 1/20- 1/22	(1½) 1½	1/18- 1/20	(1½)							
	42	A.G.MUDARIHAMY	8	4	11/17-11/18		3	12/2 -12/8	(¾)	1/13- 1/18	(2)									
	43	W.G.KARUNAWATHIE	9	5	11/17 11/22-11/26	½ 2	½	12/5 -12/8 12/10-12/13	(¼) (1½)	12/20-12/22 1/21- 1/25	1 ¾	1/15- 1/19 1/20- 1/24	(½) (1)	11/10		½	11/26-12/1	⅛	1/20- 1/25	(½)
	44	W.G.UNGI	12	5	11/29-12/5 11/23-11/24	2	1½	12/19-12/20 12/7 -12/9	(1) (½)	12/30-12/31 1/19- 1/20	(1) (½)	1/23- 1/25	(1)	11/29-12/1		1½	12/15-12/20	½	2/10- 2/13	1
	45	Y.G.HARMANIS	9	7	11/28-12/1	2¾		12/15-12/19	(1½)	12/28- 1/2	1½	1/25- 1/30	1½	11/9 -11/10		2	11/24-12/1	½	1/19- 1/25	½

(6) Water management, Weeding and Plant Protection.

To facilitate more efficient water management the project paddy area was divided into 11 smaller areas, according to the lay out of the secondary and tertiary channel system. The responsibility of water management in each of these subdivisions was assigned to the Cultivation Committee member who represented the area. In working out this new system 4 water management cum extension apprentices were recruited from among the young men of the project staff and farmers and they assisted the Agricultural Extension Workers in convincing the farmers. They worked for $1\frac{1}{2}$ months, but their work needed more soul and heart to be praised as very satisfactory.

Weeds overwhelmed some of the broadcasted fields even on this water abundant year. Weeds appeared on some of the random transplanted fields. Row transplanted fields were kept under perfect weed control by using rotary weeders. Row transplanting is expected to increase rapidly in the coming seasons due to the conveniences experienced in weeding and fertilizing.

Hardly any insect attackes or pest incidences were discovered in this well timed cultivation and the 20 power sprayers imported remained unused. BG 11-11 even with 80 lbs. nitrogen per acre did not lodge indicating its high fertilizer response.

(7) Yield

Harvesting was carried out as scheduled before the Sinhala New Year celebrations in April 1972. The average yield 74 bushels per acre is an increase of 40% over the previous season. 114 farmers who followed the project guidance programme obtained 50% over their yields in the previous season. The highest yield obtained was the best harvest in 22 years since the inception of the colony, and all were convinced that proper paddy cultivation is a well paying business.

Possibilities of achieving the project target, 90 bushels per acre, in a shorter time became very evident in this season. A repetition of the agronomic extension programme under a better infra structure with high yielding varieties, fertilizer and row transplanting would enable this achievement. The following table indicates the yields obtained under various types of plant establishments of different varieties.

Table 5-1 (4) Effect of Fertilizer, Pattern of Plant Establishment and Variety on the Paddy Yield.

Bushels per acre

Fertilizer	Applied				Not applied			
Variety	BG 11-11	H4	H8	others	BG 11-11	H4	H8	others
Row transplanting	100.0	88.5	90.6	-	-	-	-	-
Random transplanting	87.6	81.3	77.5	68.0	48.8	50.6	53.2	48.0
Broadcasting	-	69.4	65.7	50.2	-	44.2	45.6	44.4

5-1-3 1972/73 Maha Paddy Cultivation

1. Objectives

(1) In 71/72 Maha record breaking yields were obtained by implementating the "Productivity maximization programme." Success of this cultivation was mostly due to (i) the Rural indebtedness liquidation programme. (ii) Expanded credit system and (iii) Intensive supervision cum extension drive, which supported the Productivity Maximization Programme. Better irrigation and farm road systems also contributed for this achievement. However, inspite of all efforts made by project officers to get 100% participation of farmers in the productivity maximization programme there was only 75% participation. To achieve 100% participation is the main objective of the season.

(2) In the case of the previous corresponding season, cultivation plan of each individual farmer was prepared by project officers. It was later explained to them carefully. In 1972/73 Maha farmers were requested to prepare their own cultivation plans under the guidance of the project officers.

(3) Training of the Cultivation Committee as a guiding agency for the farmers, to handle various agricultural and institutional problems.

(4) Group operation of various agricultural practices such as water management, machine utilization etc. Farmers were expected to take the initiative in group forming while the Cultivation Committee acted as the guiding agency.

(5) Encouragement of the Young Farmers Club to actively take part and support the 72/73 Maha cultivation.

(6) To achieve an average paddy yield of 82 bushels per acre, which is a 10%

increase over the last Maha season (74 bushels/acre).

2. Planning and Preparations

(1) Last dates for sowing and transplanting were fixed as 15th and 30th of November respectively, to enable harvesting before the Sinhala New Year, on the 13th of April.

(2) To enable harvesting before April 13 a well planned programme was prepared with 38 two wheel tractors and a single four wheel tractor owned by the project and buffaloes owned by farmers. Ploughing operations were scheduled to start on 30th September and finish before the 20th of November.

(3) 100% of the acreage should come under improved varieties out of which 80% should be under the new BG 11-11.

(4) Transplanting: Broadcasting ratio should be increased to 75:25 from the ratio of 67:33 achieved in the previous season. But of the transplanted acreage at least 25% should be in rows which means 18.5% of the total acreage.

(5) A fertilizer dosage which ensures 90 and 60 bushels per acre for transplanted and broadcasted paddy respectively was recommended. $1\frac{1}{2}$ cwt. of V 1 basal mixture was recommended for all varieties and types of cultivation to be mixed up with the soil at the time of secondary ploughing or levelling. Urea was recommended for the first and second top dressing while TDM-2 was recommended for the final top dressing to be applied at the time of young Panicle formation (young ear formation stage). This was suggested to create a balance in the fertilizer application since Dewahuwa soils indicated a slight Potassium deficiency. Table 5-1 (5)

(6) Farmers were made to apply for cultivation loans well in advance before the 20th of August 1972.

(7) On the incept of 71/72 Maha there were 66 loan defaulters. 22 of them remained as defaulters inspite of the successful Maha cultivation. It was decided to give them expanded credit once again in Maha 72/73.

(8) Following items were confirmed by making the farmers forward their individual plans before 31st August 1972.

(i) Acreage desired by the farmers to be ploughed by Project two wheel tractors.

(ii) Renewal of seed paddy desired by farmers.

(iii) Type of plant establishment under different varieties.

(iv) Acreage desired by the farmers, to be row transplanted by the young

Table 5-1 (5) Recommended

Application of Fertilizer (1972/73 Maha)

Dewahuwa Special Project

1972. 12. 5.

BG11-11 Transplanting (over 80 bushels per acre)

Order of Application	Basal	Topdressing			Nutrient Contents (lbs)		
	V 1	1st Urea	2nd Urea	3rd TDM-2	N	P	K
Quantity	168 lbs (1½ cwt.)	56 lbs (½ cwt.)	56 lbs (½ cwt.)	112 lbs (1 cwt.)	4.5 51.5 34.5 90.5	46	21.6 22.2 43.8
Time	2nd Ploughing	After 2 Weeks	4 Weeks	8 Weeks			

BG11-11 Broadcasting (60-80 bushels per acre)

Order of Application	Basal	Topdressing			Nutrient Contents (lbs)		
	V 1	1st Urea	2nd Urea	3rd TDM-2	N	P	K
Quantity	168 lbs (1½ cwt.)	28 lbs (¼ cwt.)	28 lbs (¼ cwt.)	112 lbs (1 cwt.)	4.5 25.8 34.5 64.8	46	21.6 22.2 43.8
Time	2nd Ploughing	After 2 Weeks	6 Weeks	10 Weeks			

H 4, H 8 Transplanting (60-80 bushels per acre)

Order of Application	Basal	Topdressing			Nutrient Contents (lbs)		
	V 1	1st Urea		2nd TDM-2	N	P	K
Quantity	168 lbs (1½ cwt.)	28 lbs (¼ cwt.)		112 lbs (1 cwt.)	4.5 13.0 34.5 52.0	46	21.6 22.2 43.8
Time	2nd Ploughing	After 2 Weeks		8 Weeks			

H 4, H 8 Broadcasting (50-70 bushels per acre)

Order of Application	Basal	Topdressing			Nutrient Contents (lbs)		
	V 1	1st Urea		2nd TDM-2	N	P	K
Quantity	168 lbs (1½ cwt.)	28 lbs (¼ cwt.)		84 lbs (¾ cwt.)	4.5 13.0 29.0 46.5	46	21.6 18.6 40.2
Time	2nd Ploughing	After 2 Weeks		10 Weeks			

(lbs) (lbs) (lbs)

Nutrient Contents per cwt.	V 1	N	P	K	Urea	N	TDM-2	N	K
		3.0	30.7	14.4		51.5		34.5	22.2

girls groups.

(v) Fertilizer requirements.

(9) Arrengements were made for the farmers to receive inputs in time from the MPCS. stores according to the plans prepared by them.

(10) Farmers were divided into 8 groups and trained on paddy cultivation before the commencement of the season.

3. Various stages of the cultivation and results.

(1) Water issue: 6500 acre feet of water were available in the tank at the time of the first date of water issue on 30th September 1972. The full capacity of the tank is 8800 acre feet.

(2) Land preparation: 38 two wheel tractors were deployed for ploughing from October 4th 1972 to November 4th 1972. The achievements were as given below.

Primary ploughing 639.5 acres (84.8%of the total acreage).

Secondary ploughing 221.0 acres (29.3% of the total acreage).

(3) Plant establishment;

Broadcasting: 27.10.1972 to 27.11.1072 = 121 acres

Transplanting: 27.10.1972 to 06.12.1972 = 632 acres

Target for transplanting was fixed as 75% of the total acreage and the achievement was 84%, considerably surpassing the target. Six young women's groups row transplanted 95 acres and transplanting under attam system increased considerably.

(4) Introduction of seed paddy of high yielding varieties.

336 bushels of BG 11-11 certified seed were used which covered 38.6% of the Project seed requirement and 76% of the BG 11-11 requirement by the farmers. Target for the extent under BG 11-11 was set up as 80% of the total project acreage, but the achievement came down to 59% of the total acreage.

(5) Fertilizer V 1 was used as the basal dressing and urea for the first and second top dressing TDM-2 mixture was used for the final top dressing at the panicle premodia initiating stage. 144 farmers out of 153 used basal fertilizer on 660 acres (88%) out of 753 acres. Although all the urea top dressings were applied only 25% of the farmers applied TDM-2 top dressing fearing a total crop failure due to the serious scarcity of water experienced towards the latter part of the season. Effect of TDM-2 application at the Young Panicle formation stage on the paddy yield is indicated in the table below:

Table 5-1 (6) Effect on Application of TDM-2 Fertilizer at the Stage of Young Panicle Formation

Variety	BG 11-11		H-4	
Application of TDM-2 at Young panicle formation stage	Applied	Nil	Applied	Nil
Yield	87.2	79.4	64.5	60.2
Yield ratio	100.0	91	100	93

(6) Water Shortage - Drought.

On December 6th when transplanting was just finished the water that remained in the tank was just enough for two weeks. However, it rained in mid December and the tank got filled up to supply one month's demand. There was no rain afterwards and water was issued at 7 day intervals. On February 17th the tank was almost empty and no further issues were possible.

8 acres of paddy fields died completely and a large extent was affected very badly by the severe water shortage.

(7) Yields.

Harvesting commenced on 18th February 1973 and was completed before Sinhala New Year. Yields dropped due to the drought and the ommission of the TDM-2 last top dressing. (This omission was also due to the drought). Yield decrease in comparison with Maha 71/72 was as follows:

BG 11-11	5 - 10%
H 8	10 - 15%
H 4	25 - 30%

Large grain type H4 indicated the biggest drop in yield.
Although a drop in the yield was inevitable due to drought, the larger extent under BG 11-11, increase in the transplanted acreage and fertilizer (basal 1st and 2nd top dressings only) application by more farmers enabled to register a high yield of 72 bushels per acre. This is only 3% (2 bushels per acre) less than the average yield of previous season.

This 3% yield decrease compared to the 30% yield decrease in Anuradhapura District clearly indicates the effectiveness of project guidance even in this drought affected season.

5-1-4 1973-74 Maha Paddy Cultivation

1. Out line of Progress.

This year the entire dry zone has experienced the drought and the food situation of Sri Lanka has worsened due to the world wide food shortage. Sri Lanka has launched a massive food drive with the leadership of the Prime Minister, Mrs. Sirimavo Bandaranaike, and under this drive the Project intended to do the best with the co-operation of farmers to conquer the drought and to cultivate the maximum acreage on the paddy lands and high lands.

In September, October and November there was very little rain and the tank water level increased only by a few inches. The amount of water accumulated in the tank was far below the requirement to start issuing water for 73/74 Maha cultivation. In the meantime there were several discussions between the Project officers and the farmers regarding a cultivation under these circumstances and finally at the Cultivation Committee Meeting held in late October it was agreed to work out one of the three alternatives given below depending on the tank water level.

(i) To do a normal Maha cultivation with 4 month varieties as in the past if the water level reaches 5000 acre feet by early December.

(ii) To do a normal Maha cultivation with 4 month varieties as in the past in a reduced acreage if the water level does not go beyond 4000 acre feet in early December.

(iii) To do a bethma cultivation with three month varieties (late Maha) if the water level does not go beyond 3000 acre feet in mid December.

There was a possibility of dry sowing making use of the rains in October and November. However this idea was not promoted as it was not possible to assure the issue of tank water for the dry sown paddy in the event rain ceases or becomes insufficient after sowing. A handful of well to do farmers undertook the risk of dry sowing in 27 acres.

Actual Maha rains did not fall even in early December and all alternatives suggested became impracticable. However on the 13th of December it rained very heavily and it continued till the 20th precipitating a total of 8 inches. Again from the 24th till the 30th there was heavy rain again which amounted to 10 inches. By this time the tank water level went up to 8000 acre feet which is 90% of the total capacity. However according to the rainfall data of Dewahuwa in the past much rain cannot be expected in January. Therefore it was suggested to carry out strongly the third alternative plan suggested earlier, i.e. Cultivation of three month varieties under a bethma in half of the total extent. However Government Agent, Anuradhapura, authoritatively stressed the

cultivation of the full extent, at the water meeting, probably under the pressure of the food drive ideology.

The decisions taken at the water meeting regarding the implementation of plan 3 (modified to cultivate the whole extent) are as follows:

(i) Broadcast sowing of 3 month varieties was the main pattern of crop establishment, however transplanting of less than 20 days old seedlings of three month varieties was allowed.

(ii) Water issue will be from 15th of January and will be over on 1st April. Primary ploughing has to be done without utilizing tank water and should be completed before the first water issue.

(1) Seed Paddy.

There were 300 bushels of BG 11-11 and 300 bushels of BG 34-8 certified seed paddy prepared by the Project staff for 73/74 Maha season. However since for the first time in the history of Dewahuwa it was decided to cultivate the entire extent under three month varieties a large quantity of BG 34-8 certified seed was required. It was not possible to obtain such a large quantity of seed paddy from the Department of Agriculture due to an island wide shortage of seed paddy at that time and therefore 1632 bushels of BG 34-8 (sufficient for 816 acres) were purchased from the Paddy Marketing Board. This paddy was earlier purchased by them for national consumption purposes and was inferior to certified seed paddy. Later it was observed that the P.M/B. seed paddy was thoroughly mixed up and was very poor in germination.

(2) Irrigation.

According to the past rainfall data much rain cannot be expected in January. 2200 acres (95% of the total extent) were put under cultivation of which 55% was under 4 month varieties (cultivated by farmers disregarding the decisions taken at the water meeting). Compared to the acreage cultivated the amount of water available in the tank was 8000 acre feet with a small fraction of run off water. Under these circumstances a mammoth effort was required to protect the entire crop from water starvation up to the harvesting period. The cultivators understanding the magnitude of the situation entrusted the full authority of controlling irrigation water to the project officers at one of the Joint Cultivation Committee Meetings.

When 90% of the sowing was over as shown in Table 5-1 (7), a rigid programme was formulated to issue water twice weakly from 10th February. This pattern of water issue enabled the irrigation of the entire extent cultivated, but also promoted weed growth in the broadcasted and kekulan sown fields, short

Table 5-1 (7)

New Water Issue Rotation 1973/74 Maha

Dewahuwa

As discussed at the Joint C.C. Meeting on 05.02.74 the Water Issue Rotation will be changed as follows:-

1st Rotation from 13.02.74

Main Laterals :

Tract 3 - Lower section	2 days
Tract 5 - Lower section	2 days
Tract 6 - Complete M/lateral	2 days
Tract 8 - Manamperigama chl.	2 days

Small Field chls.

Tract 5 - Lots 50 to 65
Tract 8 - Lots 1-2, 87-96

2nd Rotation from 15.02.74

Tract 3 - Upper section F.C.7 (school chl.)	2 days
Tract 5 - Upper section	2 days
Tract 7 - M/lateral complete	2 days
Tract 8 - Galkaruyaya chl.	2 days
Tract 9 - Main chl., lots 25-35	2 days

Small Field chl.

Tract 1, 2 and 4 complete
Tract 7 - Lots 1 - 11; 54 - 63
Tract 8 - Lots 3 - 8; 84-86
Tract 9 - Lots 1 - 9

Water issue to Small Field channels will be generally according to the minimum requirements, i.e. rotation will be limited to about first 12 hours of the first day and last 12 hours of the second day.

The main sluice of the Tank will be CLOSED for 2 DAYS at the end of the second rotation.

The main sluice will be opened for the first Rotation at 4.00 P.M. on 12.02.74, and all outlets upto Tract 7 will be kept closed till 7.00 A.M. on 13.02.74 and opened according to the above programme.

stemed three month varieties receiving the haviest damage. The transplanted four month varieties received 9 inches of rain from end of February until the end of April and survived. It received less weed damage. Transplanted three month and four month varieties did better than the broadcasted varieties. This however was an unanticipated result which happened by chance. (Table 5-1(7)

The total tank discharge for the season was 11400 acre feet, which is roughly 5.2 acre feet/acre. Even if we consider the gross duty as 6 acre feet by accounting the supplementary rain water, it is by all means a Yala type of irrigation. It should be well noted that this 5.2 acre feet includes the losses by seepage in the channels. The plants did not receive the correct amount of water at the correct time during the course of their growth and this became one of the main reasons for yield decrease.

*Dr. T. Murakami in an experiment conducted on irrigation at different stages of growth found out that fields left under a saturated condition and intermittently by irrigated condition after transplanting, yield only 60% of the fields left under flooded condition. The following table indicates how the results at Dewahuwa are tallying with the results of Dr. Murakami.

Table 5-1(8) Decrease in Yield of Paddy due to Water Shortage

Type of plant establishment	Fertilizer	Variety	Average yield per acre during normal seasons	Comparison of acreages cultivated in this season under the three different types	Percentage covered by each planting type in the total yield
Transplanting	used	BG11-11	80	11	8.8
Broadcasting	used	H4 BG34-8	60	52	31.2
	nil	H4 BG34-8	40	37	14.8
		Total		100	54.8

Expected yield of this year at Dewahuwa

$$54.8 \text{ bushels} \times \frac{60}{100} = 32.9 \text{ bushels.}$$

If the water supply was adequate this season's average yield would have been 54.8 bushels/acre. 60% of this yield is 32.9 which is almost the same as the average yield obtained in the crop cutting i.e. 33.0.

*(Reference:- Dr. Toshio Murakami: 1966 Report of the experimental results on rice water relation study, Department of Agriculture, Sri Lanka).

(3) Pests and Diseases.

There were no pest and disease incidences worthy of mention.

(4) Cultivation Loans.

1972/73 Maha crop was affected by a drought towards the latter part of the season and as a result the average yield was 72 bushels per acre which in 3% less than the previous year. Rate of repayment of cultivation loans was 87.5% and when including the rural indebtedness liquidation loan it is 75%. However Deahuwa Colonists maintained the No.1 position in Anuradhapura District in the repayment of cultivation loans. Number of defaulters increased by 2, making the total 38.

These defaulters were a serious problem for the coming Maha season. During this time a government decision was taken to extend cultivation loans even to defaulters to step up the cultivation under the National Food Production Drive. Defaulters received agrochemicals, fertilizer and Rs.100/acre upto a maximum of 3 acres. 32 defaulters obtained credit under this new scheme and started the 73/74 Maha cultivation.

(5) Crop cutting Survey.

Varieties and planting pattern adopted in 73/74 Maha differed markedly from the previous years where 4 month varieties were transplanted and sown. The acreage of the rearranged paddy fields had increased compared to last year. Therefore the number of crop cuttings were increased to 154 from 103 last year. There places were cut in rearranged paddy fields and two in ordinary fields, each cut measuring 3 m^2.

2. Results.

(i) Variety:- Unlike in the previous years 3 month varieties were used in Maha 1973/74 and the seed renewal rate was 54 %. Three month varieties covered 45% of the total acreage and this seed was supplied from outside sources and made available to the farmers through the M.P.C.S. Three month varieties other than BG 34-8 such as Pachchaiperumal,Dahamala Udugoda Balawee and Sulai were found by farmers themselves and these were cultivated in about 50 acres. 34% of the acreage was under BG 11-11 and 19% was under H4 and H8.

(ii) Planting Pattern:- 88.6% of the acreage was under kekulan and broadcast sowing, only 11.4% was transplanted. Kekulan sowing was done by a few farmers and covered only 4% (27.25 acres).

(iii) Transplanting by Groups of Girls:- Unlike in the past three years trnsplanting by groups of girls was not organised since it was too late.

(iv) Land Preparation:- 30 acres were ploughed in December using rain water. The rest were ploughed under submerged conditions after the first water issue on 7.1.74. However 90% of the acreage was finished at the end of January. The total acreage ploughed was $737\frac{1}{2}$ which is 96.7% of the total acreage, hence the difference from a normal year is inconspicuous. Acreage ploughed by two wheel tractors was 75% compared to the last season but the time taken for land preparation was shortened by one week, without a reduction in the acreage ploughed. This indicates that there have been some hidden ability for quicker land preparation which was not made use of so far.

1st ploughing $474\frac{1}{2}$ Ac. (64.3%)

2nd ploughing $145\frac{1}{2}$ Ac. (19.7%)

(v). Fertilizer:- As practised in the past following fertilizers were recommended at various stages of growth:

V 1 - Basal dressing

Urea - first and second top dressing

TDM-2 - Young Panicle formation stage.

Most of the farmers feared a total crop failure due to drought and only 86 out of 164 farmers applied the basal fertilizer, and it was the same with other fertilizers. Amount of fertilizer applied per unit area decreased markedly.

(vi). Yield:- Out of 737.5 acres cultivated 86 acres (11.7%) were beyond rescue and only 651 acres were harvested. Average yield was 33 bushels per acre. This is less than 50% of the previous Maha season and could be attributed to the drought. Actual yield per acre would have been less than 30 bushels since 11.7% of the acreage did not yield anything.

In the past seasons high yielding BG 11-11 and old improved varieties H4 and H8 were used in combination with better cultivation practices such as transplanting and proper fertilizing. High yields were obtained under these conditions. This year only 8.7% of the total acreage was cultivated under the above combination and since the yields decreased markedly. The effects of water shortage was also very evident and BG 11-11 under row transplanting with the recommended dosages of fertilizer yielded only 62 bushels per acre. This is a yield decrease of 30% compared to 90 bushels per acre obtained in 72/73 Maha season. 35.4% of the acreage was under the worst combination of broadcasting with no fertilizer. This gave an average yield of 28 bushels per acre. When considering the water level in the tank at the beginning of the season (January) it is impossible to expect the farmers to invest thoroughly in the cultivation.

Nine farmers cultivated 27.25 acres under kekulan 20% of this was overwhelmed with weeds and not yield at all. Out of the rest those fields which received some fertilizer yielded 28 bushels per acre and those which did not receive any fertilizer yielded only 22 bushels per acre.

Variety:

BG 11-11 out yielded all variethies under all types of cultural practices. Local varieties cultivated without fertilizer yielded 25 bushels per acre which is the same yield as H4 and H8 without fertilizer. Fertilized local varieties yielded 33.7 bushels per acre which is markedly less than that of fertilized improved varieties.

Planting Pattern:

Even in this drought affected year transplanting did remarkebly better than broadcasting. Row transplanting gave the best results. Following yields were obtained under different types of plant establishment.

(a)	Row transplanting	50.2 bushels per acre
(b)	Random transplanting	48.6 " " "
(c)	Broadcasting	38.8 " " "
(d)	Kekular sowing	30.0 " " "

Fertilizer:

All transplanted fields were fertilized. The differences in yields of the fertilized and non fertilized fields are given in following table. The difference was around 10 bushels per acre.

Type of plant establishment	Yield	
	Fertilizer bu/ac.	Non fertilized bu/ac.
Transplanting	49.7	-
Broadcasting	37.7	26.2
Kekulan sowing	30.3	20.5

3. Rearranged paddy fields and their yields.

Field other than in track 4 had to be sown before the final levelling which is usually done after the water issue as a part of the paddy field rearrangement work. As a result all rearrnged fields other than in track 4 were broadcasted and the growth of these young plants after germination was very uneven due to poor levelling. On higher places plants died due to lack of water

and in lower places they died due to over-submergence. As a result 19% of the rearranged paddy fields had to be left out without harvesting 7% of other fields were also left out due to similar reasons.

As no steps were taken to preserve the top soil fertility and unevenness in fertility was very conspicuous. This was very clearly seen in the upper areas of the rearranged fields. 1.5 cwt.of V 1 mixture (N:P:K 2.7%: 27% : 13%) per farmer per 5 acres were issued free of charge to compensate for the unevenness is growth and undernourishment. It is not evident whether this application of fertilizer had any effect on the yield. However we can presume it as effective since the overall growth of the plants bettered after the application of V 1.

Generally in rearranged paddy fields there is a tendency for the yields to decrease during the first season. According to table 5-1 (9) this decrease is around 10%.

In a separate investigation it was observed that paddy fields rearranged in 1973 yielded 31 bushels per acre compared to 34.6 bushels per acre in ordinary fields. This is a decrease in yield of 10%. Fields rearranged a year earlier (1972) yielded 33.1 bushels/acre which is only 4.5% less than the ordinary fields. This indicates that there is a certain amount of self recovery in soil fertility in the reaaranged paddy fields, with the passing of time. Table 5-1 (9)

The main reasons for decrease in yield in the rearranged paddy fields are -

(a) Uneven levelling of the soil.

(b) Uneven growth of rice plants due to the difference of fertility in the same soil surface.

In the paddy field rearrngement programme at Dewahuwa no attention has been paid to the disturbance and displacement of the top soil. Following suggestions are made for future consideration in the paddy field rearrangement work.

(a) Perfect levelling should be attained.

(b) Bulldozers should not be allowed to get bogged, in the soil during the rainy season.

(c) Organic manure should be added to deeply cut surfaces.

(d) Higher dosage of basal fertilizer should be added to the newly exposed sub soil surfaces, especially to the upper areas of partitions. This should be followed with immediate top dressing of fertilizer whenever uneven growth is detected.

(e) Avoid broadcasting and adopt transplanting to minimise the unevenness in growth.

Sometimes application of phosphate fertilizer for the rearranged paddy fields is effective.

Table 5-1 (10) Achievement of Maha Paddy Cultivation (i) (ii) (iii) (iv) (v) (vi) (vii)

Table 5-1 (11) Achievement of Maha Paddy Cultivation in Dewahuwa

Table 5-1 (12) Results of each Management Season (i) (ii)

Table 5-1 (9)

Comparison of Consolidated Field in 73 Yala and Non-consolidated Field in 73 Yala

(1)

Field	Number of Field	Extent sown Ac.	Extent Harvested Ac.		Extent Damaged Ac.	
			Ac.	%	Ac.	%
73 Yala Consolidated	31	139¼	111½	73	27	19
Non-consolidated in 73 Yala	122	595¼	551	93	44¼	7

* Extent Damaged : Caused by drought-injury and wet-injury

(2) Yield

Planting Pattern	Application of Fertilizer	Variety	Non-consolidated (A)	Consolidated	
				bushels	% for (A)
Row Transplanting	Do	Bg11-11	64.6	60.7	94
		H 4	57.4	55.7	97
Random Transplanting	Do	Bg11-11	59.5	56.5	95
		H 4	46.8	47.2	101
Broad-casting	Do	Bg34-8	34.8	31.7	91
		Bg11-11	44.6	40.1	97
		H 4	41.2	36.9	90
		Others	33.5	33.9	101
Broad-casting	Nil	Bg34-8	20.6	19.3	94
		Bg11-11	33.6	30.0	89
		H 4	29.0	29.8	102
		Others	25.9	25.3	98

Field	Bushels per Ac.	Ratio for (A) %
Non-consolidated (A)	34.6	100.0
71,72 Yala consolidated	33.1	95.7
73 Yala consolidated	31.0	89.6

Table 5-1 (10)

Achievement of Maha Paddy Cultivation

(i) Variety

Variety	70/71 Maha		71/72 Maha		72/73 Maha		73/74 Maha	
	Ac	%	Ac	%	Ac	%	Ac	%
H 4	400	55.2	320¼	42.5	199¼	26.5	114½	15.5
H 8	200	26.6	218¼	28.9	90.0	12.0	27¼	3.6
BG 11-11	-	-	195.0	25.8	443¼	58.9	253½	34.4
BG 34-8	-	-	-	-	-	-	291½	39.5
IR-8	20	2.7	10.0	1.4	-	-	-	-
Others	131	17.5	11.0	1.4	18½	2.6	50	7.0
Total	751	100.0	754½	100.0	753	100.0	737½	100.0

Note : Number of Colonists : 153

(ii) Replacement of Old Varieties by Improved Varieties (Bushels)

Variety	70/71	71/72	72/73	73/74
H 4	60	240	-	-
H 8	-	112	-	-
BG11-11	-	119	336	-
BG34-8	-	-	-	367
Others	-	11	-	148
Total	60	562	336	515
Ratio	8%	56.1%	38.5%	34.7%

(iii) Planting Pattern

Pattern		70/71 Maha		71/72 Maha		72/73 Maha		73/74 Maha	
Trans plant-ing	Row Trans.	Ac 23	% 2.9	Ac 99	% 13.0	Ac 175	% 23.3	Ac 44½	% 6.0
	Random Trans.	310	40.1	405	53.8	457	60.7	40.0	5.4
Broadcasting		418	57.0	249¼	33.2	121	16.0	625¼	84.9
Kekulan		-	-	-	-	-	-	27¼	3.7
Total		751	100.0	754¼	100.0	753	100.0	737½	100.0
Yield	Bushels per acre	53		74		72		33	

Table 5-1 (10)

(iv) Row Transplanting by Girl's Groups

70/71 Maha		71/72 Maha		72/73 Maha		73/74 Maha	
Ac	%	Ac	%	Ac	%	Ac	%
9½	1.2	62	8.2	95½	12.7	0	0

Note: Percentage is for total area

(v) Ploughing by Two Wheel Tractor

	70/71 Maha		71/72 Maha		72/73 Maha		73/74 Maha	
	Ac	%	Ac	%	Ac	%	Ac	%
1st Ploughing	215	28.5	638	84.6	639½	84.9	474½	64.3
2nd Ploughing	14	0.2	296	39.3	221	29.4	145½	19.7

(vi) Use of Fertilizer

Items / Year	Number of Farmers used Fertilizer	Ratio of used Farmers	Basal (ton)			Topdressing (ton)		
			Rock P_2O_5	Kcl	V 1	$(NH_4)_2SO_4$	Urea	TDM 2
70/71 Maha	82	53.6%	9.5	4.9	-	26.0	-	-
71/72 Maha	114	74.5	-	-	37.5	-	32.2	-
72/73 Maha	143	93.5	-	-	47.5	-	28.0	8.0
73/74 Maha	86	53.1	-	-	22.2	-	7.2	2.7

Items / Year	Components			Amount of per Acre (lbs)			
	N	P	K	N	P	K	Total
70/71 Maha	6.6	2.9	2.4	34.6	15.2	12.6	62.4
71/72 Maha	16.0	10.0	4.9	61.8	38.6	18.9	119.3
72/73 Maha	16.6	12.6	7.7	51.5	38.8	23.7	114.3
73/74 Maha	4.7	6.0	3.4	17.7	30.7	12.8	53.1

Note: V 1 - Components (N:P:K = 2.7%: 27.0%: 13.0%)

TDM-2 (N:K = 31%:20%)

Table 5-1 (10)

(vii) Effect of Variety, Transplanting and Fertilizer

(1971/72, 1972/73 and 1973/74 Maha)

(Bushels per acre)

Year	Fertilizer Application	Applied Fertilizer					No Fertilizer				
	Variety	BG11-11	H 4	H 8	BG34-8	Others	BG11-11	H 4	H 8	BG34-8	Others
71/72 Maha	Row Transplanting	100.0	88.5	90.6	-	-	-	-	-	-	-
	Random T.P.	87.6	81.3	77.5	-	68.0	48.8	50.6	53.0	-	48.0
	Broadcasting	-	69.4	65.7	-	50.2	-	44.2	45.6	-	44.4
	Kekulan	-	-	-	-	-	-	-	-	-	-

Year	Fertilizer Application	Applied Fertilizer					No Fertilizer				
	Variety	BG11-11	H 4	H 8	BG34-8	Others	BG11-11	H 4	H 8	BG34-8	Others
72/73 Maha	Row Transplanting	89.5	68.9	78.0	-	-	-	-	-	-	-
	Random T.P.	83.2	64.5	75.0	-	70.0	51.3	52.2	45.2	-	-
	Broadcasting	55.3	49.0	52.3	-	51.8	-	46.5	46.7	-	45.0
	Kekulan	-	-	-	-	-	-	-	-	-	-

Year	Fertilizer Application	Applied Fertilizer					No Fertilizer				
	Variety	BG11-11	H 4	H 8	BG34-8	Others	BG11-11	H 4	H 8	BG34-8	Others
73/74 Maha	Row Transplanting	61.8	56.0	43.8	48.3	-	-	-	-	-	-
	Random T.P.	58.5	47.1	41.0	47.7	-	-	-	-	-	-
	Broadcasting	44.2	40.6	34.9	35.1	33.7	33.6	28.5	22.8	20.6	25.3
	Kekulan	40.0	33.3	-	17.5	30.0	25.0	24.5	-	12.0	-

Table 5-1 (11)

Achievement of Maha Paddy Cultivation in Dewahuwa

Subject \ Season			1970/71 Maha	1971/72 Maha	1972/73 Maha	1973/74 Maha
Under Guidance of Project	Acreage Ac		150	755	755	737½
	Number of Farmers		30	153	153	153
First Date of Water Issue			1970. 10. 20	1971. 9. 24	1972. 9. 30	1974. 1. 6
Total No. of issue days			155	188	111	96
Total amount of issued water		Ac.Ft.	22,000	20,000	16,600	11,428
Ploughing by Project 2 wheeler		1st	229	638 — 933	639½ — 860½	474½ — 620
		2nd		295	221	145½
Renewal of Seed Paddy		Amount	60	562	336	515
		%	8	56	38.5	34.7
Acreage under different Varieties Ac.	BG11-11		-	196	443½	253½
	BG34-8		-	-	-	183½
	H 4		600	320½ — 538½	194½ — 289½	141¾
	H 8			218½	90	
	Others		151	21	18½	159½
	Total		751	754½	753	737½
Planting Pattern %	Row Transplanting	By Girls	(1.3)	(8.2)	(12.6)	(0)
		Total	3	13.0	23.3	6.0
	Random Transplanting		40	53.8	60.7	5.4
	Broadcasting		57	33.2	16.0	88.6
Fertilizer Total Number of Colonist 153	Nutrient Contents (ton)	N	6.6	16.0	16.6	4.7
		P_2O_5	2.9	10.0	12.6	6.0
		K_2O	2.4	4.9	7.7	3.4
	No. of Farmers applied Fertilizer		82	114	144	86
Yield (Paddy) (Bushels/acre)			53	74	72	28
Sold to Co-operative	Amount (Bushels)		10,437	27,250	23,245	4,937
	Percentage for 1971/72	%	100	261	223	47
Cultivation Loan	Amount of Loan	Rs.	38,230	123,500	147,294	105,074
	Percentage of Payment	%	75.1	81.9	74.8	13.5
			Project activities were started some time after the water issue. The farmers had already planned their cultivation by this time. Therefore an area of 150 acres cultivated by 30 farmers were selected for intensive guidance. Utilization of Government cultivation loans were very low. Only half the number of farmers used the loan. As a result the input were reduced to half the previous corresponding season. However the yield remained unchanged. There was sufficient water.	A Productivity Maximization Programme was launched, based on the three pillars. (1) Liquidation of rural indebtedness (2) Expanded credit system and (3) Intensive extension cum supervision drive. There was adequate water. Paddy field rearrangement progressed over 50% of the previous year's performance. An average yield covering 80% of the final project target was achieved. Rate of loan repayment including the previous outstanding balances was 81.9%. And it was best in Anuradhapura district. This rate surpassed the next best performance by a wide margin.	Activated by the favourable results of the previous season 95% of the farmers participated in the project guidance programme. Although varieties, planting pattern and fertilizer application improved remarkably, the effects of these improvements were diminished by a water shortage experienced towards the latter part of the season. The yield went down by 3% of the previous season. However in the surrounding areas there has been a yield decrease of 30% and hence the effect of project guidance became more evident. Rate of lown repayment was once again the best in Anuradhapura district.	Due to the water scarecity in the tank it was suggested to cultivate ½ the total extent. However on an order by the Government Agent the full extent was cultivated. As a result many fields got affected by drought and 12% of the fields were continuously overwhelmed with weeds. The loan repayment was only 5%. 95% of the cultivators lost their eligibility for cultivation loans in the following season.

Table 5-1 (12) Results of each Management Season (i)

Dewahuwa

Year	1970	1971										1972										1973		
Month / Subject	10 11 12	1 2 3			4 5 6			7 8 9			10 11 12	1 2 3			4 5 6			7 8 9			10 11 12	1 2 3		
PADDY FIELD																								
Crop season		Maha						Yala				Maha						Yala					Maha		
Acreage cultivated			Ac 751	100%			4 Ac						754½ Ac	100%			27- Ac Irrigated						753 Ac	100%
Crops Varieties	Improved Varieties	H4	400	55.2	Green Gram and another Pulses		1 Ac					H4	320-	42.5	Green Gram		20					H4	199-	26.5
		H8	200	26.6								H8	218-	28.9	Soyabean		2					H8	90	12.0
		BG11-11	0	0	Red Onion		3					BG11-11	195	25.8	Beans		3					BG11-11	443	58.9
		Others	20	2.7	Vegetables							Others	10	1.8	Tomato		2-					Others	0	0
	Local varieties		131	17.5	Total		4					Local varieties	11	1.8	Total		27-					Local varieties	18½	2.6
Planting pattern	Row Transplanting		23	2.9	Demonstrated cultivation							Row Transplanting	99	13.0								Row transplanting	175	23.3
	Random transplanting		310	40.1								Random transplanting	405	53.8								Random transplanting	457	60.7
	Broad casting		418	57.0	First cultivation by Project guidance							Broad casting	249-	33.2								Broad casting	121	16.0
Fertilizer	Number of farmers applied fertilizer		86									Number of farmers applied fertilizer	114									Number of farmers applied fertilizer	143	
				ton	lbs/ac								ton	lbs/ac									ton	lbs
	Amount of fertilizer applied (3 main components)	N	6.6	34.6								Amount of Fertilizer N	16.0	61.8								Amount of Fertilizer N	16.6	51.5
		P	2.9	15.2								P	10.0	38.6								P	12.6	38.8
		K	2.4	12.6								K	4.9	18.9								K	7.7	23.7
Transplanted acreage by organized girl's group			9½ Ac	1.2%									62 Ac	8.2%									95½ Ac	12.7%
Yield paddy (bushels/ac)			53										74										72	
HIGH LAND																								
Crop season						Yala					Naha					Yala					Naha			
Crops					Cowpea 2½ Ac Red Onion 2 Green Gram ½ Total 5 First Guidance of the Project at paddy field in Yala in addition to this 30 acres Tobaco						Chillies 2 Ac Maize 3 Krakkan 8 Red Onion ½ Manioc 2 Total 15				Chilies 2 Ac Red Onion 1 Total 3 Import of chillies stopped in addition to this 50 acres Tobaco				Maize 5½ Ac Krakkan 10 Green Gram 3½ Tur Dhal 2 Gingelly 2 Total 23		
COUNTERPART																								
Agricultural Officer	Co-Manager																					Cum Co Manager		
		Transfer			Appointment						Farm Management Counterpart													
Agricultural Instructor	Ag. Extension																							
	Transfer Appointment														Training in Japan (Paddy)									
															Ag. Extension Upland Crops and Vegetables									
Agricultural Extention Worker	Transfer Appointment														Appointment									

Table 5-1 (12) Results of each Management Season (ii)

Sri Lanka Japan Rural Development Project

Year		1973									1974												1975						
Month / Subject		4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9
Crop season				Yala							Maha					Yala								Maha					Yala		
Acrease cultivated				32 Ac							737 Ac			100%															
PADDY FIELD		Irrigated		Unirrigated																									
	Crops	Green Gram	21 Ac		3 Ac																								
		Tomato	0		5																								
	Varieties	Vegetable	1		2																								
		Total	22		10																								
											Improved varieties	H4	114½ Ac	15.5%															
												M8	27½	3.6															
												BG11-11	253½	34.4															
												BG34-8	291½	39.5															
											Local varieties		50¾	7.0															
															Irrigated		Unirrigated												
															Cow pea	10 Ac	5												
															Green Gram	3	1												
															Soyabean	4	1												
															Groundnuts	2													
															Sorgham	2													
															Others	3													
															Total	25	7												
																							Paddy	18 Ac		Black Gram	6 Ac		
																							Sorgham	31		Tobaco	1		
																							Cow pea	46		Vegetables	-		
																							Others	15					
																							Total	100					
	Planting pattern	22 acres irrigated was a demonstration on the Dept. of Agriculture. Cultivated by Young Farmers Club.									Method of cultivation	Row transplanting	44½	6.0	25 acres irrigated was a demonstration of the Dept. of Agriculture out of which 8 acres cultivated by Young Farmers under cow pea.								- Bethoma cultivation of covering all the colonists			6 acres demonstration of black gram of the Dept. of Agriculture cultivated by Young Farmers.					
												Random planting	40	5.4															
												Broad casting	623	84.9															
												Dry sowing	27	3.7															
	Fertilizer										Number of farmers applied fertilizer		86																
											Amount of fertilizer applied (3 main components)		ton	lbs/ac															
												N	7.2	27.2															
												P	6.0	22.6															
												K	5.0	18.9															
	Note	Heavy attack of yellow-virus on green gram									No transplanting by young girls groups No special programme for pest and disease control				Aphid attack on late sown cow pea (sown after June)															
	Yield (per acre)										33 (except 7% of the completely bushels dried up fields												Paddy 15 bushels Sorgham 300 lbs Cow pea 600 lbs								
HIGH LAND	Crop season	Yala							Maha					Yala									Maha						Yala	
	Crops	Chillies	12 Ac						Chillies	6 Ac	Manioc	14 Ac		Chillies	1 Ac	Manioc	10 Ac						Chillies	169 Ac						
		Tur Dhal	1½						Upland rice	14	Vegetable	5		Cow pea	5	Vegetable	10						Sorgham		in addition to this					
		Manioc	2½						Maize	9	Tur Dhal	18		Green Gram	2	Caster	-						Cow pea		68- Tobaco					
		Others	2						Krakkan	15	Total	100		Ground nuts	1								Gingelly	32						
		Total	17						Sorgham	3				Tur Dhal	3								Manioc	60						
		in addition to this 40 acres Tobaco							Green Gram	4				Sorgham	4								Caster	2						
									Soyabean	2				Sweet potato	2								Others	6						
									(Stating of Food Production Drive)					(Pod borer damage serious unsuitable for cultivation)									Total							
COUNTERPART	Agricultural Officer																												
	Agricultural Instructor																												
					Transfer						Resignation															to follow Extension course in Japan				
											Appointment																		
	Agricultural Extension Worker																												

5-2 Agricultural Machinery

5-2-1 Farm management and the labour availability in the project area at its inception.

In 1949 at the time settlement started in Devahuwa Colonization Scheme each settling family was given a 5 acre irrigated paddy field and a 3 acre highland with a cottage to live in. The government with-held the ownership of the land and the farmers cultivated it on a long term lease basis. They grew paddy in the irrigated fields and planted permanent crops such as coconut, jack fruit trees, mangoes and bananas, on the highland. Therefore the area left on the highlands was rather small being 0.6 acres on the average.

The mortagaging or re-leasing these lands were forbidden by law since the ownership remained with the government. However it has been observed that many farmers indeed had mortgaged or leased their paddy fields as a remedy of overcoming hardships caused by drought and to find money for treating sick, funerals, weddings and for other important events in their life. A few had gone even to the extent of completely selling their cultivation rights and remained in the government list as name sake cultivators, while the actual cultivation was carried out by complete outsiders. This indebtedness was the result of droughts, poor irrigation facilities, low harvests due to lack of technology, ill health, deaths and other calamities. Again with the upcomming of the second and the third generations the situation worsened due to fragmentation of their holdings. However, in Sri Lanka it is considered that a five acre paddy land is a too large holding for a single family to handle.

According to the 1969 report of the Second Survey Mission of the team of investigators on the Development of a Model Agricultural Community in Sri Lanka the farm management pattern at Devahuwa was as follows.

Table 1-A. Size of farm land, labour and implements per household at Devahuwa Colonization Scheme.

Size of farmland	Paddy field 4 acres, Upland field 0.6 acres chena 0.7 acres Total 5.3 acres
Size of family	7.1 persons, (Labour force male 1.9 & female 1.7 (Total labour force 3.6 persons
Number of cattle	Buffaloes 1.0
Agricultural Implements	Plough 1, Harrow 1, Hoe 3, Sickle 4

On the average there was a buffalo per family to supply the power requirements for land preparation. However these buffaloes were owned by only 17% of the number of households in the area and as a result all the others had to hire the services of these animals at some form of rental during the ploughing season. Within the project area only two farmers owned a tractor each. A tractor station of the Department of Agriculture is located at Makulugaswewa village had four wheel tractors which are hired to the farmers for ploughing. This tractor station was opened in 1961 under the Farm Mechanization Programme of the Department of Agriculture and it covers an area of more than 2400 acres of paddy and 2000 acres of highland in and around the project. This station has become the main power providing source for all farming operations and the farmers are heavily dependant on it. The buffaloes in the village cover the rest of the area but their population is going down due to the availability of tractors and lack of pastures.

Each 5 acre allotment is fragmented into very small areas demarcated by narrow ridges and there are about 150 - 180 such fragments in each 5 acre allotment. The soil is gravelly with reddish brown clay. These soil conditions and the size of fragments paused problems in land preparation and in turn to the farm mechanization programme. The efficiency of the four wheel tractors dwindled under these conditions and also caused frequent break-downs. In addition to these the recent foreign exchange shortages have limited the import of spares required for the repairs of these tractors and as a result the number of tractors needing repairs increased annually reducing the number of operatable tractors to 11. It became quite impossible to keep up with the targets in this manner and the tractor stations failed to serve their purposes. In many instances the ploughing season prolonged unavoidably due to these power shortages causing the waste of precious irrigation water.

5-2-2 Mechanization Programme.

The main source of income for Dewahuwa colonists was through their paddy cultivation. However, since Devahuwa is located in the Dry Zone it received little rain during the Yala season and as such only a Maha cultivation was possible with supplementary irrigation with tank water. Any way the cultivation depended heavily on the amount of water accumulated in the tank. The fluctuation of the rainfall is very large and this hampered the stabilization of the paddy cultivation. The available labour cannot impose a cultivation to match the rainfall pattern. It was felt that due to the shortage of irrigation water full attention should be diverted in concentrating all modes of power available at the

time of land preparation. However this being not available the ploughing dragged on for longer periods consuming time available for other improved cultural practices such as transplanting. As a result there was more broadcast sowing than transplanting.

The first step taken after the inception of the project to solve this problem was to provide power by way of mechanization. Small size mechines which seemed to be fitting for Dewahuwa were imported under the mechanization programme.

5-2-3 Training in Fam Machinery Utilization.

23 Units of 6 Hp. two wheel tractors were introduced to the project even before the signing of the Project agreement between Sri Lanka and Japan. By this time preparations were already on the way for the 1970/71 Maha paddy cultivation. Therefore the newly arrived tractors were considered as a great relief to the farmers. Immediate training of young farmers in the operation of these two wheel tractors was started to make the services of two wheel tractors the young farmers as early as possible. Applications were called from the younger generation and training commenced from the 10th of November 1970 under the guidance and supervision of a technical expert of ISEKI Agricultural Machinery Manufactoring Co., Ltd. with the assistance of a Sri Lankan counterpart. Two groups, each having 20 boys were trained in a five by course on the operation of the two wheel tractors under the following curriculum.

TABLE 3-A Curriculum for Hand Tractor Operation Training

1	a. Introduction; Outline of Agricultural machinery, explanation and discription of the parts b. Operation method; Tilling and main shift
2	c. Oiling and exchange; Engine, Transmission, Air cleaner, Rotary, at various parts. d. Adjustment of parts; Tention pully, Main clutch, Side clutch, Throttle, Stand, etc.
3	e. Operation practice; Attaching and detaching of rotary tiller, exchange of Wheels and tralers f. Operation practice; Ploughing and ridging on the up-land field.
4	g. Operation practice; Transportation driving on the road h. Operation practice; Ploughing and puddling on the paddy field.
5	i. To be throughly check vital parts prior and after operation. j. Overall review of the cause.

The young farmers who turned out for the tractor training course were keen and enthusiastic. In spite of the short course they easily mastered the operational techniques and successfully engaged in ploughing the paddy fields. As a result smooth and gradual introduction of machinery could be considered as a success.

Thereafter these training classes were repeated volunteers periodically to train new volunteers in between the Maha and Yala ploughing seasons. By and by the tractor operational techniques of the young farmers reached a higher level enabling to draw the maximum use of the tractors and as such the purpose of the initial mechanization programme was fully achieved.

Training of Mechanics

All the agricultural machinery required a proper and smooth operation and at the same time strict maintenance and conservation since the wear and tear of various parts of a machine is high according to the type of work taken out of it. All machinery should be kept and used in the very best condition. All repairs should be done immediately after a breakdown which may occur while working, so that the machine is even kept idling and that the work does not get delayed due to the breakdown. For this purpose a high knowledge of repair and maintenance techniques and related facilities become indispensable.

Training of mechanics in a rural community where the knowledge in machinery is of a very low degree, is of utmost importance for the successful mechanization of agriculture in that community. Out of the tractor operators trained so far the most successful and qualified six were selected to be trained as mechanics for the maintenance and repairing of tractors in the future at the proposed Agricultural Mechanization Centre.

The course was started by briefing them with the outlines of agricultural machinery, principles of internal combustion engines and the functions of various parts of the engine until each trainee could understand the composition and the mechanism of an engine. It was followed by lessons on assembling and dismantling and on making various adjustments to their parts. These were done by repeating of practical exercises.

A very long time is required to master these techniques completely. However, in a short period a trainee could learn the basic techniques of handling each part of a machine and how to assemble and tune up the machine. The learning ability of Dewahuwa boys deserved high prise and their achievement was remarkable.

They gained more and more confidence while in the process of actual operation and it was a continuous process.

The long awaited mechanization centre buildings were completed in 1974. Hydro-electric power was provided too. Electric and gas welding, plants, screw cutters, various gauges and many other equipment indispensable for the repair and maintenance of two wheel tractors were installed and imported from Japan. The mechanics quickly mastered the art of using these equipment amd it was a big moral booster for all of them. Thus the completion of the mechanization centre gave them more confidence and sense of responsibility which is a vital driving force in the increased agricultural production.

Along with the expansion of the mechanization centre facilities were made available to train more and more volunteer operators. All these advancements laid a basic structure for the mechanized agriculture at Dewahuwa. These young people could play a great role in and educating the senior farmers in the techniques of mechanised farming.

TABLE 3-B Curriculum for Mechanical Training

1st stage	Introduction; Internal combustion engine, Electric and Compression ignition engine 2-cycle and 4-cycle system engine; intake, compression, combustion exhaust cycle. Mechanism; Diesel engine, petrol engine, Kerosine engine, air cooled system, water cooled system, etc. Performance curve; Engine power, torque of P.T.O., r.p.m. etc. Function of each part of the engine.
2nd stage	Tractor body; Function of power transmission, stirring system, clutch, speed change gears, side clutch, P.T.O., etc. Tilling system; counter gear case, rotary speed change gears, rotary plough, ridger, steel wheels, rubber wheels.
3rd stage	Trouble diagnosis and corrections.
4th stage	How to use the repairing equipments and tools.

TABLE 3-C Performance of Mechanical Training Class

Date	Attendance boys	Date	Attendance boys	Date	Attendance boys
1971 2.1 - 2.6	10	1972 7.4 - 7.6	6	1974 5.31 - 6.8	2
" 8.26 - 8.28	5	" 8.29 - 9.2	6	" 8.26 - 8.29	1
" 9.21 - 9.25	5	" 9.12 - 9.14	4	" 10.11 -10.20	6
1972 1.16 - 1.19	6	" 9.21 - 9.24	4	" 12.2 -12.6	9
" 3.30 - 3.31	2	1973 3.1 - 3.2	3		
" 4.5 - 4.6	2	" 2.2 -12.6	9		

5-2-4 Progress in Farm Machinery Utilization.

Following suggestions were made by the project staff regarding the ownership and utilization of machinery after carefully considering the local conditions.

(a) Utilization of Machinery by small groups of cultivators:

effective economic area which a two wheel tractor could handle in a single season (Yala or Maha) is 25 acres. It was suggested that five farmers cultivating this 25 acres form a group and carry out ploughing operations while managing the tractors by themselve.

(b) Utilization Under Central Control:

Assuming the entire project area as the acreage owned by one single group the project staff to control the utilization of tractors centrally. The tractors to be hired out to the farmers on a fair rental basis.

Advantages of the method (a) above are:

(i) Timely and effective utilization of the tractors. Since a small group of farmers are using the tractor it could be used in any way or at any time they like.

(ii) A move towards self help and mutual corporation could be expected from the farmers.

(iii) Multi Purpose Utilization of the two wheel tractors. These tractors suit all of their cultural practices.

(iv) Better care and less damages by negligence since the tractors are owned by small groups.

Advantages of the method (b) above are:

(i) Relative easiness of introducing new techniques through machinery the

central controlling agency of the machinery also being authoritative. Easy combination of the cultivation plan with the machinery programme.

(ii) The idle period from the time of application for ploughing by the farmers till the actual ploughing of their lands will be reduced to zero since there will be no officialdom at all.

(iii) This will enable the farmers to plough at their will with each and every rain there by increasing the area ploughed each season.

(iv) The farmers will bear only the cost of fuel and lubricants and repair charges initially. The depreciation value of the tractors could be paid by them after harvesting.

It was decided to hold a meeting of the Cultivation Committee members and farmer representatives to get their views on the group utilization of two wheel tractors, they indicated the difficulties in forming these groups due to the unsatisfactory relationships between the neighbours. Furthermore due to the crop failure in the previous season farmers did not have enough money even to supply fuel and lubricants for the tracktors. They feared of having to share repair costs of the damages to the tractors caused by the negligence of other farmers in the group. The usual agricultural credit to the farmers given at the beginning of the season remained undecided this year and as a result their attitude towards the cultivation was a depressed nature. The group utilization idea had to be dropped out under these circumstances.

Dewahuwa is based on an ideal structure suitable for the formation of an institution for collective farming. The size of each holding and other conditions are also favourable for this purpose. However, the cultivators who for a long time existed under indefinite protection of the upper hands lacked the courage to tide over and self emerge from difficulties. Their conciousness and regard for mutual co-operation was as low as the fertility of their soils. The implementation of the "Machinery group utilization programme" became impossible and the machines were made used of under the second alternative i.e. Utilization under central of the project management. Ploughing had to be carried out under unsuitable soil conditions depending on rain water since the water available in the tank was very limited and under these adverse conditions the 6 Hp two wheel tractor could not perform satisfactorily and they were assigned an almost impossible task. The quality of ploughing was poor and inspite of the heavy wear and tear of the tractors.

Yala cultivation was carried out on those fields which could be irrigated by lifting water from the drainage channel and this amounted to only 20 or 30 acres. Ploughing and ridging with two wheel tractors were carried out with

ease after wetting the soil with water and it was a very good quality compared to the ploughing by the four wheel tractors with tine tiller attachments and with buffaloes the quality of ploughing by two wheel tractors was superior. It reduced the time taken in removing the large humps after ploughing under the usual methods. Soil was prepared by running the two wheel tractor with rotary attachment after wetting the soil sufficiently with water. It was followed by ridging with an impliment attached to the two wheel tractor. Land preparation with the two wheel tractor is of superior quality and it eased irrigation and seeding. The Yala income though very small adds in a large way to the living of the dryzone farmers. Therefore emphasis should be laid on finding out water resources, methods of using the two wheel tractor efficiently and on formation of groups to utilize the tractors. This will enable to increase the average under cultivation during Yala even under the water starving small tanks.

able 4-A: Efficiency of two wheel tractors (6 H.P.) in flooded paddy fields and on dry paddy fields after rain.

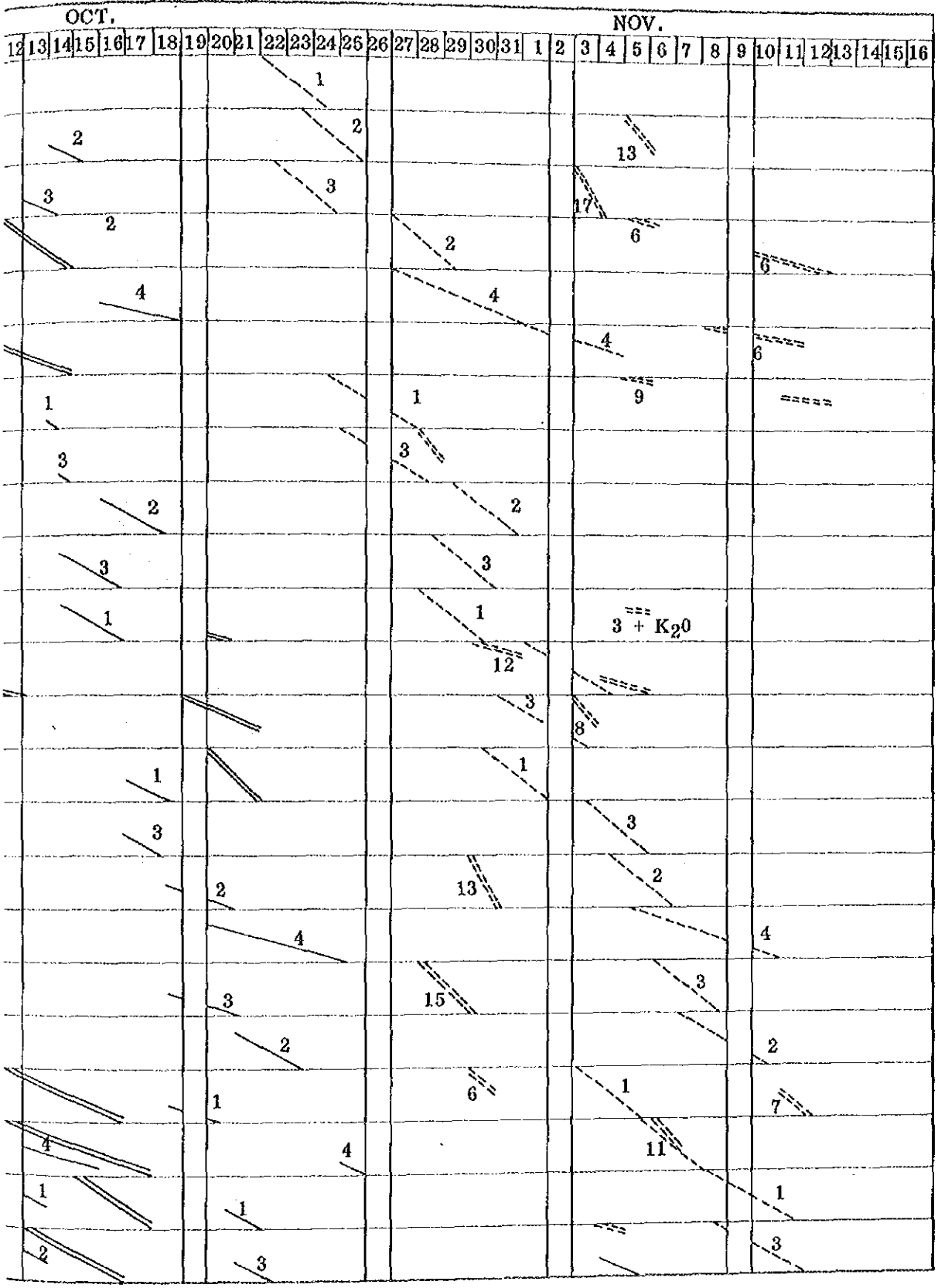
	Efficiency Acres/ day	Fuel Consumption Gallons/ Acreage	Blade	Methods of Land Preparation	Notes
Floodes Paddy field	1.0 - 1.2	1.5 - 1.6	Hatchet Blade	Rotavator	Flooded to a depth of 2.5 cm.
DRY Paddy field	0.8 - 1.0	2.0 - 2.5	-do-	Rotavator	2 days after rain, perfectly moist condition
DRY Paddy field	0.5 - 0.6	3.5	-do-	Rotavator	4 days after rain some what hardened

The following table indicates the plan formulated for carrying out ploughing smoothly and the actual performance in ploughing. The numbers in front of the names of the farmers are the acreages suggested for ploughing. The single time is the project time table for land preparation. The dotted single line indicates the time table for puddling. The double lines and the dotted double lines indicates the actual performance.

Table 4 - B Ploughing Program Tractor

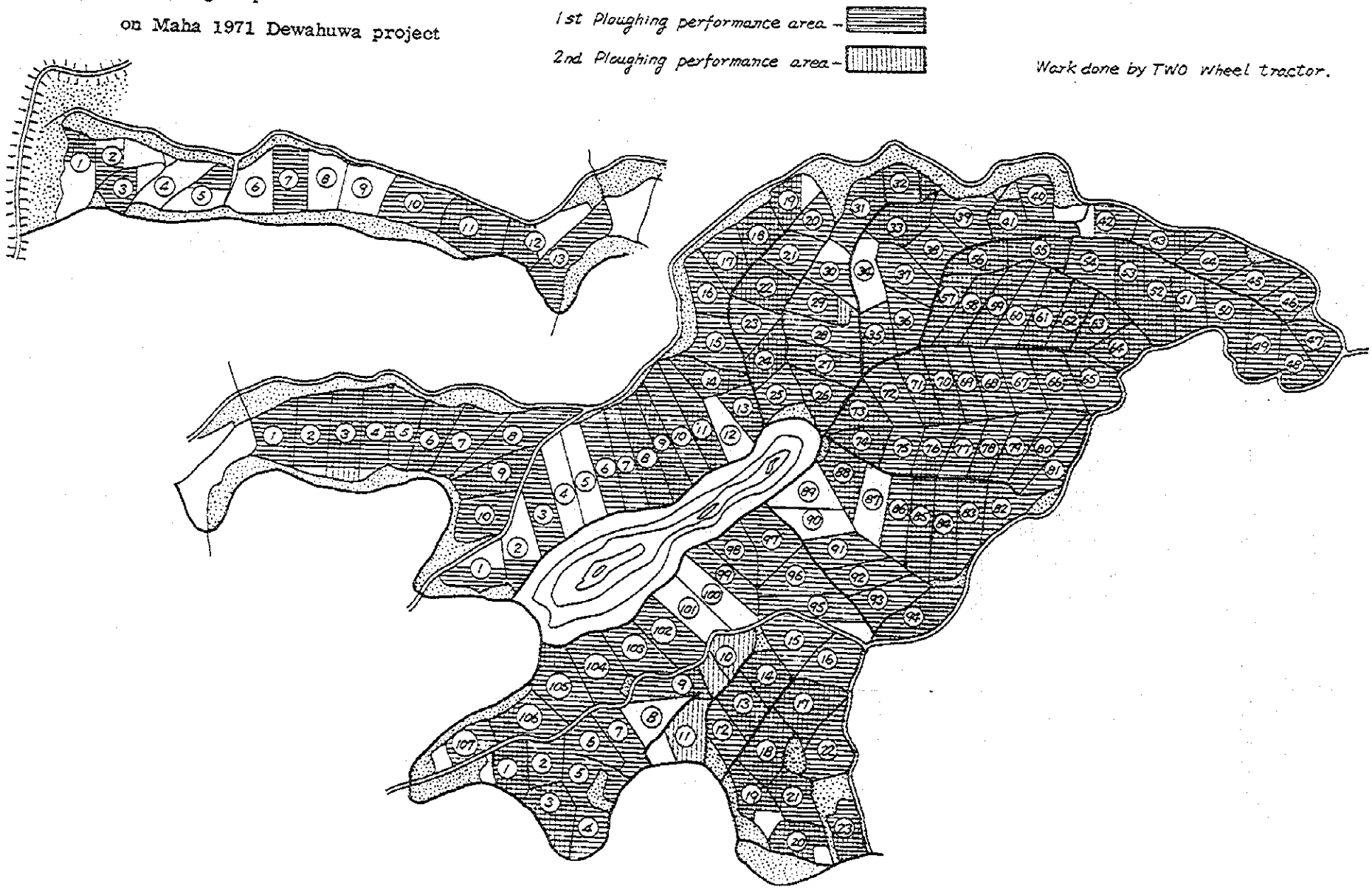
Gr. No.	Tr No.	Fl No.	Name		SEP. 28	29	30	1	2	3	4	5	6	7	8	9	10	11
B		6	P.G.JAMES	5.0				1										
		7	M.LOKU DINGIRA	3.0 2.0			2											
		8	P.RANBARANA	3.0 2.0			3											
		9	P.TIKIRI PANNIKKIYA	4.5 0.5				2										
		10	P.KAKUWA	3.0 2.0			4											
		11	P.THISARA	3.0							4							
		13	A.G.TIKIRI UKKUWA	4.5 0.5							1							
		14	D.RATTARANA	4.5 0.5			3											
		15	K.A.PUNCHIRALA	1.5 3.5							2							
		16	A.G.K.ALU BANDA	1.5 3.5							3							
		17	U.G.KALU BANDA	1.5 3.5							1							
		18	A.G.HEEN MENIKA	5.0							2							
		19	S.D.A.GUNATILEKE	4.5 0.5							3							
		20	B.A.RANHAMY	3.0 2.0							1							
		21	S.M.MUDALIHAMY	3.0 2.0											3			
		22	R.R.TIKIRI BANDA	3.0 2.0											2			
		23	U.G.MUDIYANSE	1.5 3.5											4			
		24	A.G.KAPURUHAMY	3.0 2.0												3		
		25	R.M.KIRI BANDA	1.5 3.5												2		
		26	U.G.MUDALIHAMY	3.5 1.5												1		
		27	A.G.PODIHAMY	4.5 0.5														
		28	D.M.GURUHAMY	3.0 2.0														
		29	A.RANHAMY	3.0 2.0														

Nos. - 7 —— Ploughing ----- Puddling O V_1 Packet



4-C Ploughing map

on Maha 1971 Dewahuwa project



Transplanting (Transplanter PF - 20)

The main method of crop establishment was by broadcasting and random and row transplanting were also carried out in small extents. Rowtransplanting, a technique which the project intended for achieving higher yields was done only in 3% of the acreage at the inception of the project.

The reasons for the low acreage in transplanting were

(i) Elongation of the crop establishment period due to improper organisation of the labour

(ii) The improper fertilizing and management at practices the transplanted paddy does not result in substantial yield increases.

(iii) Financial incapability to hire labour for transplanting.

With the introduction of the two wheel tractors and new managemental and fertilizing practices and with the expansion of the agricultural credit system the above problems were gradually overcome and the row transplanted acreage in 1972 and 1973 covered 13% and 23% of the total acreage respectively. Dewahuwa is rich in human labour and it takes a full day for 16 women to transplant an acre. However, in the future with the improvement of the water situation there is a tendency for agricultural diversification causing a labour scarecity. As a result in 1973 a tiller type transplanter was imported for the exclusive use at the project pilot farm on experiments. The next table indicates the result obtained in testing the transplanter.

Table 4-D Results of the experimental use of the transplanter PF - 20

Experiments conducted at the Project Pilot Farm

Type	Nursery Technique	Field	Efficiency	Fuel consumption	Labourers	Inter Hill Space	Number of hills	Obsintism of hills
	Box type Nursery Dapog	Tract 3 Field No.4	4 houses per acre	0.75 gallons per acre	2	30x14 cm	80 per 3.3 m^2	2%

Note: The Dapog nursery is a indoor nursery technique popular locally and it was tried out with the transplanter with considerable success.

Any two wheel tractor operator could handle the transplanter with ease. On a well prepared land the transplanter is 15 times more efficient over manual and the quality of the transplanting is as good as the manual operation. As a result it could be considered as very economical. The seedlings required for the transplanter could be prepared in the Dapog method and this is almost, similar to the box nursery technique. As such there is no problem

regarding the preparation of seedlings for the transplanter. In 1973 the transplanter was tried at the pilot farm. However, this year was an exceptionally dry year and irrigation water was issued only at very long intervals. As a result the machine transplanted seedlings could not establish themself well in the field. Therefore only an unsatisfactory result was obtained which unfortunately did not link the good qualities of the transplanter with the yield improvement.

The considering the present agricultural potential of Dewahuwa and the severe water shortage it may be felt that the introduction of the transplanter is premature. However, in the future with the solving of the water shortage and introduction of proper water management practices there is a tendency for labour intensive agriculture and the transplanter will be of much use. The results of the above experiment with the transplanter will be very useful in such a situation.

Pest and Disease Control (Knap Sack Type AM-8)

The proper control of irregular disease and pest outbrakes is an important aspect in maximization of yields. This was made possible at Dewahuwa by 24 power driven mist cum dust sprayers. It was heard that there were relatively few pest and disease incidences in the past since paddy was cultivated with almost no fertilizer. And as a result the farmers had a very poor knowledge on preventive measures from pests and diseases and it was felt rather unnecessary. However with the introduction of new high yielding techniques, fertilizing techniques and the high fertilizer responding varieties it was observed that the farmers had gone up to the standard of spraying their nurseries with agrochemicals. The "Bloomic" power sprayers played a vital role in controlling the "silver shoot incidence" which sprang up in Maha 1971/72. Disease and pest incidences of such large scales were not observed after that, but the machines were used in controlling minor out brakes which came up at random.

The diseases and pests damages of the highland crops were very common and in certain crops it was impossible to obtain any yield without the proper control of such diseases and pests. In 1971 Yala the efficiency, easiness in operation and effectiveness of the "Bloomic" power sprayers were demonstrated to the farmers by spraying over the legumes and vegetables cultivated on dry paddy lands under lift irrigation. This demonstration increased the farmers concern over the pest and diseass control.

The control of "Pod Borer" on "Tur Dhal" needs special mentioning. Perfect control was achieved by using the project sprayers by the project management. However in the following year the control of "Pod borer" was left to the

farmers and in most of the places no yields were obtained due to no spraying at all or improper ill timed spraying. This result specifically indicated the necessity of a through pest and disease controlling plan with efficient equipment.

Table 4-E. Control of "Pod Borer" in Tur Dhal

Machine used	Crop	Pest	Number of Sprayings	Efficiency	Quantity Sprayed	Fuel	Effect	Control Plot
AM 8	Tur Dhal	Pod Border	3 times	1.8 hours per acre	32 gallons per acre	0.32 gallons per acre	80%	No yield

Threshing (D2-LK, DD-1)

The common method of threshing in Sri Lanka is to pile reaped paddy stalks on a threshing ground and to drive buffaloes or a four wheel tractor over it.

The efficiency of these operation were:

(1) Buffaloes : 1000-1500 Kg. of paddy per day by a group of 6-8 buffaloes (6-8 in one group)

(2) 4 wheel tractor : 5000-8000 Kg. of paddy per day per tractor

The fully automatic thresher D2-LK imported to the project in 1972 and the semi automatic thresher DD-1 imported to Sri Lanka under Kennedy Round Aid programme were tested at Dewahuwa at the request of the Ministry of Agriculture and Lands, Sri Landa. The results obtained were as follows:

Type D2 - LK	130 Kg./hour
Type DD - 1	100 Kg./hour

The performance of both threshers was poorer than that of the buffalo threshing and this was quite an unexpected result. There was a technician from the makers of the Type D2-LK in Sri Lanka at the time and the experiment was repeated at Dewahuwa in his presence only to obtain the same result. Several adjustments were done to the threshers at the project mechanization centre within its capabilities in the preceeding 2 year. However these adjustments improved the performance only by 15% and the threshers could not be recommended for the satisfactory use by the farmers.

In conclusion, it should be mentioned that the DD-1 type is manufactured for threshing the ear heads only and as such it does not suit the traditional reaping method of Sri Lanka. To reap the ear heads to suit the thresher is not an economical practice when considering the tradition and the labour of the

locality. As regards to type D2-LK the paddy straw in Sri Lanka is very soft and it breaks into pieces rapidly. The paddy too has a very high shedding quality. These factors decrease the efficiency of threshing, and the ready acceptance of the threshers by the farmers. However it is also felt that in the future when it becomes possible to cultivate paddy in two seasons of the year threshers will be required as a labour saving device. Therefore the designing and testing of a thresher to be used on the local paddy varieties in the future is a problem of utmost importance left to be tackled by expert machinery designers.

5-2-5 Effectiveness of Mechanization.

The purpose of the Project Mechanisation Centre was to ease the sudden demand for power and labour during the cultivation season the smooth mechanization ploughing and harvesting operations. Mechanization will also help to propergate widely the practices such as transplanting and fertilizing which are held up due to labour shortages. On the other hand once the poor water management practices are improved mechanization will enable the maximum utilization of farm lands through the cultivation of cash crops in the paddy fields during Yala season and on the highlands during Maha season.

On looking back at the last five years it is felt that the farm mechanization programme has not been a complete success owing to adverse natural and social phenomia. However when going through the following points it will be understood that the Farm Mechanization has plyed an important role in the development and modernization of the agriculture at Dewahuwa.

(1) The two wheel tractors have resolved the acute power shortage experienced during land preparation prior to crop establishment in the entire project area has been reduced to one month from almost 3 months taken in the past. As a result mechanization became a fundamental factor in yield improvement by enabling a well timed cultivation with improved techniques such as transplanting and fertilizing.

(2) Indirectly mechanization has effectively brought in water conservation. 180 acre feet of water is issued daily during the ploughing season for land preparation and with the introduction of the two wheel tractors time taken for land preparation has been reduced to 1/3. This is a considerable achievement in the water starved dry zone. It will be possible to reduce the time taken for land preparation to $1\frac{1}{2}$ months in the entire 2400 acres under Dewahuwa tank by the introduction of two wheel tractors. The amount of water required during this period will be 180 x 45 = 8100 ac.ft.

Let us consider that during the $1\frac{1}{2}$ months reduced from the time taken for land preparation, the established paddy plants continue to grow and they consume 1/3 of the total water already saved for their existence. Then the total amount of water saved by the introduction of two wheel tractors will be 8100 ac.ft. - (8100 x 1/3) ac.ft. = 5400 ac.ft.

(3) Introduction of tractors provided employment for the younger generation and also safeguarded the farmers from the exorbitant ploughing charges of the private four wheel tractor owners. The wages of the tractor operators amount of Rs.40,000 annually and this money will be re-invested in agricultural production. Thus the money circulates within the project without going out of the area.

(4) Mechanization has helped to create enthusiasm in the younger generation in agriculture thereby preventing the drifting of future agricultural population out of the village.

It is a usual thing for the youth in poor villages to get attracted to the city life and leave the villages seeking better opportunities in big cities. However for mechanization and modernization has contributed in a big way in checking this phenominan. It is not possible to tabulate or express this effect in figures, but it remains as one of the major factors in the process of developing farming communities.

(5) The operators of farm machinery earn an added income by making their services available for machinery owners outside the project area during off seasons.

(6) The two wheel tractors have provided a means of transportation for agricultural inputs such as seed, fertilizer etc. which were usually carried with difficulty. The distance from the homested to the paddy field being very long.

The perfomance data of the Farm Machinery in the past five years has been tabulated and indicated below:

TABLE 5-A

PERFORMANCE OF MECHANIZATION WORK

	1970 Oct. Nov. Dec.	Jan. Feb. Mar.	1971 Apr. May. Jun.	Jul. Aug. Sep.	Oct. Nov. Dec.	Jan. Feb. Mar.	1972 Apr. May. Jun.	Jul. Aug. Sep.	Oct. Nov. Dec.	1973 Jan. Feb. Mar.
Arrival machinery. cheeking, assembling testing,	2-wheel tractor 23 nos.		2-wheel tractor - 17 nos. 4-wheel tractor - 1 nos. Thresher - 6 " Sprayer - 20 "	test	Mower -2 Repair tool-1 set. Spare part -1 lot.	test.	Seeder - 6. Sprayer - 2 set Reaper - 2 Thresher - 1 set.	Cutter -1 Tractor attachment - 1 lot. Spare part - 1 lot. Repair tool - 1 lot.		test.
Ploughing, Ridging. Splaying, Planing.	Ploughing 225 ac.		ploughing riging-2.	splaying planing	ploughing splaying 922 ac.		ploughing ridging 23 ac.	aplaying planing	ploughing-860 ac upland-ploughing 12 ac	
Maintenance Ajustment, Repairing & other work.	2-wheel tractor, 4-wheel tractor, motor bic. and other equipments									
* Counter part's post Training counterpart. mechanic-boys operators.	40boys.	10	4 10	5 21 5	12	6 5	alternate 5 training to Japan	6 6 5	40	arrival from Japan 3

	1973 Apr. May Jun.	Jul. Aug. Sep.	Oct. Nov. Dec.	1974 Jan. Feb. Mar.	Apr. May. Jun.	Jul. Aug. Sep.	Oct. Nov. Dec.	1975 Jan. Feb. Mar.	Apr. May. Jun.	Jul. Aug. Sep.
Afrival machinery. checking, assembling, testing.	4-wheel tractor-2 2-wheel tractor-6 cutter -4 transplanter -1	spare part-1 lot repair tool-1 lot		test			2-wheel tractor-15 attachment - 1 lot repair tool - 1 lot engine for 2-wheeltractor-15			spare part - 1 lot
Ploughing, ridging, splaying, planing.	ploughing ridging 23 ac.	splaying planing	ploughing 5 ac.	ploughing 620 ac	ploughing ridging 35 ac.		planing ploughing	ploughing ridging 280 ac.		
Maintenance. ajusting, repairing, other work.	2-wheel tractor, 4-wheel tractor, mortor bic. car service, and other equipments.									
Counter part's Training counterpart mechanicboys and operators.	alternate		40boys 2	left the post.	successer 2	arrived.	6 29		training to Japan alternate	

5-2-6 Future of Farm Mechanization.

Land Preparation.

The quality of the land preparation by the two wheel tractors (6 HP) is excellent under perfect irrigation. The mode of operation and the efficiency have been superior. The direct and indirect effects of Farm Mechanization on the economical farm management programme has been clearly exposed. A Farm Mechanization programme which absorbs the surplus unemployed and under-employed labour in faming communities is desired at Dewahuwa. Regarding the introduction of two wheel tractors, small units which nearly requires the same amount of labour as in the case of draft animals is considered as ideal. The two wheel tractor is an ideal machine which satisfies all the conditions mentioned above.

However the reddish brown earth in the dry zone which includes Dewahuwa Project contains quarts and it becomes hard when cry though it is very soft and sticky when moist. These qualities cause a difficult problem for the two wheel tractors and as a result during the Yala seasons and drought affected Maha seasons where tank water is not issued for land preparation, operation of two wheel tractors (6 HP) under rainfed conditions becomes very difficult.

In order to facilitate better land preparation even during drought affected years, several tractors which could perform satisfactorily even under rain fed conditions have to be suggested. These suggested are made base on the data collect during the project period.

Table 6-A Experiment on various types of tractors.

Type of Machine	Field	Efficiency Hours/acre	Fuel economy gallons/acre	Depth of Ploughing	Notes
KL 781.6 HP	Upland	-	-	-	Hard soil and difficulties
"	Dry paddy land	7		3.5	Plenty of weeds, after rain
KMB-200 12HP	Upland	4	1.8	12	No weeds, after rain
"	Dry paddy land	5	2.5	12	Plenty of weeds, little harder.
TS2400 24HP	Upland	1.5	2.0	15	Less weeds, after rains.
"	Dry paddy Land	2.5	3.4	12	Plenty of weeds,little harder

Table 6-B Effect of hardness of soil on ploughing operations

Hardness of soil / Type of tractor	Plot A	Plot B	Plot C	width of ploughing
KL-781	difficult	little difficult	easy	60 cm.
KMB-200	little difficult	easy	easy	72 cm.
TS-2400	little difficult	easy (but slightly difficult)	easy	150 cm.

Notes: The hardness of the soil was classified as A, B and C based on the readings of the cone-penitrometer.

The physical factors relevant tc ploughing operations such as stickyness (cohesiveness) and resistivity for cutting action differs according to soil types. However since no other instrument was available for the measurement of these factors only the readings of the cone-penitrometer was used for expressing the hardness.

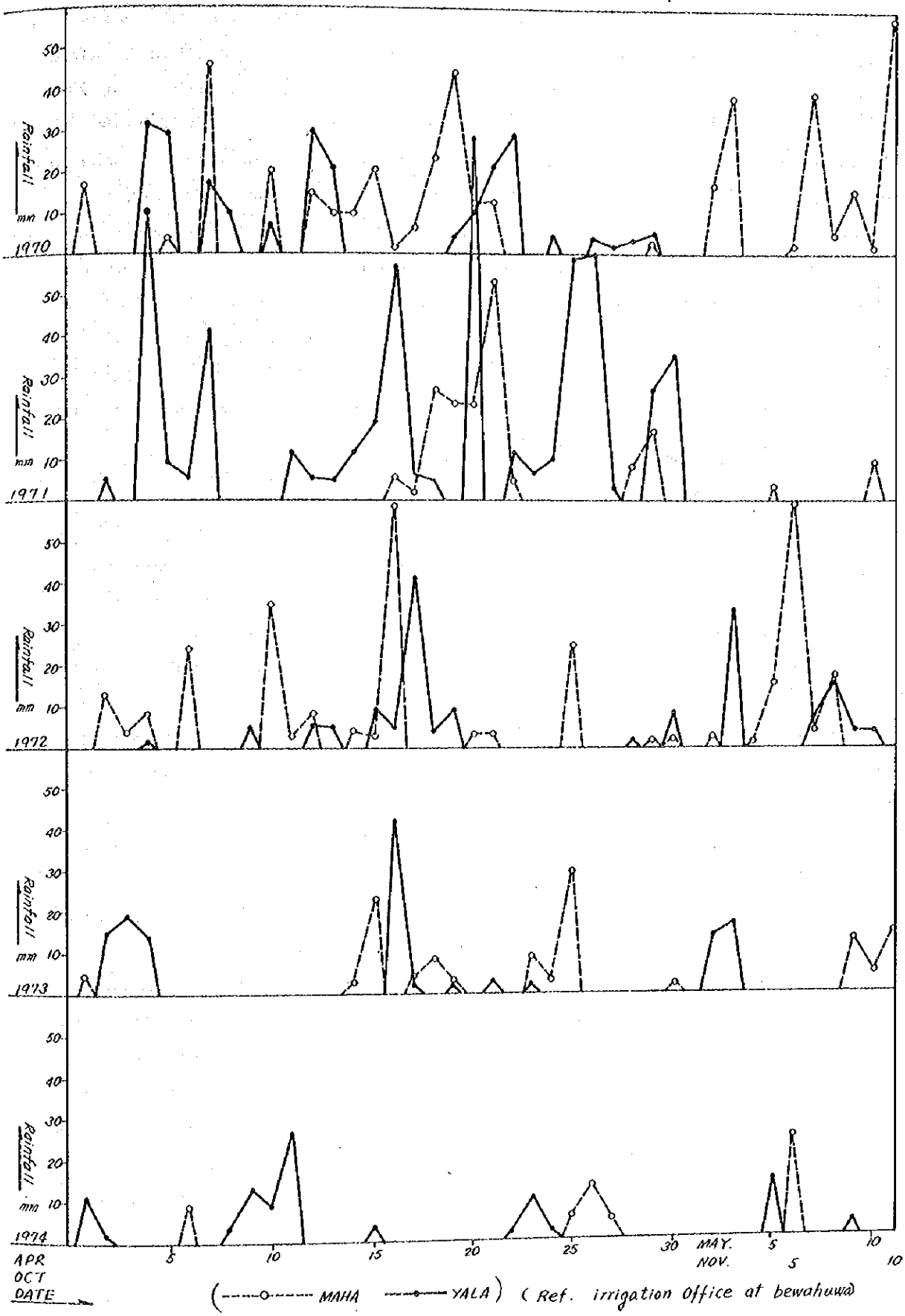
Plot A: Penitration of 2.23 cm with a load of 35.5 kg.

Plot B: Penitration of 10.00 cm with a load of 33.5 kg.

Plot C: Penitration of 10.00 cm with a loan of 29.9 kg.

All figures ara averages of 10 readings taken at difference places of each plot.

Fig. 6-C Rainfall at the begining of Maha & Yala season



Inferences were made from the co-relatinship of the tables A, B and C. It was observed that even at the beginning of the Yala season more than 10 mm. of rain has been received on three occasions. If we consider the time interval where ploughing is possible after each rain as 3 days it will be possible to plough during Yala for a total of 9 days with the rains. Therefore with 12 or 24 HP tractors will be possible to plough 30-40% of the total acroage without utilizing any water from the reservoier. Even in a drought affected Maha which usually occurs once in five or six years, it will be possible to save around 5000 ac.ft.of water by imitating the project mechanization programme in the entire scheme. The time taken for land preparation will be reduced by over a month. From the above point of view the following suggestions could be made in respect of selecting tractors and the organizations utilizing the tractors.

(1) To couple the 6 HP two sheel tractor with the 4 wheel tractor so that under a water scarce situation the 4 wheel tractor could take over the impossible tasks of the 2 wheel tractor.

(2) To couple the 6 HP two wheel tractor with the stronger 12 HP two wheeler.

The above two combinations could be recommended as efficient under the present circumstances. However in the first combination the efficiency and the quality of work of the two tractors are different and as a result it might lead to various disagreements among the users and as such it requires a very high standard of co-operation among the farmers and through guidance from the management. As such it is felt that the time is too early to introduce this combination at Dewahuwa. The second combination has no difference from the system already under operation and as such will be readily accepted by the farmers.

Suggestions on the formation of machinery utilization groups and improvements on the methods of utilization.

(1) To bring the entire area served by Dewahuwa tank under a mechanization programme as done in the project. This will enable to shorter the time taken for cultural operations such as land preparation and it will solve the power shortage experienced during these operations while preventing the prolonging various operations within the season. It enables the development of a new agriculture. It will also enable to decrease the amount of water used during this period by reducing the time taken for land preparation. (Number of days reduced from the time taken for various operations 30 days; amount of water issued per day during this period 180 ac.ft. The total water saving 5400 ac.ft.)

(2) Shifting from the use of 6 HP two wheel tractors to 12 Hp two wheel tractors. This will enable the expansion of the habit of ploughing with the rain fall and there by conserve the water. The acreage cultivated during the Yala will increase and each farmer will be able to cultivate a minium of 1.5 acres.

(3) In order to maximize the effectiveness of mechanization and to promote the habit of ploughing with the rain fall the machinery should be made to use by small groups of farmers. Our experiences during the past five years show that the farmers have developed their knowledge about agricultural machinery and mutual co-operation and as such 5 or 6 farmers for each machinery utilization group was felt as most convenient. This group should manage their machinery according to a programme and must take the maximum advantages from the wetted conditions left behind by the early rains in each season. In this manner we can except maximum utilization of rain fall for increasing agricultural production. In the present system of central management of machinery where tractors are hired out to the farmers there is always a tendency for a delay to miss the best condition for ploughing after rain. However in the "Machinery Utilization Group" system such delays are avoided and the extent could be ploughed under rain fed conditions and therefore it significantly increases the total work out put during a seanson while bringing out water conservation. Certain differences of opinions among farmers cannot be solved overnight. However it will not be a serious obstacle for an efficient extension worker in the formation of machinery utilization groups.

Transplanting

During the 1972/73 Maha season 84% of the project area came under random and row transplanting which is considered as a very satisfactory outcome. The introduction of the two wheel tractors has reduced the time and labour taken in land preparation. 16 women are required to transplant an acre. There is a supply of labour force from the nearly villages for transplanting during this season since there is a slight difference in the period of transplanting in the project and in the villages. However there is only one season cultivation and hence no crops in the following season to receive any ill effects of delayed transplanting. Therefore it is felt that the introduction of the transplanting machine at present would contribute only minutely to the progress. However with the augmentation of Dewahuwa tank from Nalanda reservoier and in the implementation of various agricultural policies of the government it may become possible to cultivate two seasons at Dewahuwa. Under such a situation the reduction

of time taken from land preparation upto the crop establishment and in the process of harvesting will become an important factor which affect management. Under such a situation a labour force of 16 women to transplant one acre may not be available during the peak period and the necessity of the transplanting machine will be clearly indicated. The transplanting machine mentioned under chapter 4 is 15 times as efficient as a group of 16 women and needs consideration here.

Disease and Pest and Control

The pest and disease incidences increased with the introduction of the new high yielding varieties combined with higher doses of fertilizer. The sprayers made available at the project were of the knap sack type, easy to operate and very efficient. Once the farmers gather more experience on pest and disease control these sprayers will have a bigger demand and they will contribute to the yield increase and management stabilization.

Harvesting and Processing

The automatic thresher tested at the project D2-LK and the semi automatic thresher DD-1 as mentioned in a preceeding paragraph were unsuitable for the local paddy. Its low in efficiency and uneconomical compared with the local threshing methods. Several threshers have been tested at the Central Agricultural Research Station and they were all found to be unsuitable. Although various improvements and adjustments are been done to these threshers designing a thresher for suitable for the local conditions still remains as a challenge to researchers.

The paddy threshed by the hoofs of buffalos contains impurities such as sand and pebbles. However they pause no problem since there is no strict quality control during purchasing. However in the future when it becomes necessary to produce better quality rice and when it becomes possible to cultivate both seasons and the necessity arrises to shorten the time taken for harvesting and processing an efficient threasher becomes indispensable. Therefore the modernization and upliftment of agriculture in Sri Lanka it is necessary for the engineers and the designers to develop an efficient thresher to suit the local conditions.

Mechanization Centre

The mechanization centre functioned as an institute providing training in know how, maintenance and repairs of machinery and in the planning of mechanized cultivations and their implementation. As such improvement and expansion of the mechanization centre will ensure efficient and economical

agricultural mechanization.

The mechanization centre was shifted from the temporary buildings to the new building which was completed in 1974 and all equipment required for training in repairs and maintenance were provided. The experience gained by the younger generation on mechanized agriculture and the techniques they learned in machinery will contribute to the expansion of mechanized agriculture with the mechanization centre as the axis of their activities.

Self operation and management of machinery by farmers is felt as ideal for the future of the mechanization centre. However until the farmers become capable of managing their own machinery a supporting role has to be played by the instructors by providing training for the farm youth.

During the five year project programme agricultural instructor on machinery in the project was changed 4 times. Three of the instructors who served in the project were learners who had just passed out from the school of agriculture. It is a regrettable fact that these officers were transfered after working for 1 or 2 seasons without giving them sufficient time to master all aspects of agricultural mechanization. It is hoped that these instructors should be provided sufficient time to master the techniques and skills thoroughly on machinery in order to manage the mechanization centre efficiently and to train others in maintenance and operation work. The instructors as well as the related departments should never expect a person to master all aspects of mechanization in a short period.

It should be noted that for the smooth progress of mechanized agriculture, it is essential that the introduced machines should be maintained at running conditions at any time. Specially in Sri Lanka where dependence on imported spares are very high the following should be noted:

(a) first hand knowledge and information on wear and tear

(b) to know in advance about breakages and repairs

(c) supply of spare parts needed in advance.

It is also required that the technicians managing machinery should be well informed and be upto date and fully experiaenced in machinery and their operation.

Servicing of motor vehicles and a black smith shop were also started at the mechanization centre to improve the income of the centre. Small farm tools, improved farm tool and certain simple spares required for machinery repairs could be turned out in the black smith shop. The income from these divisions will enable to stabilize the income of the mechanization centre and they will contribute to the modernization and development of the village.

Mechanization of agriculture cannot be achieved simply by the provision of machinery to the farmers. Mechanization will be possible by guiding the farmers in the techniques of machine utilization, improvement or change of traditional cultivation methods generating a motive for better production and by reforming the traditional and conventional ways of thinking. Presently there is a penitration of modern technology through extension work into rural communities and the government has also adopted a variety of policies to enhance agricultural development. With these developments and with the environmental and social changes and with the aspiration of technology the agricultural mechanization will also stabilize on its own.

It is heard that there is a plan for the domestic production of agricultural machinery. Agricultural mechanization with the policies and improvements of other factors for increased production will lay a path for the modernization of the farming villages of Sri Lanka.

5-3 Water management

5-3-1 Preface

In the 13th century King Parakrama Bahu made the famous saying "Let not a drop of water falling on this land flow into the ocean without being used to men."

In the severe arid zone of the Near East where ground water is carried for miles by underground canals called canoto, or where irrigation is practised with collected dew fallen in nights, very strict (way of using) control of irrigation water has been established both by personal and social custom.

In the paddy cultivating area the Asian monsoon zone, a rule of cooperative use of irrigation water has been established spontaneously among farmers as a wise way of life through long history of quarrel and bloodshed to "draw water to one's own field."

In this island too, under severe natural conditions, as for example in Jaffna peninsula, a method of thoroughly effective use of water has been established. But usually many years of trial and error are spent to establish this custom of effective water use in a new colonisation scheme when new facilities are provided.

In the Aichiyosui project that is the first modern major irrigation scheme in Japan in which some thousand million Rs. was invested, 30 - 40% of precious water which was carried a distance of 130 miles from the reservoir through a river and the main channel, and flowed away to the sea at the end of the main channel for the first few years although managed with a high leveled quantitative water control system with specialists for water management.

Now they have made a regulating pond at the end of the channel using the remainder for upland irrigation economically. In this country, from a broad point of view, water is used several times from the uppermost area to the lowest area in the same basin by very skilful method of combining many dams which as Dr. Fakuda admired. But in one scheme water is not always used most effectively.

In Dewahuwa, for example in 72/73 Maha, although farmers suffered from water shortage in the latter half stage, about 3,600 Ac.Ft. which was 40% of tank capacity flowed away waste-fully to the drainage.

Judging from these matters, water management is a very important theme and it is quite natural that this item was adopted as one big fcter.

The investigation team judged that this area had adequate water resources and the main irrigation facilities so that only small renovations were enough to support the practice of good water management. And that by rationalizing of the method of water use, paddy in 1/3 of the area, and subsidiary crops in 1/3 of the area could be possibly cultivated in the Yala Season besides paddy cultivation in the whole area in the Maha Season in S.D.Y. (Standard dry year).

However, after the project started we have come to the conclusion that even in a S.D.Y. water resources are absolutoly insufficient to expect any acreage of Yala cultivation.

And we cannot deny that this fact has become a big obstacle to the progress of the project purpose.

However, the ultimate purpose of the project is not mere production increase of paddy but rather to establish a social foundation on which the above increase can be made possible. But unfortunately, being spurred by the nation wide "food drive policy", people's concern has been concentrated merely to the momentary increase itself, so that many people now consider this project a failure, to our great regret.

In this chapter, our activity and its results will be reported, and a tentative plan of water requirement in future will be given through examination of the actual situation of water use in Dewahuwa.

ii. Meaning of water management.

Generally speaking, construction of a facility and its way of use is to achieve a target dependent on each other. It is no use planning a facility disregarding the convenience and the ability of the user. And we can not expect a proper way of use disregarding capacity of the facility. The work of water management includes operation of intake-gate way of controlling main channel discharge, control of distribution, and irrigation and drainage methods suitable for the soil and each crop in the field.

Naturally, in the upper stream and the nearer you go to the tank, the more it comes into the field of civil engineering. But it comes to each field, it falls under the category of agronomy. In the plan of this project, two ways have been proposed for water management; to improve the facilitites, and to aim at the nationalization of water use through the strengthening of the farmers organization.

Here we would like to distinguish between the utilization of channel facilities and the use of water in the field. The former will be mainly dealt with.

5-3-2 Annual work

Annual work and results are shown in table 5-3-1. Some comments were given here:

70/71 and 71/72.

Due to the delay of the arrival of construction materials and machinery, which was to be supplied from Japan, the project laid emphasis on domonstration of production increase.

However, performed in 71 yale, brought about a big profit in cultivation in 71/72 Maha. Both 70/71 and 71/72 we were blessed with ample rainfall that we had no trouble with distribution of water.

Table 1

Water Management Programme

	70, Oct. 1	Apr. 1	71, Oct. 1	Apr. 1	72, Oct. 1	Apr. 1	73, Oct. 1	Apr. 1	74, Oct. 1	Apr. 1	75, Oct. 1
Water issue	10th 178 days 15th		24th 188 days 30th		1 st 140 days 17th net 111 days		6th 158days 12th net 96 days		18th 20th net 15 days		
acreageirrigated	2,340 Ac		2,340 Ac		2,340 Ac		2,205 Ac		309 Ac		
quantity issued					14,500 Ac Ft		11,400 Ac Ft		1,250 Ac Ft		
Works											
	Water measurement of main channel, outlets		investigation of outlets, flow condition, and loss.		Water measurement by Parshall flume No.1.		Water measurement by P.f. No.1 No.2				
	investigation of the field		in addition to works done in the previous year.		Study on water requirement (1)		Study on water requirement (2)		Preparation for subsidiary crops irrigation		
							Preperation of operation manual (1)		Preparation of operation manual (2)		
Control of the flow in main & branch channels	by current metering		- do -		- do -		Patro l by operation of gates with notch		by operation of gates with notch		
Farmers' Organization	re-organization of C.C. study meeting				discussion on Nalanda dam		meeting on water saving using rain fall	meeting on billson water issue	meeting on group forming, Bethoma,		
Facilities	roads		roads				outlets (main chanel)	outlets (branch)			
	desilting		desilting P.F.1				check gates (2) P.F.2	check gates (2)			

Current metering, Reconnaissance and Observations were done to grasp a concept of general condition of water flow in the main channel and branch channels.

Actual conditions of present facilities such as main and branch channels and outlets to each allotment. From the investigatioss, we found the following matters, quantitatively or qualitatively.

1. Conveyance less in the main channel is very high, approximately 0.025 cusec/cusec/mile.
2. Capacity of the outlets to allotments ranges from less than 1 to 5 times of the designed quantity.
3. Ineffective flow to the drainage from each allotment is very much as expected.
4. Almost nothing of rainfall was stored in the field. And we found it practically impossible to do so.
5. There was not a good combination of schedule of planting, ploughing and water issue, during the ploughing period. Therefore, very often water entered the unnecessary fields and did not arrive at the necessary field. Consequently ploughing work did not progress as scheduled and the amount of water wasted became large.
6. Ploughing work of each allotment was spread over two months. And it seemed difficult to shorten it.

As for the activity on guiding farmers, cultivation committees were re-organised to meet practical situation of water distribution and guidance was done through several meetings.

o 72/73

Actual condition of water use was confirmed quantitatively by record of parshall flume which was newly constructed, and current metering at the main channel, branch channels and Havanella Oya, together with the knowledge we get from former years experience as shown above.

We showed a doubt that a big amendment would be necessary on original irrigation planning in ("R. R.") and ("D. P."). As for the farmer's guidance, we mentioned the importance of rationalization of water use through farmers" meeting and C.C. and in fact we practised very severely restricted water distribution. But the activity of building up "c.c." into a strong body to deal with water management independently was poor, because there was not an expert in this field.

In the later stages, under the drought condition, farmers requested strongly the diversion of water from Welamitiya Oya and we were requested to study the technical feasibility.

o 73/74.

Main improvement works were done during the last Yala season and the channel facilities became much better. So we prepared for the practice

of a better water management. But unfortunately the true Maha rain started in late December and total availability of water was by far insufficient to get a dood yield of paddy.

We were forced to do rotation issue because of the severe drought, to distribute evenly to all the fields. However in the field of water management, we can say that we got certain good results because, the issue day was made known fully by posters and other means, so that farmers went out to their fields automatically, though it lead to some troubles regarding "drawing water to one's own fields".

As for observation, we had some trouble. Only a little water arrived downstream, and we found that some points did not have a sufficient water cross section. In addition there was a thick growth of weeds in the channel caused by very late start of issue.

Investigation of water requirement was carried out in the pilot farm and the irrigation plan of the project was reexamined.

As for the guidance of water management, of the organized farmer's unit, we had discussed and examined a method of strengthening "c.c" through organization of competitions and imposing penalties in group bases, regard to weeding and cleaning of the channels, study meetings, group ploughing and cultivation and water patrol.

But the project has no executive ability because of absence of an expert on farmer's organization. Instead, the cases in which individual farmers addressed their complaints directly to T. A. S and Project staff increased.

ρ 74/75.

It was the last Maha of the project.

We got again an expert on farmers' organization and prepared to realize the group activity on all cultivation works. But we were teased by extraordinary weather conditions and were forced to prepare always to make new plans suitable to new situations regarding rainfall.

The final result was that only a miserable 309 acres of subsidiary crops were cultivated. This is only 13% of the total area.

We decided to do sorghum cultivation which was new to us, so that we studied about it, visiting Peradeniya, Maha-Illuppallama, and some fields before making a cultivation and irrigation schedule.

In the field of water management, we experienced many troubles which were caused because of partial water issue. Nothing was done in the field of farmers' water management because farmers from three different Tracts were allotted to one allotment and we could not expect co-operation among them.

o Yala cultivation

The first two seasons, we gave up the idea of Yala cultivation giving priority to progressing infrastructural renovation works. The later three seasons, we gave it up to keep scarce water for the Maha cultivation.

Table 5-3-2

Annual water use, rainfall, yield

Year	Total Issue	No. of Actual Issue days	Start of Issue	Storage at the beginning	Irrigated Acreage	No.of Rainy days	Rain fall in feet	Gross duty of water	Total usable water	Unit yield	Water efficiency (1)	" (2)	Remarks
Year	A Ac.Ft	B	C	D Ac.Ft	E Ac	F	G ft	H=A/E ft	I=G+H ft	J bus/Ac	K=J/I	K'=Jxcost/I	
51/52-67/68 Ave *1	10230		Nov.	1730	(2006) *2 2340	*3 51	*3 3.89	(5.10) *2 4.37	(8.99) *2 8.26		(5.01) 5.45		14 years excluding 56/57, 57/58, 60/61 (no data) Spill over 9 times
" *1	12660		"	1970	2340		(") *4	5.41	(9.30)	45 *6	(4.84)		11 years excluding 52/53,58/59, 64/65 (cultivated years only)
66/67 *1	21980		Oct.	2000	2340		(") *5	9.39	(13.28)		(3.39)		issued quantity was largest in this year
70/71			Oct.20		2340					53			first year spill over in December
71/72			Sep.24		2340					74			"
72/73	14520	111	Oct.1	6500	2340	53	2.90	6.20	9.10	72	7.9		
73/74	11460	96	Jan.6	8000	(2205)* 2340	33	0.85	(6.20) 4.90	(6.05) 5.76	32	(5.29) 5.67		
74/75	1250	15	Feb.18	1900	(309)* 720	24	1.52	(4.06) 1.74	(5.58)	Sub-sidiary crops			
64/65	5640		Oct.	405	2340		2.98	2.41	5.39	90	16.7		

* ; Actually cultivated acreage

* 1 from "F.R."

* 2 {(12 x 2340) + (2 x 0)} ÷ 2

* 3 Sum of each month's average from Oct. to Feb.

* 4 Supposed same to above

* 5 Supposed same to above, because total rainfall in the year is only a little more than the average

* 6 Common idea at investigation period

* 7 1 bushel Rs. 33, subsidiary crops; from Sato's report

It was practiced only in a small scale by the young farmers club, using water pumped up from Havanella Oya.

5-3-3. Actual Circumstances of Water Use.

On the next page, annual results of water use are shown with hydrological data and yield. According to the table 5-3-2.average issued quantity in 14 years before the project started is rather less than of 72/73 Maha when we suffered from water shortage, though we cannot say this sweepingly because the data are from different sources.

But the highest quantity was issued in 66/67 when annual rainfall was higher than average. And this shows that issued quantity is not equql to necessary and sufficient quantity.

There are two cases when a certain small quantity is issued. One is that we need only that amount owing to ample rainfall. The other is that we can issue only that amount, though we need more, because of water shortage.

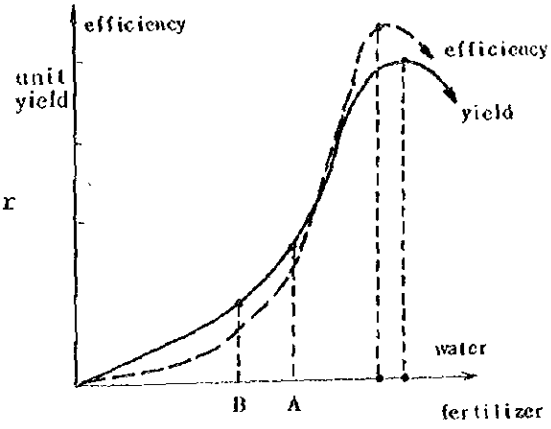
.Since 72/73 Maha, we experienced only the latter case. Then, we gave a figure, which is here tentatively called "total usable water", by adding rainfall during the period to the issued quantity as in the table in the next page. And the circumstnces became a little clearer. We can see clearly that after project started, the condition has been becoming worse yearly.

Next, we named tentatively "water efficiency" the figure made from unit yield divided by total usable water.

Judging from this figure we can say that 'water efficiency'was good in 72/73, and bad in 66/67 when the biggest quantity was issued, and in 73/74, it was nearly the same as the average of 14 years before the project started.

According to Dr. Murakami, who was in Maha-Illuppallama, the present situation of paddy cultivation in Sri Lanka is, speaking as a concept, at point "A" in the figure below, where it is still in a very effective position for water and fertilizer to be used.

The meaning that the "water efficiency" in 73/74 was bad is not that water management was poor, but that inspite of concentrated and energetic activity of management, we were not rewarded with good result, and that the position of 6.05 ft. of total usable water is point "B" in the figure on the right. Next, some comments will be given about annual data.



In 70/71 and 71/72, we were blessed with plenty of water. We could see water flow over several times from the spill crest. And unit yield increased favourable.

But the issued quantity seemed to be far bigger than 7400 - 5600 Ac.Ft., or 3.16 - 2.39 Ac.Ft/Ac. which is shown in "F.R" as estimation of quantity to be issued in a S.D.Y, though unfortunately we don't have accurate data for these two years. And the spilling of water that occurred in these two years. And the spilling of water that occurred in these two years seemed to be because much water had been stored before the start of water issue.

If Yala cultivation had been practised, even a water shortage might have occurred in the late stage of Maha in both years.

o 72/73 Maha.

Judging from hydrological data, mainly rainfall in the Maha season, this year is said to be a S.D.Y.

But, we suffered from severe water shortage in the later stage of the season and the unit was lower than in the previous year; though we issued 6.2 Ac.Ft./Ac. of water which is far bigger than the expected quantity in the plan of a S.D.Y. given in "F.R". One reason for this may be that we issued even in some rainy days in the early stage, being optimistic due to the last two years' lucky experience, but the following three points are the main reasons.

1). Water requirement is much bigger than expected.

2). Effective use of rainfall cannot be expected so much.

3). A great portion of the quantity which is usually regarded as farmers' wastage is unavoidable due to social conditions such as "C.C." and physical conditions such as unequality of conditions of water utilization and hydraulics.

Among these items, water requirement is shown in detail in the attached report. "Re-examination of water requirement in Dewahuwa", which say a that percolation is far bigger than expected in "F.R".

Average daily water requirement in depth is only 8.5 m.m/day during 100 days from sowing till harvesting, in the "F.R". This seems too little.

As for utilization of rainfall, we can expect very little due to the feature of rainfall pattern in this district - short duration and over small areas - and due to the irrigation method of continuous plot to plot irrigation among many small liyadas (land re-arrangement is done only in the upstream project area).

In "F. R" 60% of total rainfall is expected to be used in a S.D.Y. of 64/65.

While in our tentative plan of water use, 25% of rainfall is to be be saved by stopping issue.

The fluctuation of water requirement of each field is very big, and capacity of the outlet to each field is also fluctuates very widely; the biggest one is 5 times as big as the planned capacity.

The water which enters the advantageous field spills away merely to the drainage and this water cannot be expected to be used in other fields.

Unless we can control strongly the schedule of ploughing and other cultivation works, we cannot reduce to a minimum ineffective water issue caused by time lag of working days. By the present facilities, control of the discharge entering into each allotment cannot be done, so ineffective water issue cannot be avoided unless we can control the quantity to be supplied to each allotment strongly by shortening the hours of issue by some other means, according to the change of water requirement in various stages. Therefore we must estimate a certain amount of loss unavoidable loss for those.

("Water use in 72/73 Maha in Dewahuwa".

"Re-examination of water requirement in Dewahuwa.")

Water management on farmers level means, in one way, to take away the "advantage" from farmers who have been thinking it as "vested rights" and give it to "disadvantageous farmers". Therefore it cannot be solved without strong administrative power or pressure from these farmers who recognized their "disadvantageous" position.

Taking these points into consideration, the actual situation of water use in 72/73 Maha is illustrated in Fig. 5-3-2.

There are many assumptions in calculation, using loss rate and percoration in "F. R".

In the "F. R" the present discharge of Havanella Oya is said to be 70 - 80% of issued quantity at the main sluice (at that time).

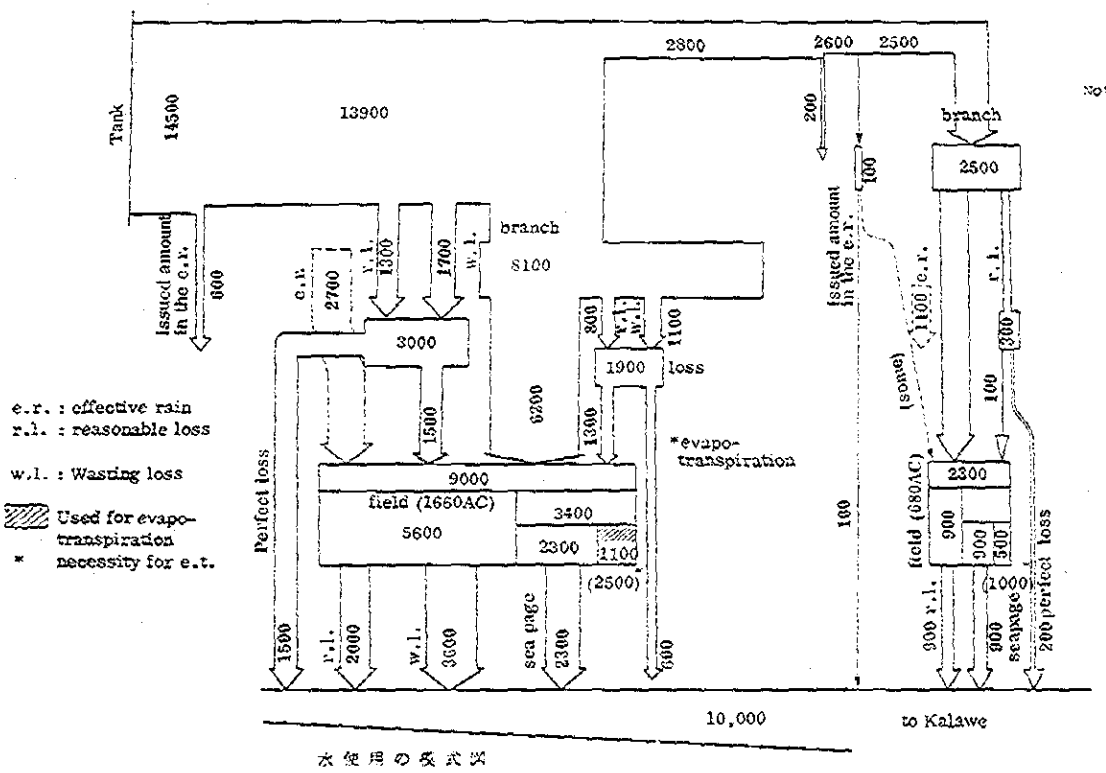
In this illustration, it is fairly big, too. But a major part of this consists of "reasonable loss" such as expected conveyance loss and percolation or seepage loss.

"Wasting loss" is calculated at 3600 Ac.Ft.

Net water consumption, that is evap-transpiration, is 3500 Ac.Ft. in the whole area.

And we could supply only half of it even though we issued 14,500 Ac.Ft. from the Tank. Or, only 11% of issued water entered into the paddy plant.

Fig. 2 In the main channel (unit Ac.Ft) T-7 - 8



水使用の模式図

Note in Fig. 5-3-2

Note 1:

Reasonable loss of the main channel is,

$14500 \times 0.1 = 1450$ Ac.Ft.

This is separated to each section by discharge rate x length rate,

So, after T-8 (T-8 and after) $1450 \times \dfrac{1}{1 + \dfrac{1660}{650} \times \dfrac{7.8}{1.7}} = 120$

down to T-7: 1450-120 = 1330

Note 2:

Reasonable loss from branch channel: 10%

total $14500 \times 0.1 = 1450$ — 1100

down to T-7 800, T-8 & after — 300

3: Reasonable loss from fields: 20%

total $14500 \times 0.2 = 2900$

down to T-7 2000 after T-8 900

4: Sum of reasonable loss down to T-7

$1300 + 2000 + 800 = 4130$ — 4100

5: Wasting loss from the main channel; observed loss − reasonable loss;

down to T-7 3120-1450 = 1680

after T-8 negligible

6: Wasting loss from the branch channel;

Rate of wasting loss to reasonable loss is same supposed to be same as that of the main channel;

total: $\dfrac{1700}{1300} \times 800$ 1100

down to T-7: 800, T-8 and after: 300,

7: total seepage:

down to T-7: 0.29m^3/s x 35.316 cusec/ m^3/s x 2 x 111 days = 2300

T-8 and after: 940

8: final loss from the main and branch channels;

(10,000 − (2000 + 3600 + 2300) = 2100 (down to T-7)

9: Required E. T.

down to T-7 : 0.454 m x 3289 Ft/m x 1660 Ac. = 2480 Ac.Ft.

after T-8 : 1020 "

total : 3500 "

o 73/74.

The tank was almost filled up by heavy rain in the end of December. After this, there was only a little rainfall and run off from the catchment was also little.

"Total usable water" was so little as 6.05 ft. but, issued quantity if a little more than the average in the past.

And the result was a tragedy as already shown by "water efficiency" in the table 5-3-2.

But water management itself was much rationalized. Due to infrastructural renovation, effort of T.A's and all other project staff and farmers effort in the field, distributed water to each branch channel and conveyed water to the downstream was controlled to show fairly proper quantity. Besides we found that the water conditions of Dewahuwa tank is one of the worst among tanks in North Central Province, as shown in Fig. 5-3-3.

From these facts, we were convinced that 4 - 5 Ac.Ft./Ac.of water issue which is often thought to be adequate for paddy cultivation in Maha is far insufficient in a S.D.Y. apart from average year or more favoured year of rainfall. And we arrived at a conclusion that the necessary quantity of water to be issued from the tank is about 6.5 Ac.Ft/Ac. for Maha, from observation done at the pilot farm.

(See Re-examination of water requirement)

As for the results, of improvement of irrigation facilities, we got a profit of reducing conveyance loss in the main channel by 6.6 cusec or 7% of the designed discharge mainly owing to improvement of outlets.

o 74/75.

Maha was a still more severe drought year. We decided to carry out sorghum cultivation in 720 Ac. after a long hesitation and it ended in 309 Ac. of poor cultivation including many other crops.

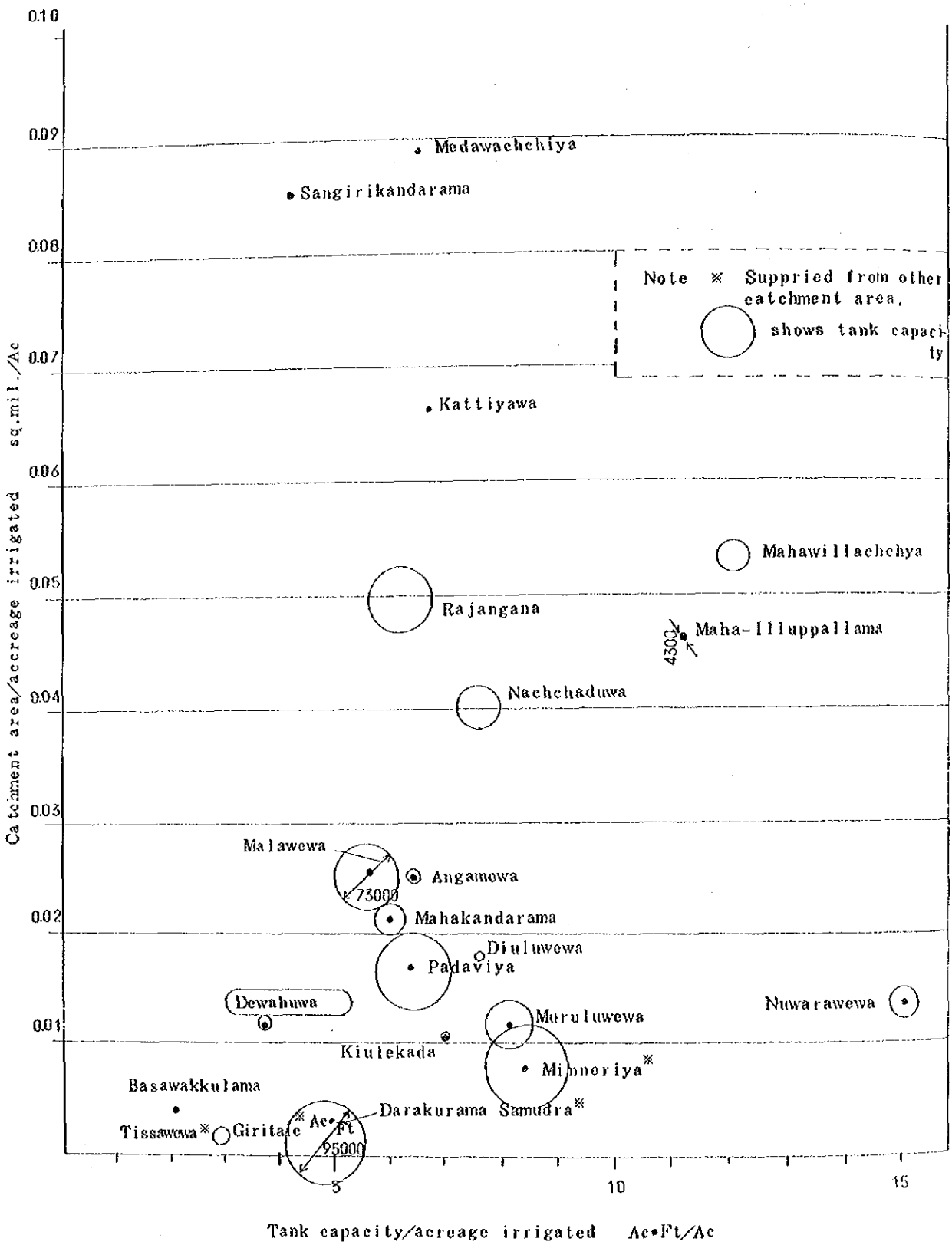
The total issued quantity was only 1250 Ac.Ft.(14% of the tank capacity)

The largest storage shown since the end of 73/74 Maha was 2420 A.Ft.(27.5% of the tank capacity).

The total run off from the catchment area during the term was only 1760 Ac.Ft. or 0.75 Ac.Ft/Ac. neglecting evapo-seepage loss from the tank.

The irrigation loss was very high because the field are small and scattered. In fact, we issued 406 Ac/Ft./Ac. of water in only 15 of actual issue days. This becomes 0.27 Ac.Ft/Ac. per day.

Fig 5-3-3 Characteristics of Tanks
in North Central Province



During the interval of issue due to the rotation, channels were dried up, initial conveyance loss became very big, and approaching speed fell down to 16 cm/sec, so that it took more than 20 hours for water to arrive at the terminal part of the area. Some outlets suffered from difficulty of getting water due to low water in the main channel.

Paddy cultivation has been the unalternable proposition since the start of the project, but this year unexpectedly we were forced to practice cultivation of upland crops. If we indicate "water efficiency" by an amount of money gained, upland crops may give us better figures than paddy, and the total quantity of water to be issued is less.

Therefore it might be better to recommend upland crops, at least from the view point of water use.

5-3-4 Conclusion

(1) Water requirement.

The necessary amount of water to be issued from the tank (gross duty of water) in a S.D.Y. Maha season is not (7400-5600 Ac.Ft.) or (3.16 - 2.39 Ac.Ft/Ac.) as shown in the "F. R.", but approximately 15.000 Ac.Ft. or 6.41 Ac.Ft/Ac.

The reasons for this,

(i) Water consumption in the field during the paddy growing period mainly due to greater percolation.

(ii) Water requirement in the ploughing period in the whole scheme differs depending on the method of ploughing. In this scheme, a 5-10 day allowance should be estimated considering the general ability of the work - capacity of ploughing means and actual effective capacity of operation under combination of achedule of planting, ploughing and water issue.

(iii) Ploughing period spread over nearly 2 months in the whole area. Net required amount of water increases daily, theoretically speaking. And during the paddy growing period the actual required amount of water changes. But practically we cannot expect a severd operation according to the change of water requirement.
Therefore we should include a certain quantity for this allowance as "operation water".

(iv) We should estimate a certain quantity as "operation water" for the unevenness in the capacity of facilities, too.

(v) Rainfall of short duration in a small area is common here and difficult

to be anticipated. And there is no space to store rain water in liyadas, usually, due to plot continuous irrigation. Therefore, we cannot expect much on effective use of rain.

(2) Water availability.

Run off from the catchment area to the tank is just enough for the Maha cultivation of paddy in a S.S.F (see the chapter on hydrology).

And that the seasonal distribution of rainfall is not definite.

Therefore we cannot start the cultivation till a considerable quantity of water is stored in the Tank. And a fair amount of rainfall which the fields receive in the early Maha season cannot usable.

(3) Inigation Method.

(i) From the view point of paddy growth, shallow and continuous plot to plot irrigation is rather advisable. And the facility is also designed principally on this idea.

Rotation issue which we have been forced to practice for these several years is, therefore, not good for the paddy plant (nor for the exsting channel facility itself).

We cannot always get good irrigation efficiency because -

1) initial conveyance loss becomes high at every starting time of issue, and
2) farmers have interest only in gaining more water during the issue time and pay little attention to keep water in the allotment in good condition. We cannot show this phenomena quantitatively yet.

(ii) There is strong opinion that we have to carry on ploughing mainly with rainwater and issue should be done only supplementarily.

But this is very unpracticable because of the soil texture in Dewahuwa, as proved by the five years' experiment, since we use 2-wheeled tractor of 5 - 7 HP. (see the chapter on agro-machinery).

Therefore on irrigation planning, we should adopt the idea of issuing every day principally except when there is adequate rainfall.

On the other hand,the quantity of ineffective issue caused by disharmony of schedules of planting, ploughing and water issue because of powerless C.C. and poor administration is very great and significant.

(4) Inequality of hydraulic conditions.

Hydraulic conditions in the scheme differ from place to place according to topography, soil and ground water conditions. But plan and design are made based on the supposition that these conditions are the same in allotments,

without corresponding to the actual conditions.

(5) Present condition of facilities.

All facilities at the end of the project term are shown in table 5-3-3 and table 5-3-4.

Problems we felt about the facilities through our five years experience are shown here.

(i) The scale of the Tank

Total yield from the catchment and total amount of water to be issued from the tank are both approximately 15,000 Ac.Ft. which is 1.7 times as large as the tank capacity, 8,800 Ac.Ft.

This capacity is more than enough in a year with an average rainfall of normal seasonal distribution.

But fluctuation of not only quantity but also seasonal distribution of rainfall is very big.

If there is a rainfall of the same quantity that we had in late December of '73 after a normal S.D.Y. Yala Season, tank water will spill over in the early stage of Maha even though total Maha rain is less than of S.D.Y. And in the later stage, we will suffer from water shortage.

Because in the latter half of a Maha season, we can expect almost nothing of run off at all, and tank capacity of 8800 Ac.Ft. is conusmed in 50 days of maximum discharge, and such a case is very likely.

The fact that water spilled from the tank many times as shown in table 2-25 in F.R. does not always mean there were plenty of inflow in those years. The tank capacity is not sufficient to assure the good cultivation in any S.D.Y.

(see Fig. 5-3-3, Characteristics of Tanks in N.C.P.)

(ii) Layout arrangement of branch channels

There are many small outlets from the main channel in the upstream parts of big branch channels, partially due to topographic conditions. This causes trouble and difficulty in practising proper distribution.

(iii) outlets

Some outlets have a difficulty of getting water while some are enjoying ample distribution in the main channel.

This inequality is very big among outlets to each allotment. And mostly the capacity is bigger than designed, so that a big amount of water is taken to allotments in the upstream parts of big branch channels.

Facilities at the end of project term Table 3

Item	Contents	Remarks
Tank	Effective storage; 8,800 Ac Ft, effective head; 27.5 feet	
Outlet	Type; 36" dia. -hume pipe & tower sluice	
Main channel	Total length; 9.5 mile (50,160 ft), slope protection 7,300 ft (total of both sides) Capacity; 95 cusec ——— 1 cusec, natural spill; places, in total feet Acquiduct; places, under crossing drain; places, drain inlet; places, bridge; nos	

Outlets

Size	Nos	Acreage	Planned max. discharge	Size	Nos	Acreage	Planned max. discharge
1.5' x 1.5' x 2	2	447, 421	18.5, 17.5	ϕ 9	12	54 - 21	1.91 - 0.76
ϕ18 + ϕ 12	1	248	10.3	ϕ 6	16	20.2 - 9.7	0.72 - 0.34
ϕ 18 + ϕ 6	1	216	8.9	ϕ 4	12	7.6 - 2.5	0.22 - 0.08
ϕ 18	1	119	4.2				
ϕ 12	2	91, 75	3.2, 2.7	Total	47	447 - 2.5	18.5 - 0.08

With lectangular notch, except 6 sets in Tract 9.

Parshall Flume

No. 1 at the beginning of Main channel qmax. ; 95 cusec With automatic level recorder

No. 2 at tract 3 4.5 mile point qmax. ; 54.5 cusec "

Both are submerged at a high water level.

Check Structure

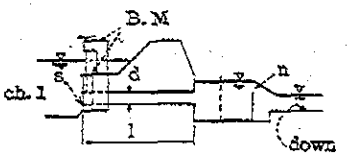
Site	Tract 3	Tract 5	Tract 6	Tract 7	Tract 8	Others
Max. discharge						
Gate						Wood block
Type of spile	2 sides spill	Cross spill	"	Diagonal	Cross	

Guage stuff T-3, T-6, T-7, T-8 of main channel and T-3, T-5, T-6, T-7, T-8 of branch.

List of Outlets

Project

	Gate No.	Location ft.	Acreage	Discharge cusec	Discharge m^3/s	Diameter d. inch	Length l ft.	El. of sill s	El. of down side	El. of notch n	B.M. el.	El. of c.h.	Remarks
T-1	1	600	12.0	0.425	0.012	6	24	570.10	569.21	569.74	572.67	(569.65)	
	2	1,100	15.0	0.532	0.015	6	24	569.86	570.25	570.41	.51	"	
	3	2,700	30.0	1.064	0.030	9	24	569.41	568.66	569.47	.92	"	
	4	5,580	12.9	0.457	0.013	6	24	568.80	567.46	569.06	1.78	"	
T-2	5	8,580	45.6	1.617	0.046	9	24	567.79	565.65	568.02	0.93	"	
	6	9,780	5.5	0.171	0.005	4	24	567.83	566.96	567.92	0.97	"	
T-3	7	11,760	447.0	18.488	0.524	1.5x1.5x2	18	566.86	567.74	-	3.28	"	
	8	12,160	90.9	3.222	0.091	12	24	567.41	566.95	566.95	0.56	"	
T-4	9	16,040	15.3	0.542	0.015	6	24	565.34	566.41	566.80	568.38	562.05	
	10	17,140	2.5	0.078	0.002	4	15	566.30	566.10	566.54	9.58	"	
	11	18.240	35.0	1.241	0.035	9	24	564.10	563.94	564.56	6.65	"	
	12	19,240	41.0	1.453	0.041	6	24	564.45	564.88	565.13	8.66	"	
	13	21,620	20.0	0.709	0.020	6	24	564.07	564.67	564.90	8.44	"	
T-5	14	22,320	247.8	10.249	0.290	18+12	24	563.28		-	9.39	"	
	15	23,220	5.0	0.155	0.004	4	24	563.54	564.22	564.41	6.45	562.05	
	16	23,820	16.8	0.596	0.017	6	24	563.42	563.41	563.54	6.08	"	
	17	25,620	35.1	1.244	0.035	9	24	562.38	562.57	563.31	4.85	"	
	18	27,200	15.5	0.549	0.016	6	24	562.37	562.36	562.49	5.15	"	
	19	27,900	11.1	0.393	0.011	6	24	561.76	562.18	562.11	4.63	"	
T-6	20	29,300	4.2	0.130	0.004	4	24	561.24	562.14	562.22	4.09	"	
	21	30,200	7.6	0.236	0.007	4	24	561.07	561.15	560.99	3.81	"	
	22	31,400	10.0	0.355	0.010	6	24	560.51	557.74	559.81	2.85	"	
	23	32,180	46.0	1.631	0.046	9	24	560.27	560.30	560.36	3.32	"	
	24	33,580	119.1	4.222	0.120	18	24	559.87	559.08	-	4.44	"	
	25	33,680	5.1	0.158	0.004	4	24	560.18	560.38	561.14	2.99	"	
	26	33,980	4.9	0.152	0.004	4	24	559.90	559.24	560.96	2.64	"	
	27	34,180	4.5	0.140	0.004	4	24	560.01	560.00	560.70	3.92	"	
	28		5.0	0.155	0.004	4	24	559.44	559.62	559.89	3.55	560.10	ch.3
	29	35,480	5.0	0.155	0.004	4	24	559.28	559.35	559.49	2.19	"	
	30	36,880	47.4	1.680	0.048	9	24	558.91	558.59	558.80	1.04	"	
T-7	31	37,760	54.0	1.914	0.054	9	24	558.26	558.27	558.25	1.25	"	
	32	38,060	216.2	8.942	0.253	18+6	24	558.41	558.35	-	2.79	"	
	33	39,060	13.4	0.475	0.013	6	24	559.93	558.34	557.96	1.29	558.65	ch.4
	34	39,960	10.8	0.383	0.011	6	24	557.88	557.59	557.92	560.72	"	
	35	40,060	20.6	0.730	0.021	6	24	557.86	557.93	557.93	.67	"	
T-8	36	41.560	14.9	0.528	0.015	6	24	557.36	556.08		.30	"	
	37	42,160	421.1	17.417	0.493	15x15x2		556.60	556.80		1.35	"	
	38	42,340	25.4	0.865	0.024	9		556.68	556.71		559.70	"	ch.5
	39	43,440	10.5	0.372	0.011	6		556.82	557.23		61.45		
	40	44,600	9.7	0.344	0.010	6		555.62	555.76		58.80		
T-9	41	45,940	5.1	0.158	0.004	4		555.31	555.73		.46		
	42	46,740	21.3	0.755	0.021	9		555.03	555.49		.17		
	43	47,920	21.6	0.766	0.022	9		554.55	554.96		557.63		
	44	49,020	75.4	2.673	0.076	12		553.98	554.01		.02		
	45	49,420	5.1	0.158	0.004	4		554.43	554.30		8.36*		------metal top
	46	50,520	20.2	0.716	0.020	6		553.49	553.82		556.47		
	47	51,420	30.0	1.064	0.030	9		553.15	553.15		7.38		



ch.2 Main channel & T-3.5.7.8 big branch --- Q=0.004136 $^{*}A$ cusec

Branch ----- Q=0.03545 $^{*}A$

Direct outlet ----- Q=0.03102 $^{*}A$

-------- covered with stones

(iv) Land consolidation is very desirable, for water management, but there is no plan for the middle and downstream areas of the scheme which covers 2/3 of the whole area.

(v) Drainage

It was a big theme to stop water flowing away from fields to drainage. But roads are located only along the irrigation channels, and normally it is difficult to approach drainages.

In this context, it is regrettable that the construction plan of a maintenance road along Havanella oya was rejected by the sub-committee at the early stage.

(vi) Channel structure

Co-efficiency of roughness seems to be for bigger than that expected, 0.025 - 0.020.

Therefore actual channel capacity is generally smaller than designed, and some sections have only half of the designed capacity especially in the middle and downstream areas. Partially, enlargement work is undergoing in 75 Yala construction work.

But, there will definitely be collapse, silting, and weed growth in some sections from now on, too. So, average velocity will be also much lower than expected and a change of discharge in the upstream will have an effect for a long time in the downstream, in future, too.

5-3-5 Recommendations and proposals

Here (i) a way of thinking at making a plan, in general, (ii) radical renovation plan of Dewahuwa scheme, (iii) method of effective water use under present conditions are studied based on above findings.

(1) A thought on planning.

(a) planning based on an actual investigation of present conditions.

It seems that now an irrigation plan is made often adopting the same figures to the whole area, based on planners experience or accepted ideas.

But it is advisable to make a rule of separating the area into several blocks of the same natural conditions based on actual present-state survey.

(b) reasonable supposition of irrigation and managing method:

It is also advisable to make a rule of planning keeping close contact with agronomical and administrative fields about operator, cultivation method (ploughing, sowing, trans-planting, period etc.) and irrigation method.

(c) Standard dry year for planning.

Apart from national policy, the rule of adopting average year, or S.D.Y. as a standard year for planning, or the idea of covering 7 to 8 years in 10 years gives users (farmers and field officers) big trouble.

If we expect stable farm managment, we must take a more severe year as the standard year for planning for the sake of safety.

(On these matters, radical examination is necessary on a nation-wide scale).

(d) Necessity for the observation on water balance in a wide area or in a basin.

The necessity of stopping wastage or re-use of water in a scheme is discussed now as one step of effective water utilization or water management.

But in the dry zone where there are many tanks in the same basin, the change of the water use in the upstream will break the balance in the downstream area.

On the other hand, basic investigation on water balance etc., covering a wide area is very important, because we will be able to find out existence of big idling water resources and also ineffective use of water.

(e) To take over the fundamental thought in planning to constructors and maintainers of the scheme;

It is also recommended to make a rule that the thought or intention in planning and matters that demand special attention in maintenance is to be taken over to the maintainer clearly, when the facility is constructed based on items (a) to (d) above.

(f) System of feeding reservoir and baby tank on regulating tank.

A long main channel is not suitable for a strict operation.

It is desirable to make a baby tank or regulating pond which will play the leading role in water issue schedule.

(2) Radical renovation of Dewahuwa Scheme

Following items of radical renovation seem to be necessary to carry on stable paddy cultivation of unit yield of 90 bushels/Ac. in the whole area of 2340 Ac. in the Maha, and in 1/3 the whole area in a S.D.Y.

(a) Augmentation of the water resources.

Even after the custom and system of water management at a high level

are established, there will be no water for the Yala cultivation in a S.D.Y., and diversion from Welamitiya Oya or any other places is necessary as already shown in "An Outline of Benefits Nalanda Diversion can bring" and some other reports.

(b) Enlargement of the tank capacity.
In addition to (a), it will be necessary to enlarge the existing tank or making a new additional tank because annual fluctuation of seasonal distribution of inflow is very high even in same S.D.years of rainfall.

(c) Enlargement of the main channel capacity.
There are some neck points in the middle and downstram even now. Furthermore, the main channel section should be enlarged in the whole scheme to meet the increase of necessity which will be caused by the concentration of ploughing work to a shorter period.
In this case, widening is preferable to deepening because of water head for distribution.
(See appendix 8-5 "Study on channel section")

(d) Improvement of outlets.
Outlets from the main channel have been improved to that quantitative distribution can be done.
But, all outlets to each of the allotments are left for the farmers' free operation and the capacity are often far bigger than the planned. So, it is necessary to adopt some measure for this, though the cost is not small.

(e) Importance of drainage control.
There are not many places where drainage work is necessary to avoid inundation in the dry zone. On the contrary, it is important to control water which once enters the field from flowing away to drainage. However, the irrigation facility is made only for the purpose of supplying water and gives users difficulty to approach to the drainage side.
The facility itself shows the thought that "the necessary thing is to get water, and once water enters the allotment, nobody (farmers and officers concerned) need pay attention to wastage."
Therefore, we would like to propose a radical change of principle that maintanance road and water management block (c.c.) should be made on drinage bases.

(f) Consolidation work in the whole area.

This is desirable from the view point of water management especially at farmer's level, though there is a problem of high cost.

(3) Effective utilization under present situation.

It is very difficult to describe "a way of effective water use" in a style of a manual or specification because there are big fundamental problems in facilities maintenance and organization or farmers co-operation as mentioned so far.

Therefore, here are shown (i) items of work that have to be improved (ii) items which require simply routine works and (iii) one tentative plan on cultivation.

(a) establishment of organization which deals with water management.

It is necessary to clarify the responsibility of management from branch channels on words practically.

This cannot be solved only in Dewahuwa. It must be examined carefully by the Government.

The water management at present means to deprive some farmers of their advantageousness in getting water and to distributing it to the other farmers who had been at a disadvantageous position.

Therefore a strong administrative power, leadership and executive ability is requested.

Officials in the head office are
situation in the field, as well as farmers recognition.

There will be no solution if nothing is done saying "farmers are wasting water."

(b) Quantitative operation.

Now we have equipped the main channel with parshall flumes, check-structures outlets with notch and gauge stuff, which made it possible to practise quantitative management.

So it is requested to make a rule of keeping a record on management so that we can get data for a better management in the following year and for future planning.

The method of measuring each facility is given in the reference data of report on "Water management in '74/75 Maha".

(b)-i Water issue in the main channel.

Rotation issue must be avoided as much as possible. If we are forced to practise it due to water shortage, we must keep constant

flow in the main channel. We must consider the sectional capacity of the channel and distribution quantity and make a plan as shown in (Fig. 5-3-4) and (reference data) in the report on "Water use in 73/74 Maha".

(b)-ii. Water issue on schedule in the ploughing period.

It is very important to practise issue programme based on the calculated quantity according to the work schedule of ploughing and planting. Because water requirement should be increased gradually and daily, being restricted by working capacity of ploughing and transplanting during this period as shown in the report on "Re-examination of water requirement" and "Water use in '72/73 Maha.

(c) Upland crops.

We can not expect Yala cultivation at all in a S.D.Y. If we persist on paddy cultivation.

Therefore it might be more economical to cultivate subsidiary crops twice or three times a year, instead of only one cultivation of paddy.

From the view point of "water efficiency" it is desirable to examine this radical change of cultivation pattern.

(d) Regarding "anticipation of weather".

The greater problem than scarcity of water is that we have no means to anticipate the water availability in the coming season. And that the figure fluctuates from practically zero to 4 times as much as the necessity.

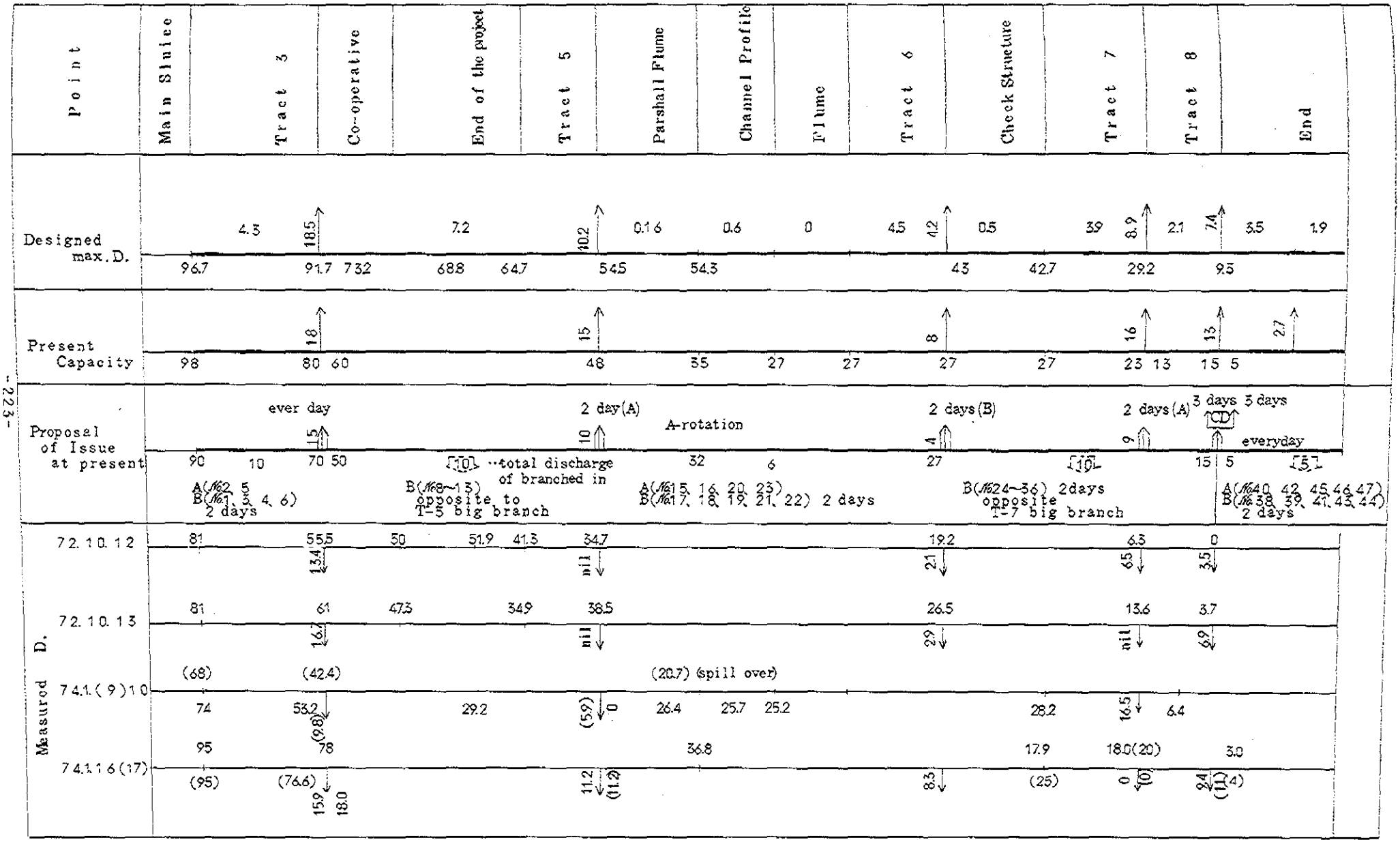
Therefore we cannot start until we get a certain storage. But this means we cannot use early heavy Maha rain on the field and evapo-seepage loss from the tank is not negligible. To meet these two contradicting conditions, the next two plans are tentatively considered.

To meet these two contradicting conditions, the next two plans are tentatively considered.

(i) to cultivate upland crops which can withstand much rain in early stage of Maha season, September to November, without tank waterissue. And soon after this, to start paddy cultivation deciding the acreage according to tank storage with minimum expectation of rainfall judged from past data.

(ii) To start Maha cultivation only in the acreage which can be irrigated by the storage, at the beginning of October.
After this, watching the increase of tank storage, fields should be added for cultivation.

Fig 5-3-4 Discharge in Dewahuwa Main Channel (CUSEC)



This order of cultivation should be decided by the water meeting and is to be continued yearly.

As for plan 1, the rainfall in September, October, November in the past are, 0.06, 3.33, 5.29 inches respectively in the Minimum year. 2.27 12.64, 12.57 inches in the average, and 1.97, 7.20, 8.45 inches in 64/65, a S.D.Y.

Therefore, to say nothing of an average year, in a S.D.Y. also, we can get enough rain for upland crops, and the risk will be little.

If there is too much rain for upland crops, we can abandon this and immediately change to paddy cultivation.

Using crop plants as green manure. In this case, we will not need water issue for first ploughing.

As for plan 2.

According to past data, 50% of years we have less than 1000 A.Ft. of storage in the Tank at the beginning of Maha season. This water can irrigate only 160 Ac. since we need 6.2 Ac.Ft. for one acre.

Therefore even in this plan, we have to wait till the storage increases to, for example 2500 AC.Ft. which can irrigate 400 Ac.

For both plans, a strong system of water management to make a plan and practise the order of cultivation work, smoothly and promptly is necessary.

Although these two plans are tentative, they are based on our experience and careful observation.

Therefore we hope further study will be done and adopted to practise one of them.

5-4 Pilot Farm

1. Purpose

The pilot farm programme was started with the aim of testing the suitability of new techniques to the local conditions and also to familiarize the farmers with such new techniques through practical education. The contents of this programme were as follows;

(1) A practical place for the technical education of farmers, and a demonstration field of various crops and techniques.

(2) A place for researching the agricultural problems of the present and those expected to come up in the future.

(A) Irrigated Paddy pilot farm

Area - 6 acres

(1) Establishment of high yielding techniques and their demonstration.

(2) Introduction of new techniques.

(i) Nursery techniques

(ii) Testing the suitability of various agricultural machinery for Dewahuwa and the rationalization of the use

(iii) Investigation on dry (kekulan) sowing

(B) Upland pilot farm

Area - 3 acres

Aim - Stabilization of upland cultivation.

(1) Introduction of suitable vegetables (including Japanese varieties), its' selection, cultivation method and marketing.

(2) Establishment of cultivation techniques suitable for highland irrigation.

2. A brief history of the establishment of Pilot Farm and the results obtained.

Table 5-4(1) and 5-4(2) indicates the course of working out the pilot farm. However due to a number of problems described subsequently the original purpose was not achieved.

(1) Difficulties experienced in locating the sites.

The site recommended in the Definite Plan for the paddy pilot farm was an abandoned barren tank bed which did not represent the soil type of Dewahuwa paddy fields. Its location at the tail end of the project made it unsuitable as a demonstration farm. The site recommended for the upland pilot farm was a barren, illdrained marsh, of which the better areas were already occupied by squotters. Removal of these

squotters posed a difficult problem. Hence there was no other alternative than to shift the two pilot farmes to a better site. Locating a new site for the two pilot farms remained as a big problem of the project.

In 1972, construction of the mechanization centre building started at a site near a hill in the central project area. Pilot farm buildings were also constructed within the same site without giving due consideration to the location of sites. Upland pilot farm required a fertile land with easy access to water, but since the buildings had already come up there was no other alternative than to select a $2\frac{1}{4}$ acre plot from the same gravelly hill. Finding a suitable place for the paddy pilot farm was not possible. Therefore one acre of rearranged paddy field close to the upland pilot farm was borrowed from a farmer in October 1972. In 1973 the entire 5 acres were borrowed for the pilot farm. A soil study was carried out during the first year and a real cultivation was started in the second year(1973). However due to a drought which prevailed from 1973 the trials and expriments of the pilot farm had to be reduced to a minimum. There was no possibility of drawing a special supply of water since the farm was located among the other fields belonging to the farmers.

(2) Guidance in advance for Productivity Maximization

One of the aims of the project was to maximize the paddy yields of all farmers and their by contribute to the national food production drive. A tremendous effort was made during the first two years of the project in guiding the farmers to maximize their yields. It was observed that they obtained yields for below the actual potential of their fields. As a result the starting of the pilot farm programme got considerably delayed.

(3) Negative attitude of Srilankan officers and absence of a Japanese Expert to work the pilot farm

The management of the pilot farm required quite a number of personal and equipment, which involves in the investment of a large sum of money. Considering from the present situation in Sri Lanka a pilot farm of such a big scale with activities limited only to Dewahuwa Project was not desired. Furthermore research station of the Department of Agriculture in Sri Lanka conducted adequate research pertaining to various agricultural problems in the dry zone. As such it was

felt that intensification of the demonstration programmes and various field trials carried out by the Department of Africulture in the project would be sufficient for the present. There was no Japanese Expert to handle the experimentation and the demonstration of the pilot farm. The project manager, who also had enough work as the leader of the Japanese team and the project agronomist was burdened with the heavy work of the pilot farm. Work became more and more difficult due to his thorough involvement in the productivity maximization programme and finally a request was made to the Sri Lankan Government for permission to recruit a Japanese assistant for the project agronomist in order to carry out the pilot farms smoothly. An Agricultural Instructor who received training in Japan on agriculture was sent for his assistance.

Under these circumstances experimentation for precise data was not possible and the work of the pilot farm had to be curtailed within a small framework.

(4) Alterations to the Farm Mechanization Programme

Mechanization is one of the main aspects of introducing new technology. However with the recent foreign exchange difficulty experienced by Sri Lanka, the Farm Machinery Introduction Programme was largely altered. As a result in February 1972 import of automatic paddy threshers which had been considered as useful earlier was cancelled. Again at a conference on Agro-Industries held in July 1972, Secretary to the Ministry of Agriculture and Lands expressed that orders should be placed only for machinery for which spare parts could be turned out in Sri Lanka and these machinery should be of such a nature that they could be manufactured locally in the future.

It was the same for the rest of the farm machinery and combine harvesters and binders which were not directly connected to productivity maximization were felt unneccessary and deleted from the order listes.

(5) Suspension of the Demestic Water cum Upland Irrigation Programme

Upland irrigation was the key note of the upland pilot farm. Water for upland irrigation was sought from Hevanella oya, the main drainage channel of the project area. The flow of water in Hevanella oya varied widely anually and it required some time for determining the water availability. A reliable estimation was done two years after the inception of the project. In the mean time due to difficulties experienced in locating a site, construction of the upland pilot farm

came to a stand still.

Hevanella oya was supply source for the proposed "Upland Irrigation cum Domestic Water Scheme", which included the irrigation of 100 acres of project highland. Further investigations on this scheme revealed that the flow of Hevanella oya was sufficient to provide domestic water for the entire colonization scheme and not for irrigating the intended highland 100 acres. Irrigation of a few plots of home garden scale was the only possibility and even this had to be restricted to Maha season. As such irrigation water could not be made available for the most required Yala season. In addition to this there was continious opposition from the farmers who disliked the suggestion to charge Rs.20.00 per household every month as operation and maintenance charges. After conisdering all these factors a decision was taken to abandon the "Upland Irrigation cum Domestic Water Supply Scheme" in May 1973. As a result the upland pilot farm lost its main base in addition to the difficulties experienced in its establishment. Therefore the "Upland Pilot Programme" was also temporarily suspended. The Agricultural Instructor who was assigned the duties of pilot farms was withdrawn from the project in June 1973.

(6) Recommendations of the Fukuda Mission

In September 1973 a mission headed by Dr. Fukuda arrived in Sri Lanka. They made the following suggestions for the pilot farm.

(i) Irrigated Paddy Pilot Farm: Establishment and demonstration of high yielding techniques; experiments on efficient water management; use of transplanting machine.

(ii) Upland Pilot Farm: Introduction of suitable rain fed crops; promotion of highland crops during Maha season.

To work out the pilot farm programme according to the above advices, five acres of paddy field were borrowed from a farmer to prepare for the 1973/74 Maha season. The upland pilot farm was reduced to 3/4 of an acre from the original $2\frac{1}{4}$ acres in order to intensive cultivation. At the beginning sunn hemp was sown and ploughed into the soil to increase fertility. By this time the Agricultural Instructor had been already transfered as mentioned in (5) above and an Agricultural Extension Worker was assigned to look after the affairs of the pilot farm. Unskilled casual labourers were recruited for various jobs of the farm. The burden on the Jpanese Agronomist (Japanese team leader and Project Manager) became heavior due to this replacement of the A.I. with an

officer of a lower rank.

(7) The unusual drought weather which began in 1973

As adviced by the Fukuda Mission a concrete programme was prepared for the pilot farm and 1973/74 Maha season was met with lot determinations. Unfortunately the 1973/74 Maha cultivation was not started until January 1974 due to a water scarecity caused by the drought which continued from April 1973. Season was already three months late and water difficulties were experienced right through the season. Water issues were curtailed to "once in seven days" rotations. The conditions for paddy cultivation differed largely from a normal season. Following work was carried out in the paddy pilot farm.

(i) Seedling preparation for the transplanting machine.

(ii) Training in the operation of transplanting machine.

(iii) Observation of dry sown paddy under drought conditions.

In Yala 1974 the farm was shifted to another site temporarily to conduct experiments and demonstrations under lift irrigation. It was unsuccessful due to severe damage by monkeys and vacancies and uneven growth due to poor soil fertility. In June 1974 a team of inspectors led by Mr. Watanabe arrived at Dewahuwa and after going through the report of the pilot farm they recommended the following itmes to be carried out within the limited time before the termination of the Project.

(i) Demonstration of maximum paddy yielding techniques combined with machinery utilization and water management.

(ii) Demonstration of subsidiary food crop and vegetable cultivation during Yala season.

1974/75 Maha season was the last paddy season within the Project period. Although it was met with lot of expectations and even greater preparedness the water situation became more aggravated than in the 1973/74 Maha season. Paddy cultivation was impossible and it was decided to grow sorghum as the main crop in 1/3 the total extent with legumes and other crops as the farmers desired. There was no separate arrangement for drawing water to the pilot farm and only 1/2 an acre was cultivated under paddy using seepage water from a lateral channel.

Only training in the use of transplanting machine and some fertilizer experiments were possible. In the remaining area subsidiary food crops and vegetables were cultivated with advice from the

Maha -Illuppallama Agricultural Research Station and the District Agricultural Extension Officer. For the pilot farm, there was no other alternative than to adhere to the seven day rotational issue of water. As such the experiments and the demonstrations carried out were not of a very appealing nature.

(8) Facts and Findings from the Pilot Farm

(i) Introduction of Japanese vegetables

A long period is required for experimentation and research regarding a vegetable variety before it is recommended for commercial cultivation in Sri Lanka. All the following factors have to be considered before making the recommendation, and it takes a long time.

(a) Availability of large number of varieties and kinds of Japanese vegetables.

(b) Most of these varieties react to the differences in temperature and day length.

(c) Japanese vegetables are more diverse than common crops in such characters as disease resistance, drought resistance, resistance to over saturation, insect and pest resistance etc..

(d) Human preference for flavour, suitability for palate and custms of a nation.

(e) Marketing, storage etc..

A period of 2 or 3 years with uncertain water supply is quite insufficient for such experimentation. A promising vegetable in Japan may completely fail in Sri Lanka. Therefore lot of time is consumed for experimenting, observations and field trials before determining the suitability of a crop for cultivation in Sri Lanka.

Most of the promising vegetable varieties in the world today are raised from F1 seed (Seeds which bear special useful characteristics for one generation only). As such even if a particular variety succeeds in Sri Lanka, seeds have to be imported every season. This cannot be continued due to the foreign exchange involvement.

Already crrot, radish, beet, cabbage, knol khol, vegetable bean, tomatoes and a few more vegetables are grown in the dry zone with imported seed from Japan and many other countries. Therefore only following Japanese vegetables were cultivated in the Pilot Farm thinking of their specialities.

Pumpkin, water melon, creaping melon, creaping cucumber, brinjal, tomato, onions, nira leeks, sweet corn and leeks.

All farmers agreed that the vegetables tried out at the pilot farm were superior to the vegetables already cultivated in the island in many aspects, but at the same time they felt that the actual cultivation of these vegetables were difficult due to the requirement of a high level crop husbandry. This was clearly evident when Japanese vegetable varieties which grew successfully in the pilot farm were given to the farmers for trial cultivation. Non of the farmers at Dewahuwa could successfully cultivate any of the Japanese Vegetables given to them in spite of through advice. Dewahuwa farmers do not posses such managemental and crop husbandry ability required for the cultivation of high class Japanese vegetables. It requires some time to bring them up to that stage. For example; Dewahuwa farmers cultivate local bringjal without fertilizer even in poor soils and are content with the yields obtained. Japanese brinjal though given to them with sufficient advice had been cultivated under the same conditions and had not yielded anything. Japanese vegetable require compost or cattle manure in addition to a higher dosage of inorganic fertilizer. Only a few farmers prepare compost at Dewahuwa and the usage of inorganic fertilizer is much less compared to Japanese standards.

Import of seed was felt as a problem and therefore F 1 cucumber was cultivated for seed purposes and in the first year it was success, but when the second generation was planted most of the fruits rotted after rain leaving seed production as a difficult problem which needs careful reconsideration.

Japanese tomato cultivated at Dewahuwa was severely affected by the leaf curl virus (witches broom). Therefor a tomato variety which was resistant to tomato mosaic virus was imported. This variety when cultivated at Dewahuwa indicated a resistance to the curl disease at the early stages of growth, but in the latter stages it was overwhelmed by the virus.

Local production of large onions (referred as Bombay Onions in Sri Lanka) is an earnest wish of Sri Lanka. Only few varieties in the world bulb under 12 hour day lengths. One of extremely early maturing variety introduced from Japan was found to be superior in yield to Bombay Onions in Sri Lanka. However its has poor storage quolities due to the short dormancy period. Therefore it is necessary to test

the possibility of suppressing its sprouting by the use of MH-30 chemicals or isotopes.

It is not possible for the author to draw a final conclusion about the suitability of Japanese vegetables for Dewahuwa, due to the problems discussed above. Yet the following varieties could be recommended tentativily for intensive cultivation.

Water melon, creaping melon, brinjal (egg plant), nira leeks, Japanese large onions, sweet corn and vegetable soya beans. In the case of large onions further experimentation on sprouting and storage is required. Since seeds from these varieties were sent to Maha-Illuppallama, local suitability could be tested simultaneously.

(ii) Paddy Pilot Farm

Maha season; As mentioned under (7) above whatever possible was done during the drought affected 73/74 and 74/75 Maha seasons.

(a) Transplanter

Seedling Preparation Japanese seedling boxes were used. Resently introduced Philippine Dapog nursery technique was slightly modified and the seedlings were raised on a mixture of coire dust and soil. 18 day old seedlings suitable for the transplanter were prepared in the Depog method and its modification. These two techniques while providing seedlings for the transplanter are useful as a technique for water conservation compared with the field nursery. Further experimentation is required.

Use of transplanter The operation of the transplanter was practised in order to train the extension workers and village operators. The other intension was to demonstrate it to the farmers. Unfortunately during both seasons due to water shortages a yield comparison with normal transplanting was not possible. When looked from the angle of unemployment in Sri Lanka immediate use of the transplanter cannot be recommended.

(b) Water Management

Rational water management or cultivation under water conservation was planned to be carried out in the pilot farm and a device to measure the rate of water use was installed. The idea was to measure the influence of irrigation at different growth stages on the yield.

This experiment had to curtailed due to water shortages.

(c) Dry Sowing (Kekulan)

Weeds created the biggest problem in dry sown paddy. It was observed that the chances of failure are great under a situation where weedcides are expensive and water is insufficient to suppress the weed growth after sowing. Ill effects of dry sowing under poor irrigation on the yield was clearly evident. Row seeding was more convenient for weeding than broadcasting. In row seeding the use of Lithao and Kalmut introduced by the In Service Training Institute, Peradeniya was practical than a row seeder.

(d) Under the experimentation for determining high yielding techniques only fertilizer experiments were carried out the to limitation by water. At Dewahuwa as expected addition of compost or cow dung, wood ash, and use of potassium in the top dressing of paddy had significant effects on the yields.

Yala Season

Introductory demonstrations of the cultivation of subsidiary food crops were carried out in sites where water was available even during the tail end of Yala seasons. This cultivation could be readily expanded if water is made available to all farmers Yala seasons.

These demonstrations were later expanded to actual cultivation with the participation of Young Farmers club members. As for the techniques of cultivating each crop the results of the future experiments have to be waited.

(iii) Upland Pilot Farm

As mentioned in (6)(ii) above castor and sugar cane were selected for cultivation in the upland pilot farm under rain fed conditions.

[Castor] Castor was introduced as a source of supplying raw materials for a rural industry. Seeds planted in Maha 1973 continued to grow even in the severely drought affected Yala 1974, and yielded over 1,000 lbs per acre. It was understood that castor has drought resistant qualities and is as suitable as manioc for cultivation in the dry zone. It has an oil percentage of 50 and is up to the international standards.

Sri Lanka annually imports 100 tons (224,000 lbs) of castor oil. This is equivalent to 224 tons (484,000 lbs) of castor seed taking

the percentage of oil recovery as 45. This means only 484 acres are required annually to supply the full demand of the island, since easily 1,000 lbs could be obtained from an acre. Once local demands are fulfilled production for export should be considered. Fortunately the seed quality is good and only the production cost has to be lowered to suit international price of castor oil. In Sri Lanka this could be achieved either by improving the unit yield by intensifying the cultivation or by extending acreage under a lower level of crop management.

[Sugar Cane] Sugar cane has been planted under experimental scale to produce syrup and jaggery. This programme is assisted by the Department of Agriculture and the Sri Lanka Sugar Corporation.

3. Summary

(1) Many difficulties came accross in locating sites for the upland pilot farm and the paddy pilot farm during the first two years.

Project staff could not devote much time for the pilot farm due to their through involvement in the productivity maximization programme.

(2) Staff available from both countries was insufficient both quality and quantity to run the pilot farm.

(3) Sri Landa officers were under the impression that a separate pilot farm ment only involvement of unneccessary expenditure and staff. The results obtained would not be positive and a repitition of work carried out at the Research Stations of the Department of Agriculture was not required. They also felt that better results would be obtained by carrying out the work with cooperating farmers than running a separate pilot farm.

(4) Subsidiary food crop cultivation in Yala was started in the second year on paddy fields borrowed from a farmer. A field was borrowed from a farmer semipermanently in the third year when subsidiary food crop cultivation was started in a large scale. The upland pilot farm was located on a barren gravelly hillock owoned by the local Government.

(5) Facilities for both pilot farms could not be provided satisfactorily. Demonstration of upland cultivation and devices for upland irrigation, two main subjects to be undertaken in the upland pilot farm had to be abandoned in parallel with the desision taken to cancell the upland irrigation cum domestic water supply schema due to the scarcity

or water. As result a main objective of the pilot farm was lost.

(6) Introduction of Japanese vegetables. Japanese vegetables were introduced to extend its cultivation on the highlands during Maha and on the paddy fields under irrigation during Yala. These vegetables and their varieties differentiated according to the climate. Therefore their suitability for local cultivation, palates, and marketing has to be studied carefully.

(7) Path has been layed for expanding the subsidiary food crop cultivation on the paddy fields during Yala seasons. It has been readily accepted by the farmers.

(8) The maximum yield experiments and demonstrations, of paddy cultivation was not possible due to droughts experinced during the last two years. Only the fundamental fertilizer trials were possible.

(9) Dry sowing was introduced as a means of conserving water but weeds created one of the biggest problems in this cultivation. Its success depended on the availability of water for switching over to a flooded condition from a dry condition thus enabling the control of weeds to a certain extent.

(10) A device was fixed up for obtaining data on water conservation and management. It was not possible to work it out due to the drought.

(11) In the case of farm machinery the present two wheel tractors generated enough power for ploughing under submerged conditions. However their power was insufficient for ploughing under rain fed conditions and under conditions only wetted by tank water.

No problems were experienced with the transplanter, but its extension was felt too early due to the high price of the machine and the present unemployment problem in Sri Lanka. The nursery technique introduced simultaneously is worth trying out as a method of water conservation.

(12) Castor could be recommended straight away as a crop suitble for cultivation under rain fed conditions on the high lands. However since only 500 acres are required to provide the entire requirement of Sri Lanka a cultivation method has to be developed to adjust the cost of production to suit the international market price of castor oil.

(13) In the mean time trusting of the cultivation of new crops to the farmers was tried out and their cooperation was found to be limited. Locatiom of suitable sites for the pilot farms was very difficult. However the necessity of having an independent pilot farm even of a small scale was felt necessary. Howver the number of present Srilankan officers availabe for the management of the pilot farm is insufficient.

Table 5 - 4

Indicating the Course of the Pilot Farm (1)

Dewahuwa

Subject \ Year	1970			1971										1972										1973		
Month	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
Season	Maha							Yala					Maha							Yala					Maha					
Date of Main Meeting						3/17		5/20										2/24				6/23					11/1			2/21
PADDY FIELD	Arrival of investigation mission headed by Dr. Nasu. The site was too far from the project centre and it was an abandoned tank-bed which required two or three years to be converted to an experimental field. Therefore it was decided to use cultivator's field for the pilot farm.								June - September One acre of paddy field was borrowed from a farmer, and experimental and demonstrative cultivation of subsidiary food crops was carried out.									Rs. 5,000/= was allocated to the project to start paddy cultivation on a field burrowed from a farmer in 1972/73 Maha season.			May - September Demonstrative cultivation of subsidiary food crops in 19½ acres of paddy fields with the participation of the Young Farmers with green gram as the main crop. Irrigated with lifted water from the drainage line.								Varietal tests were carried out under the management of an Agricultural Instructor on an acre of paddy field borrowed from a farmer.					
Season								Yala					Maha							Yala					Maha					
HIGH LAND	The proposed site was a marsh and squotted by seven families. It was difficult to sent them out of this land and as a result it was decided to look for a better site.			Inspection of water resources for the upland irrigation cum domestic water supply scheme and for the irrigation of the pilot farm.			Due to difficulties experienced in finding a site for the upland pilot farm all demonstrative cultivations were entrusted to farmers to be carried out on their highlands.									Feb. 24th. Sri Lankan counterpart pointed out the humanitarian as well as physical difficulties arising in the management of the pilot farm and suggested to entrust various cultivations to selected farmers under strict supervision. With the cooperation of Mr. Sato, Japanese expert and Mr. Doluweera Sri Lanka counterpart, cultivation was started in a field belonging to a farmer.								(1) A two acre demonstrative cultivation of Tur Dhal was carried out tied up with the Dept. of Agriculture and with farmers participation. (2) 2- acres were prepared in Nov. at the barren hill near the Project Mechanization Centre. (3) February 21st: A desision was taken to postpone the upland pilot farm untill water for upland irrigation is secured and to concentrate on the cultivation of crops in the paddy fields during Yala season.					
OTHERS				May 22nd: Machinery and equipment imported for the pilot farm were considered as small scale machinery and equipment imported for testing and experimental purposes.			Arrival of the 1970 shipment of equipment and machinery for the pilot farm. 4 wheel tractor 1 No. Automatic threshing Machine 2 Nos. Equipment for a small scale labolatory.									February: Commencement of construction of the Project Mechanization Centre and the Pilot Farm building on a government reservation hill located in the central region of the project. February: Due to the circumstances which prevailed at the time Project Manager had to supervise the pilot farm personally. In addition to the large volume of work he was already handling. The request for a Japanese farm assistant was not accepted by the Sri Lanka Government. April: An Agricultural Instructor who followed a course in vegetable cultivation in Japan was assigned the duties of the pilot farm.								(1) Arrival of 1971 shipment of machinery and equipment for the pilot farm. Power sprayers 2 Nos. Hand driven row seeder 1 No. Observation and experimental equipment (2) It was decided not to import large machinery such as conbine harvesters and binders which do not directly involve in productivity maximization.					

Table 5 - 4

Indicating the Course of the Pilot Farm (2)

Dewahuwa

Subject \ Year / Month	1973 4 5 6 7 8 9	10 11 12	1974 1 2 3 4 5 6 7 8 9	10 11 12	1975 1 2 3 4 5 6 7 8 9
Season	Yala		Maha	Yala	Maha / Yala
Date of Main Meeting		9/25 11/1		5/9 5/20	
PADDY FIELD	May - September Demonstration cultivation of 22 acres with green gram as the main crop with the participation of Young Farmers. This cultivation was tied up with the Demonstration Programme of the Dept. of Agriculture as in the previous year.	Recommendation of the Fukuda Mission to conduct experiments on the establishment of techniques for higher production and water management.	1 In accordance with the recommendation of the Fukuda Mission, experimentation was started on a five acres paddy field. 2 Experimental use of rice transplanter, row seeder and broad-caster conducting of experiments on high yield techniques and facilities for water management. It was not possible to obtain proper data from these experiments due to water shortages caused by a drought.	February - June Introductory experimental cultivation of Japanese vegetables to be introduced as an early in Yala. June - September 1 Cultivation of subsidiary food crops and vegetables on a 1¼ acre of land borrowed a farmer with access for pumping up water. 2 Cultivation of 172 acres and 8 acres by Young Farmers with cowpea as the main crop.	1 Since there were no water issue from the tank, first dry-sowing was experimented. 2 Since it was decided to cultivate subsidiary food crops on the fields. Subsidiary food crops and vegetables were cultivated on the paddy pilot farm. 3 A paddy field where seepage water could be utilized was selected and the rice-transplanting machine was tried out. Fertilizer experiments were also carried out.
HIGH LAND	Season: Yala / Maha / Yala / Maha / Yala				
	May 11 Dewahuwa colonists decided against the construction of the upland irrigation cum domestic water supply scheme, and Sri Lanka Government decided to give a one year settlement period. As a result the upland pilot farm programme which depend on upland irrigation practically came to an end	September 25 Fukuda mission advised to carry out selective and introductory cultivation of suitable crops.	In accordance with the above advice at this time where lift irrigation facilities were not available the alternative was to try out the cultivation during Maha. ¾ acres from the 2- acre pilot farm constructed last year was selected for this purpose and sunn hemp was cultivated with intention of improving and equalling the soil fertility ploughing in to the soil as green manure. However, 1973/74 Maha Paddy season got over delayed and because of the through involvement in this delayed season no high land crops could be cultivated.		1 Demonstration cultivation of caster as a drought resistant crop and sugar cane for preparing syrup under rainfed condition. 2 Experimental cultivation of Japanese vegetable for selection of varieties. 3 Entrusting of the trial cultivation of caster and a few selected vegetable varieties to farmers.
OTHERS	Arrival of 1972 shipment of machinery and equipment for the pilot farm. 4 wheel tractor 1 No. 2 wheel tractor 6 Nos. Rice trans planter 1 No. Power sprayer 1 No. Cutter machine 1 No. Observation and experimental equipments	June 30 An Agricultural Instructor in charge of pilot farm transfered. No successor. One of extention worker became full-time for pilot farm.	May 20 Watanabe Mission advised to carry out the following work during the remaining period. 1 Paddy field: Try out high yielding managing practices combined with mechanization and water management. 2 Upland field: Demonstrative cultivation of subsidiary food crops and vegetables during Yala season.		

6. Agriculyural Co-operatives

6 - 1 Breakthrough to Productivity

A Novel Experiment by Dewahuwa Project under "Productivity Maximization Programme" for 1971-72 Maha

S U M M A R Y

Ceylon-Japan Rural Development Project was faced, at its outset, with a "challenge" to which it was asked to give proper "response". The challenge was a sort of the vicious-circle then working at Dewahuwa on the following inhibitive factors: (1) deteriorating infra-structural facilities - (2) backwardness in technology - (3) institutional apparatus not active - (4) insufficient incremental inputs - (5) stagnancy in productivity - (6) people's apathy for development. We meant to "respond" to this challenge through building-up a socio-economic structure wherein a virtuous-circle of (1) quicker tempo of capital accumulation - (2) wiser ploughing-back of such capital - (3) higher productivity and richer livelihood, with conscious participation (and, eventually, with initiative and responsibility) of the members of the community.

2. After the "spade-work" (since mid-November 1969 to May 1970, with 3 experts from Japan) and the "reconnaissance-in-force" (from November 1970 to April 1971), we prepare "Implementation Plan 1971/72" as a guide-line for the coming year, in July 1971. And, just before entering 1971-72 Maha season, we consolidated our "Productivity Maximization Programme."

3. The basic strategy of "Productivity Maximization Programme" was chalked out after getting first-hand information and "down-to-earch" knowledge of the socio-economic conditions of the project-area farm-households through "Socio-Economic Survey", combined with "Rural Indebtedness Survey", in August 1971. The principal findings of these surveys were: (1) more than 12% of the paddyland and not less than

25% of the colonists were involved in "Uggas"(1) and "Baddu"(2), allowing a considerable capital-outflow from the community; (2) the number of "defaulters"(3) steadily in an increase, totalling to some 50 colonists or one-third of the entire allottee-population of the project-area, and (3) similarly discouraging phenomenon in term of an increase in the number of "non-interested" farmers (who do not try to increase their yield by productively utilizing the Cultivation Loans) to 60 or so ("non-interested" farmers were believed to include not a few farmers who had lost cultivation-rights for their allotment due to "indebtedness"). Eventually, only a little more than a quarter of the total colonists could hope to obtain the Cultivation Loan for 1971-72 Maha cultivation season which would mean a considerable diminution in inputs, with correspondingly less production.

4. "Productivity Maximization Programme" is a kind of an "Action-oriented" developmental programme, combining as into a Trinity, three essential approaches to the problem: (1) Liquidation of Rural Indebtedness; (2) Expanded Credit System; and (3) Intensive Extension-cum-Supervision Drive, on the basis of improved irrigation and road systems. Although it is very difficult, and even unjust, to allocate these three functions to each different group of workers, we may roughly say that the first two (liquidation of rural indebtedness, and implementation of Expanded Credit System) fall on "institutional activities" and the last (intensive extension-cum-supervision) mainly within "extension services". A brief explanation on each component of this "P.M.P." will not be uncalled for:

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(1)/(2): "Uggas" and "Baddu" have their counterparts in East Bengal in terms of "Bandak" and "Kaikarashi". They are very similar between each other in that they are the traditional credit system by which the creditor obtains the cultivation-rights of the loanee's land which is offered as mortgage, in case the latter fails to pay back the loan in full.

(3): "Defaulters" stand for those farmers who, by failing to pay off their Cultivation Loan provided for the previous year, are not entitled to the Cultivation Loan for the corresponding year. "Eligible farmers", on the other hand, are those who paid back the last year's Cultivation Loan and, therefore, eligible for this year's Cultivation Loan.

Liquidation of Rural Indebtedness

was meant for: (1) checking outflow of locally accumulatable and re-investable capital to outside, just like stopping wastage of irrigation-water by filling crab-holes along ridges and bunds on the paddyfield; (2) allowing "indebted farmers" to recover their legitimate cultivation-rights for the land which they will be taught how to better utilize for production-increase and better-living.

Liquidation Fund was sought from the People's Bank to the amount of Rs. 50,000, repayable within five years, in the name of Dewahuwa MPCS. Rs. 39,680 was paid to the "creditors" against IOU on behalf of 32 colonist-members in debt, and additional Rs. 2,915 to enable the latter to pay up share-capital to make themselves "credit-worthy", during a week's time from 21.9.71 to 30.9.71. Debt-part (Rs. 42,595 can be broken down to an average of Rs. 1,240 + Rs. 91.10 = Rs. 1,331.10 per indebted household.

Expanded Credit System

aimed at provision of productive credit in kinds and services with "defaulters" and "indebted farmers", who could not hope to obtain Cultivation Loans for the season. Terms and conditions for providing such credits were made quasi-equal to those of Cultivation Loan, under six heads of: (i) ploughing; (ii) seed-paddy; (iii) fertilizers; (iv) transplanting; (v) weeding; and (vi) agro-chemicals. Harvesting, threshing and paddy transport services were meant for "eligible farmers", too. Financial arrangement to endorse provision of "Expanded Credits" in kind and service with "defaulters" and "indebted farmers" was made with G.A., Anuradhapura and sanctioned by the Permanent Secretary, Ministry of Agriculture and Lands, to the amount of Rs. 30,000 at nominal interest-rate. Dewahuwa MPCS allocated these credits on the basis of the recommendations by the agronomist-group, in a similar manner as with the Cultivation Loan towards the eligible farmers. Eventually, 31 indebted farmers and 34 defaulters could enjoy productive credits (strictly in kind and service), while 64 eligible farmers could be financed through the Cultivation Loan.

Intensive Extension-cum-Supervision Drive

is, in fact, an individual guidance and supervision on each one of the farmers re: (i) timely ploughing through systematic deployment of 2-wheeled tractors; (ii) encouragements for trans planting; (iii) selection of seeds for higher yields; (iv) optimum dosages of fertilizers, its ploughing-in at the time of puddling with V_1, and timely notice for and liyadde-delivery of top dressings with Urea, and (v) pest/weed control. All through this "Drive", good attention was paid for proper water-supply. It was never "forced upon" the farmers but "taught-in" through dialogues between the project-officers and the farmers.

5. After harvesting which was completed by 98% before the Sinhalese New Year Day, it was verified that the "Productivity Maximization Programme" brought a bumper crop, unknown in Dewahuwa Colony for the last quarter-a-century, amounting to 74 bushels per acre on an average, the highest being 130 bushels and the lowest, 27 bushels. 1970-71 Maha average yield remained at 53 bushels per acre, but more than 5% of its crop perished on the field through April/May showers, thus cutting down the net per-acre yield to less than 50 bushels. The said yield averaging at 74 bushels per acre achieved during 1971-72 Maha season is based on scientific calculation through crop-cuttings at 91 points all over the project-area, and as threshing was done by 80% before the New Year Day and 96% by the end of April, the net productivity-increase in this Maha over the last year is almost 50%.

6. This Programme was effective not only for production-increase. It was also implemented in such a manner that many youngmen and women in the project-area could have an ample opportunity of training, while earning good wages, in "modern paddy cultivation methods". While young women's training was limited within the sphere of "transplanting", many youngmen were intensively trained in administration, maintenance, repair and operation of 2-wheeled tractors through "ploughing", so that they could be entrusted with enlarged share in managing "mechanization" under the banner of MPCS, probably from next Maha; and some of other group of youngmen were "educated" in better water-control and extension work, with a hope to turn them into so many able assistants of Cultivation Committee members.

7. "Productivity Maximization Programme" could thus achieve quite an appreciable result. But it would not be able to claim for its nation-wide application, should it have failed to recover the credits offered to the project-area farmers under the "Expanded Credit System" as well as through the "Cultivation Loan" for 1971-72 Maha. Bulanawewa Branch of Dewahuwa Multi-purpose Cooperative Society recovered these credits, both in terms of cash and kind (Paddy), by 81.9% by the end of May 1972 and the remaining part of the loans is expected to be paid back by after Yala cultivation will be over. Loan recovery performance by the local MPCS by the end of May 1972 is shown on the following page.

Loan Recovery Performance with Liquidation of Rural Indebtedness, Expanded Credit System & Cultivation Loan

Category of Farmers	Number of Farmers Concerned	Those completey Repaid	Those Partially Repaid	Those Unfinished Repayment	-Loans to be Recovered Per Farmer	Recovery Per Farmer In Cash	Recovery Per Farmer In Kind	Rate of Recovery
Eligible	61	57	2	2	Rs. 615.50	Rs. 586.40	41.9 bus.	95.1%
Defaulter	35	22	12	2	Rs. 985.48	Rs. 772.02	55.2 "	78.3%
Indebted	31	16	13	2	Rs.1,658.22	Rs. 1,238.04	88.5 "	74.7%
Total:	127	95	27	6	-	-	-	81.9%

1. TARGETS & HANDICAPS FOR THEIR FULFILMENT FOR 1971-72 MAHA

In the project's 1971-72 Maha Implementation Plan which was submitted to the Ministry of Agriculture & Lands at the end of June 1971, the main targets over some 750 acres (gross extent to be harvested) of paddyfield in our project-area were:

		1971-72 Maha	1970-71 Maha	% of Increase
1.	Yield per acre	66 bushels	53 bushels	24.5
2.	Seed-paddy (improved & certified) supply	730 bushels	?	?
3.	Fertilizer input Nitrogen:	9.24 tons	5.60 tons	65.0
	Phosphate	6.70 "	2.90 "	131.0
	Potassium	5.50 "	2.40 "	129.0
4.	Improved cultural practices			
	Row-transp.	70 acres	23 acres	
	Row seeding	10 "	1 "	
	Random transp	380 "	294 "	
		460 acres	318 acres	
		$\frac{460 \text{ ac}}{750 \text{ ac}}$ =61.3%	$\frac{318 \text{ ac}}{750 \text{ ac}}$=42.4%	44.3
5.	Short-term credit (1,000 rupees) In Cash			
	Ploughing :	27.0	17.1	
	Transplanting:	8.0	3.35	
	Weeding :	4.0	3.375	
	In Kind			
	Seed-paddy :	1.92	2.816	
	Fertilizers :	16.0	8.197	
	Agro-chemicals	3.0	0.086	
		59.92	34.924	71.6
6.	Sowing & Planting:	Broadcast-sowing to be completed by 20-11-71; transplanting to be completed by 30.11.71.		

In a course of preparing the implementation programme for fulfilling such self-imposed targets for 1971-72 Maha, which should need to be carried on under the most intensive extension-cum-supervision, with the optimum input of productive materials and the fullest mobilization of the colonists' labour, the project had to be confronted with the following cold facts:

(1) the number of "defaulters" continued increasing year after year.

Defaulters of 69-70 Maha C.L.		Defaulters of 70-71 Maha C.L.		Non-eligible for 71-72 Maha C. L.
21	+	26	=	47

(2) the same discouraging phenomenon was witnessed in an increase of "non-interested" farmers (who do not try to increase their yield by productively utilizing the Cultivation Loans).

1969-70 Maha		1970-71 Maha		1971-72 Maha
48	+	16	+	64

(Note) "Non-interested" farmers are believed to include net a few farmers who had lost cultivation-rights for their allotment due to "indebtedness".

Eventually, the total number of the farmers who may not be benefitted by the Cultivation Loans for 1971-72 Maha season was estimated to be:

Defaulters (47) + Non-interested (64) = 111 (73% of 153 colonists)

This would mean that only a little more than a quarter of the total colonists were expected to utilize the Cultivation Loan productively during 1971-72 Maha cultivation season.

The project, therefore, decided to undertake, as the pre-requisite for finalization of its implementation programme for 1971-72 Maha, the "Socio-Economic & Rural Indebtedness Surveys."

2. SOCIO-ECONOMIC & RURAL INDEBTEDNESS SURVEYS

A survey-team comprising of four staff from the People's Bank (Colombo) and two staff from the project worked from 8-8-71 to 20-8-71. As the result, the project was better informed of the socio-economic conditions of the farmhouseholds in the area and discovered that 12.2% of the total paddyland (94 acres out of 770 acres) had been put under

irregular land-tenureship of "Uggas" and "Baddu", involving 22% (33 colonists out of 153) of the permit holders.

3. LIQUIDATION OF RURAL INDEBTEDNESS

Application to the People's Bank for a long-term, low interest loan for liquidating the indebtedness was filed at the beginning of September 1971. Five-year loan for Rs. 50,000 being approved by the same Bank on 6-9-71, Dewahuwa MPCS paid total amount of Rs. 39,680 to the creditors on behalf of 32 colonist-members in debt, and additional Rs. 2,915 to enable the latter to pay up share-capital to make themselves credit-worthy for such loan. Debt part (Rs. 39,680) and share-capital (Rs. 2,915), totalling Rs. 42,595 may be broken down to an average of Rs. 1,240 + Rs. 91.10 = Rs. 1,331.10 per indebted household. This rural indebtedness liquidation took place within a week's time since 21-9-71 and, thereby, 32 colonists in the project-area could recover full cultivation-rights on their allotment.

4. EXPANDED CREDIT SYSTEM

The project's representation to G.A., Anuradhapura on the issue of the "Expanded Credit System" on 3-9-71 was immediately sent forward to the Permanent Secretary, Ministry of Agriculture and Lands, who sanctioned financing of Rs. 30,000 to Dewahuwa MPCS to be used for its providing credit in kind and service to the defaulters and indebted farmers.

Dewahuwa MPCS's application for the Cultivation Loans on behalf of the eligible farmers and that for the Special Loan (consisting of fertilizer and agro-chemicals) for the defaulters was accepted by the People's Bank on 18-9-71. This made Dewahuwa MPCS capable of supplying productive materials and farming services to the most of its members in the project-area.

Credit Position of Dewahuwa MPCS for 1971-72 Maha

Item	For the eligible farmers	For defaulters & non-interested farmers including the indebted	Total
Ploughing	Rs. 16,470.00	Rs. 10,972.50	Rs. 27,442.50
Seed-paddy	4,392.00	7,348.75	11,740.75
Fertilizer	25,877.00	8,075.00	33,952.00
Transplanting	6,862.50	1,007.50	7,870.00
Weeding	6,862.50	-	6,862.50
Agro-Chemicals	6,862.50	2,125.00	8,987.50
Harvesting	-	2,840.00	2,840.00
Transport of Paddy	-	7,187.00	7,187.00
T o t a l:	Rs. 67,326.50	Rs.39,555.75	Rs. 106,882.25

Rs. 50,000 Liquidation Loan from the People's Bank was to be paid back within five years, with or without one-year grace (if with one-year grace, 1/4 for 4 years w.e.f. 1973; if not, straight 1/5 for 5 years w.e.f. 1972).

During the whole season of 1971-72 Maha (for six months from September 1971 to February 1972), the following credits were offered to the project-area farmers:

Item	Eligible Farmers (65)	Defaulters (67)	Indebted Farmers (32)	Total Project Area
LIQUIDATION OF INDEBTEDNESS				
Debt Servicing			Rs.39,680.00	
Share-capital			2,915.00	
Total			Rs.42,595.00	Rs. 42,595.00
PLOUGHING				
Buffaloe (cash)	Rs.15,046.00	-	-	
2-wheeler "	1,697.50	-	-	
2-wheeler (ECS)	-	Rs.10,780.00	Rs. 4,865.00	
Total:	Rs.16,743.50	Rs.10,780.00	Rs. 4,865.00	Rs. 32,388.50
SEED-PADDY				
In kind (C.L.)	3,757 (221 bu)	-	-	
In kind (ECS)	-	2,754 (162 bu)	3,094 (182 bu)	
Total:	3,757.00	2,754.00	3,094.00	9,605 (565 bu
FERTILIZER (V_1)				
In Kind (C.L.)	6,444.90 (651 pk)	-	-	
In Kind (ECS)	-	3,573.90 (361 pk)	3,910.50 (895 pk)	
Total:	6,444.90	3,573.90	3,910.50	13,929.30 (1,407 pk)
FERTILIZER (Urea)				
In Kind (C.L.)	5,229 (288 cwt)	-	-	
In Kind (ECS)	-	3,158 (107 cwt)	4,271 (203 cwt)	(310 cwt)
Total:	5,229.00	3,158.00	4,271.00	12,658.00
TRANSPLANTING				
Cash (C.L.)	5,800.00	-	-	
Girl's service (C.L.)	524.00	-	-	
Girls' service (E.C.S.)	-	1,160.00	2,430.00	
Total:	6,324.00	1,160.00	2,430.00	9,914.00
GRAND TOTAL:	38,498.40	21,425.90	61,165.50	121,089.80 (Excluding Liquidation Loan)
Per Farmer:	Rs. 576.90	Rs. 319.80	Rs.1,911.42	

It would be interesting to make comparative study of the amount of the credit so far given to that prepared by the project (excluding the loan for liquidation of indebtedness) under each head:

(In Ceylonese Rupees)

Item	Category of Farmers	Amount Prepared	Amount Given	Surplus (+)/ Deficit (-)
PLOUGHING	Eligible	16,470.00	16,743.50	(-) 273.50
	Non-eligible	10,972.50	15,645.50	(-) 4,673.00
SEED-PADDY	Eligible	4,392.00	3,757.00	(+) 635.00
	Non-eligible	7,348.75	5,848.00	(+) 1,600.75
FERTILIZER (V_1)	Eligible	25,877.00	6,444.90	(+) 19,432.10
	Non-eligible	8,075.00	7,484.40	(+) 590.60
FERTILIZER (Urea)	Eligible			
	Non-eligible			
TRANSPLANTING	Eligible	6,862.50	6,324.00	(+) 538.50
	Non-eligible	1,007.50	3,590.00	(-) 2,582.50
TOTAL:	Eligible	53,601.50	33,269.40	
	Non-Eligible	27,403.75	32,567.50	
		81,005.25	65,836.90	
BALANCE:				(+) 15,168.35

5. INTENSIVE EXTENSION-CUM-SUPERVISION DRIVE THROUGH CLOSE PROJECT-COLONIST RELATIONS

"Productivity Maximization Programme" based on the combination of Liquidation of Rural Indebtedness, Expanded Credit System and Intensive Extension-cum-Supervision Drive was explained on the occasion of the Colonists' General Meeting on 24-8-71, with the attendance of the Project Director, G.A., Anuradhapura, etc. The Colonists who attended this meeting were requested to fill in "Tentative Application for Input Materials and Farming Services" and return them through their Cultivation Committee members. By the end of August 1971, all the colonists, irrespective of the differences in their financial status and economic conditions, submitted their Applications to the Project HQ. through the Cultivation Committee.

It was the project's agronomist-group to build up from the figures appearing on the Applications a well-balanced scheme of:

seed-paddy x pattern of planting = fertilizer & agro-chemicals

in quantitative terms, while Farm-machinery group busied itself in preparing a programme for timely ploughing by use of 38 2-wheeled tractors.

Agronomists' job was an elaborate and time-consuming one, involving enquiries and confirmations with each and every colonist in the course of finalizing the Extension Programme in which the optimum dosage of basal fertilizer as well as top dressings be so calculated to multiply the yield of paddy through adequate-most combination of seed-paddy and pattern of planting. "Recommendations" to Dewahuwa Project-area farmers on 1971-72 Maha paddy cultivation which was distributed among all the colonists on 12-10-71 was the outcome of such pains-taking efforts on the part of the agronomist, A.O , A. I., and KVSS during the whole month of September 1971. Application for the Cultivation Loan on behalf of the eligible farmers and that for the Special Loan (in kind) on behalf of the defaulters, as well as representation on the "Expanded Credit System" was also based on the figures assimilated from the contents of the "Tentative Applications for Input-Materials and Farming Services" submitted by the colonists by the end of August 1971.

(Ploughing)

Primary ploughing by use of 2-wheeled tractors operated by the locally trained youngmen started on 28-9-71 giving four days' time to allow the Tank-water which had been issued on 24-9-71 to soften the paddyfield. The primary ploughing by the 2-wheelers at Rs. 35/acre was welcomed by the project-area farmers very much and as much as 638 acres (85% of the total paddyland extending over 750 acres) was finished within a month's time (by 28-10-71). Secondary ploughing-cum-puddling which was commenced on 27-10-71 completed 284 acres (38% of the project-area paddyfield) by 22-11-71. Primary ploughing of remaining 15% and secondary ploughing-cum-puddling of 62% of the paddyfield was done by buffaloes.

(Fertilizing)

Basal Dressing: To ensure optimal input of basal fertilizer, the project adopted a special measure of "ploughing-in" of V_1 at the time of secondary ploughing-cum-puddling when it was being done by 2-wheelers. When 2-wheeled tractor was sent out from the Tractor-Shed for secondary ploughing-puddling, its operator was asked to carry requisite packets of V_1 on the trailer so that the farmers waiting for its arrival on the liyadde would spray the fertilizer on the field prior to rotavation by the 2-wheeler. 38% of the total paddyfield (290 acres) was thus applied with adequate-most dosage of V_1 (791 packets at 1/2 cwt.). As for "ploughing-in" of the basal fertilizer on the liyaddes meant for puddling by buffaloes, MPCS made special delivery of V_1 at the farmers' own liyadde (261-3/4 acres with 649 packets).

Top Dressing: Project's recommendations for top-dressing of Urea to each individual colonist were based on the following formula:

Time of Application after Planting or Sowing
(In CWT.)

Varieties	Planting Patterns	After: 2 Weeks	4 Weeks	8 Weeks	10 Weeks
BG-11/11 MI-273 IR- 8	Trans-planting	1/2	1/2	1/2	-
H - 4 H - 8	Trans-planting	1/4	-	3/4	-
	Broad-casting	1/4	-	-	1/2

As the time for first top-dressing for early sown/transplanted liyadde arriving at mid-November, MPCS started distributing Urea to the colonists' houses since 18-11-71. 70 colonists were thus delivered with 425 cwt. of Urea at their houses within a week's time till December 2, when Cultivation Committee, confirming the rumor that a part of the home-delivered urea was being black-marketed to outsiders, decided to sotp home-delivery of the same. Since 7-12-71, Urea was

transported to the colonists' liyaddes on schedule in three installments a week, viz: the colonists whose top-dressing was falling at the beginning or middle or end of the week reported at MPCS at 8:30 a.m. to take delivery of their urea onto their liyadde by co-op. vehicle, on Tuesday, Thursday and Saturday, respectively. The colonists who enjoyed delivery of urea, to the amount of 220 cwt. in total, onto their liyaddes numbered 44. Thus, 114 colonists out of 153 (75%) obtained 645 cwt. of urea, which corresponds to 72% of the amount recommended by the project on the whole project-area basis. Top-dressing of urea was completed by February 10, 1972.

Fertilizer Input for the Season: Fertilizer input in Plant Nutrient Contents (in tons) during 1971-72 Maha season over that during last season is as follows:

	N	P	K
1970-71	5.6	2.9	2.4
1971-72	16.0	10.3	4.8
(% increase)	(285)	(355)	(200)
Anticipation in Implementation Programme	9.24	6.70	5.50

(Planting Pattern)

Members of the Young Women's Organization, virtually the sister-group of the Youngmen's Organization, were active in this Maha, too. Row-transplanting of 51 acres, or 7% of the total paddyfield, was undertaken by three groups (at 25 girls) of them. They were assisted by some 15 women-folks from outside of the project-area who did additional 11 acres. Farmers' own row-transplanting on 39 acres brought the transplanting: broadcasting ratio this season to 67:33.

Mention should also be made of "Water-Management & Extension Apprentices" who were likewise recruited from among the Youngmen's Organization members; four to six of them worked for a month and half (October to November 71) as assistants to three KVSS in water-management and extension work.

(Timely Sowing)

Broadcast-sowing on 247-1/2 acres was completed by 90% on 20-11-71, and the remaining 10% was finished by 25-11-71. Over 67% of the broadcasted liyadde was "ploughed-in" with optimal dosage of V_1. Transplanting on 439-1/2 acres (36 acres row-transplanted and 403-1/2 acres random transplanted) was also completed by 94% by the end of November, and the remaining 6%, by 10-12-71. Over 80% of the transplanted field was "ploughed-in" with V_1.

(Seed Paddy)

Improvement in the kind of seed-paddy was also made possible due to propaganda and Expanded Credit System. More than half the amount of seed-paddy used in this season was comprised of either the improved seeds (BG-11/11: 199 bushels, BG-34/8: 6 bushels, and IR-8: 6 bushels) or the certified seeds (H-4: 240 bushels, and H-8: 112 bushels) which were supplied through MPCS.

6. DELIVERY OF PADDY AT MPCS & RECOVERY OF LOANS

As mentioned earlier, harvesting and threshing of 1971-72 Maha paddy started since the beginning of March 1972. By 31.3.72, MPCS collected the following amount of paddy in repayment of the loans as well as on cash payments:

Category of Farmers	In Repayment		On Cash Purchase		T o t a l	
	bushels	rupees	bushels	rupees	bushels	rupees
Indebted	640.2	8,962.80	325.5	4,557.00	965.7	13,519.80
Defaulter	625.0	8,750.00	1,035.0	14,490.00	1,660.0	23,240.00
Eligible	740.9	10,372.60	1,022.0	14,308.00	1,762.9	24,680.60
	2,006.1	28,085.40	2,382.5	33,355.00	4,388.6	61,440.40

Out of some 4,400 bushels of paddy delivered to MPCS by the end of March 1972, 54% was purchased on cash and 46%, in repayment of loans. We shall see what the performance of this order means from loan-recovery point-of-view:

Category of Farmers	Total of Loans (*) bushels	rupees	Recovered by 31.3 bushels	rupees	% of REcovery bushels	rupees
Indebted	3,561.3	49,858.20	640.2	8,962.80	- (17.9)	-
Defaulter	2,138.3	29,936.20	625.0	8,750.00	- (29.2)	-
Eligible	2,671.5	37,401.00	740.9	10,372.60	- (29.0)	-
	3,371.1	117,195.40	2,006.1	28,085.40	- (24.0)	-

(*) Note: "Total of loans" include unpaid balance of previous Cultivation Loan, expanded credits for the current season, plus 1/5 of Liquidation Loan - each with 9% annual interest - for the "indebted" farmers; unpaid balance of previous Cultivation Loan and expanded credits - both interest inclusive - for the "defaulters", and current Cultivation Loan for the "eligible" farmers.

The overall performance during April and May 1972 was given earlier on Page 4(a).

7. REVITALIZATION OF FARMERS' ORGANIZATIONS & EDUCATION-CUM-TRAINING OF YOUNGER GENERATIONS

Cultivation Committee which had long been rather dormant assumed an important role this season as a medium of liquidation of rural indebtedness among their fellow-cultivators from the view-point of redeeming their cultivation-rights, by sponsoring the Colonists' General Meeting, and collecting "Tentative Applications for Input-Materials and Farm-Services", and publicizing the project's "Recommendations" on better paddy cultivation among the area-farmers.

Multi-Purpose Co-operative Society did a wonderful job in fulfilling the long-felt need of liquidating the indebtedness among its member-farmers. MPCS also implemented the unique "Expanded Credit System" which enabled, coupled by the Special Loan towards the defaulters, more than two-thirds of the colonists to adopt the advanced cultivation practices. It was held responsible for administrative as well as financial part of 2-wheeler ploughing and girls' row-transplanting, by issuing their Work-Orders in return to collection of money or debiting to the beneficiaries' account.

Through these and other varied activities, the project-area C.C. and MPCS have got valuable experiences which will doubtlessly help strengthening their own organization. They can expect for further advancement in coming season as 38 2-wheeler operators, 4 mechanics and 3 clerks who got experience during this Maha under the project's expert and A.I. Machinery are hoped to handle ploughing-cum-basal fertilizer dressing services with their own responsibility, under the banner of MPCS in 1972-73 Maha. Half-a-dozen water management-cum-extension apprentices who are the sons of the colonists and got minimum understanding and training in the advanced paddy cultivation methods during this Maha are expected to work as so many assistants to the Cultivation Committee members in the next season.

Young Women's Organization members who worked hard at row-transplanting gave significant impacts to the general colonists for switching-over their traditional random transplanting and broadcast-sowing method to the more productive (though labour-intensive) method of planting.

8. BENEFITS ATTRIBUTABLE TO "PRODUCTIVITY MAXIMIZATION PROGRAMME

Through "Productivity Maximization Programme" as briefed in the above, the paddy-yield of 1971-72 Maha season has been augmented by 50%. Thanks to this bumper crop, absolute majority of the project-area farmers have been turned "eligible" farmers. Those who have been already "eligible" this season could save enough money, after paying off their current Cultivation Loans, as for the productive-capital towards 72-73 Maha cultivation, cutting down to that very extent their dependency upon institutional finance. "Defaulters" could liquidate unpaid balances of their previous Cultivation Loans, while honoring in full the Expanded Credits. The "indebted" farmers did not feel it very difficult to pay off unpaid balances of their previous Cultivation Loans and their current Expanded Credits; most of them could manage to repay 1/5 of the Liquidation Loan. Thus, both the "defaulters" and the "indebted" farmers are now made eligible for future Cultivation Loans.

This wholesale improvement of the project-area farmers' financial standing has been facilitated, in case of negligible number of those who could not manage to pay back their loans in full, by MPCS's re-writing of the expanded credits and/or postponement of repayment of the Liquidation Loan to post-72/73 Maha.

Knowing through experiences that one of the major causes of defaulting among Dewahuwa colonists has been their mis-appropriating a considerable portion of the Cultivation Loan meant for productive purposes towards consumption expenses, the project originally designed to confine provision of the Cultivation Loans and the Expanded Credit solely along the productive lines, while offering consumption credit to needy colonists, particularly, the indebted farmers and some of the defaulters. For chanelling the Cultivation Loan only for productive purposes, the project strictly warned MPCS against offering Seed-paddy Loan in cash but, as far as Weeding Loan is concerned, all the eligible farmers were paid in cash. Ploughing and Transplanting Loans were also provided in cash, although MPCS recovered 10% against its 2-wheeler ploughing services in case of the former, and 8% of the latter against girls' transplanting services.

As for the Consumption Credit, the project did not take action so far from two reasons: (1) to avoid adding up the colonists' burden for reimbursement of production- and debt-liquidating loans which are already considerably heavy judging from their past records, and (2) because a considerable purchasing-power has been created in the project-area as a whole through payment of wages to the younger segments of the rural community. Breakdown of the wages paid to the members of the Youngmen's and Young Women's Organizations during the first-half of this season is as follows:

Amount	Payees	
Rs. 7,800.00	2-wheeler operators	(Y.M.O. Members)
1,597.50	" " mechanics	(- do -)
795.00	Tractor-shed clerks	(- do -)
950.00	Water management and Extension Apprentices	(- do -)
3,204.06	Transplanting wage	(Y.W.O. Members)

Rs. 14,346.56 ÷ 153 (whole colonists) = Rs. 93.77

Another measure to relieve the area-farmers' monetary stringency during the 'lean period' was proposed by the project in term of "Paddy Marketing Agreement" between the prospective harvesters and MPCS, under which the colonists who would sign the agreement for delivering their paddy after harvest might be paid in advance Rs. 4/- per bushel. As this proposal was not approved by the People's Bank, Bulanawewa Branch

of Dewahuwa MPCS made outright purchase of paddy since the middle of March 1972, upto Rs. 400/- per allotment, to enable its members to obtain minimum harvesting/threshing capital and ready cash for consumption purposes to tide over the first few weeks of "busy" season.

In conclusion, our tentative analysis into the factors contributing to the above-said 50% productivity-increase of paddy brought about an interesting table as follows:

	Contributing Factors	% of Contribution
(i)	Increased dosage of Fertilizers	55
(ii)	Switching-over from Broadcasting to transplanting	15
(iii)	Early Ploughing, Sowing & Transplanting	10
(iv)	Use of New Varieties such as BG-11/11 & IR-8	5
(v)	Use of Certified Seeds instead of own Seeds	5
(vi)	Switching-over from Random Transp. to Row-Transp.	5
(vii)	Others (Water-management, etc.)	5
		100

In fact, for the majority of the farmers in the project-area, this was almost the first time to realize the efficacy of fertilizer for paddy yield-increase. Their enthusiasm for fertilizer-application in coming season is so big that "over-dosage" could be a real danger. Coupled with this, every farmer now admits the high-yielding quality of BG-11/11, inspite of its fairly big shedding character. We are sure that the demand for this new variety will be very high for 1972-73 Maha. Thirdly, people are all thankful for an early completion of ploughing and puddling which resulted at an early sowing. They know that, but for this, they would have to beg the Mudalalis[4] for loans to do their New Year shopping, and a considerable portion of their harvested paddy could perish under April-May showers. Many of them attribute absence of insect-damage to early sowing, although we can not endorse their simple belief on scientific basis.

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(4) : "Mudalali" is the Sinhalese for merchant-cum-moneylender.

Validity of transplanting, particularly row-transplanting, is all apparent; it is more so as combination of high-yielding varieties and optimum dosages of fertilizer was made almost a rule in our project-area during this Maha season. Although we could not propagate weeding practices either manually by hand or by rotary-weeders or chemically, the use of rotary-weeder on row-transplanted liyadde and hand-weeding or chemical weeding on random-transplanted and broadcast-sown liyaddes will become popular in coming seasons.

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Dewahuwa:
June 6, 1972

Subject-Matter: Re. Loan Repayment Campaign staged during November 1974 in view of maximizing the number of eligible farmers for 74-75 Maha Cultivation

1. The Colonists' Meeting which was held on November 12 '74 was meant to inaugurate and intensive Loan Repayment Campaign to eliminate the defaulters and also to curve the tendency for wide-spread UGAS practices both internally and externally. Yet, it seems that not many Colonists will come forward to honour their debts as long as they are not assured of the change of the Government policy in limiting the cultivation loans to be repayable for eligibility for 74-75 Cultivation Loan to either 73-74 C. L. alone, or 73-74 C. L. plus 1/3 of all the Cultivation Loans provided by the Peoples' Bank since 1966 (as suggested by ACCD). Under such air of uncertainty, the Colonists will refrain from paying back even 73-74 cultivation Loan which the Project-team should like to claim before the Government as the minimum condition for their recovering eligibility for 74-75 cultivation loan.

2. Under these circumstances, the Project-team likes to leave no stone unturned in explaining to the authorities concerned of the abnormality of the situation and the urgency of its counter-measures and in getting their full understanding and all-out support in equipping Dewahuwa Colonists with the minimum necessary input materials (seed-paddy, fertilizers and agro-chemicals) and services (land preparation, pudding-in or basal fertilizer, transplanting, etc.) for 74-75 Maha or 75 Madha cultivation.

3. The strategy and methodology proposed for this purpose will run as follows:

a. - The Project-team expects that Working Comt. No. 1 (organized by Sato Sasaki and Perera for the Procurement of Cultivation Funds and Preparation for Input Requirements) will complete the preparation of the under-mentioned documents at latest by Nov. 25 '74.

(1) Estimate of the Total Requirements for Input Materials and Services for Maha/Madha Bethma Cultivation:

(2) List of Defaulters with Outstanding Balances with particulars as to the Peoples' Bank C. L. since 1966 out of so-called "old loans", and

(3) Colonists' Preparedness in regard to Input Materials and Services for Maha/Madha Cultivation under the Present Circumstances.

The Project-team would like to use these documents together with;

(4) Bethma Cultivation Allottees' List and Its Graphic Presentation,

and

(5) Identification of Eligibility a Non-Eligibility among the Allottees for Bethma Cultivation and Its Graphic Presentation (showing Internal and External UGAS)

(these two documents need to be prepared by Working Comt. No. 2 organized by Colonization Officer, Doluweera and Abeywardana for Bethma Allocation and Tentative Plan for introduction of Consignment Farming on the liyaddas held by chronical defaulters) by Nove. 25, at the latest.

to impress upon the coming Sub-Committee meeting with the abnormality of the current situation and to persuade it to admit that unless the Govenment should assume softer attitude in granting eligibility for coming Maha/Madha cultivation loadn, the Colonists in Dewahuwa would enter into rampant UGAS contracts both internally and externally to betray the Spirit of the Colonization Scheme and the good intent of the Project.

b.- At this juncture, the Project-team should pose the Sub-Comt meeting with the question: (6) Whether UGAS is effective for Bethma Cultivation and insist that UGAS involving the transfer of the cultivation rights is apparently illegal both among the colonists and between the colonists and the merchants and money-lenders and, even if we might admit its existence as a long standing practice, could it be applicable for Bethma cultivation which should be understood as an emergency re-distribution of cultivation rights among the colonists under the pressure of irrigation-water shortage? The Project-team must win over the Sub-Comt. meeting to ban UGAS farming in coming Maha/Madha Bethma contracted between the colonists and the merchants and money-lenders.

c.- After steering the Sub-Comt. meeting along the above direction, the Project-team will now start explaining the Sub-Comt members on a very much improved preparedness for the coming Bethma on the part of the colonists if they will be

allowed to gain eligibility by repayment of 73-74 Maha cultivation loan alone. Two documents which will need to be prepared by the Working Comt. No. 1 at latest by Nov. 25 '74, viz:

(7) Prospect for Loan Repayment in case Honouring of 73-74 C. L. promises Eligibility for 74-75 Cultivation Loan, and

(8) Colonists' Improved Preparedness in regard to Input Requirements

will be used by the Project-team as the supporting data.

d.- The Project-team will finally ask the Sub-Comt. members how to deal with the colonists who might remain as defaulters even after the Government should assume less rigid attitude for eligibility. The Project-team's proposal on behalf of the remaining defaulters will be (i) adoption of the Supervised Credit System (provision of the minimum necessary input materials and service on credit (in kind only) and their recovery with interest in the form of paddy after harvest) on behalf of A-class defaulters and (ii) introduction of "Consignment Farming" by the young farmers under the joint supervision-encouragement-guidance by C.C. + MPCS + Project on behalf of B-class defaulters who consist of chronical defaulters and UGAS contractors. Two documents will be required for explanation in regard to the above:

(9) Input Requirements on behalf of Defaulters (for Supervised Credit System towards A-class defaulters and Consignment Farming by Young Farmers towards B-class defaulters) which will be prepared by the said dead-line by Working Comt. No. 1, and

(10) Consignment Farming by Young Farmers (to be prepared by the said dead-line by Working Comt. No. 2).

And, for implementation of the above proposed Supervised Credit System and Consignment Farming by Young Farmers on behalf of the defaulters, the Sub-Comt. members will be requested to favourably consider the Peoples' Bank's over-draft to the requisite amount on capitalization of the MPCS. assets.

4. The Project-Sub-Comt. meeting under the chairmanship of Mr. Rajakarna shall be held in the fifth week of November '74 (between 26th and 29th).

TS/15-11-74
Dewahuwa HQ.

7. Project Management

7-1 Management system

7-1-1 Purpose of the Project

According to the Agreement signed by the two Governments in Colombo, on the 19th of October 1970, concerning the Rural Development Project in Dewahuwa, we can read that purpose of the Project is to carry out a project for the socio-economic development of Dewahuwa, which be executed in the area consisting of approximately 700 acres of paddy field and 100 acres of adjacent highland (Art.-1).

For this purpose, the cooperation between the two Governments was to cover the following fields:

(A) improvement of the agricultural infrastructures, such as roads, irrigation and drainage facilities;

(B) improvement of the methods and techniques of farming through increased use of inputs, joint use among farmers of agricultural machinery, conduct of experiment, demonstration and extention works;

(C) improvement of the organization and activities of agricultural co-operatives and cultivation committees.

7-1-2 The system to promote the purpose.

(A) According to the Agreement, it was supposed that, under the supervision and direction of the Project Manager, the Project Manager and Project Co-Manager would be jointly responsible for technical matters pertaining to the implementation of the Project, and the Project Co-Manager would be responsible for the administrative and management matters (Art.7-1).

And there should be close cooperation between the two Government authorities concerned for the successful implementation of the Project, and the Joint-Committee is specified also in the same Agreement would meet regularly and would be responsible for ensuring the successful implementation of the Project (Art.7-2).

(B) On the other hand, the management system in Dewahuwa is mentioned below in 7-2 however, it is noteworthy especially to mention here about the following Sri Lankan counterpart officers.

According to the Agreement, the following 3 counterpart officers were supposed to be assigned for Dewahuwa stationing together 13

supporting staff member including one colonization officer, namely

1. agricultural officer
2. irrigation engineer
3. co-operative officer

(C) Organization of the Joint-Committee

The Sri Lankian side was supposed to have the following officers as member of the Joint-Committee as specified in the Agreement;

1. Permanent Secretary, Ministry of Agriculture and Lands (Chairman)
2. Permanent Secretary, Ministry of Irrigation, Power and Highways
3. Permanent Secretary, Planning and Employment
4. The Land Commissioner
5. The Director of Irrigation
6. The Director of Agriculture
7. The Commissioner of Agrarian Services
8. The Commissioner for the Development of Co-operatives
9. The Surveyer General
10. The Director of Development
11. The Director of Town and Country Planning
12. The Director of Highway
13. Project Director
14. Government Agent Anuradhapura
15. Project Co-Manager
16. One representative of farmers in the Project area

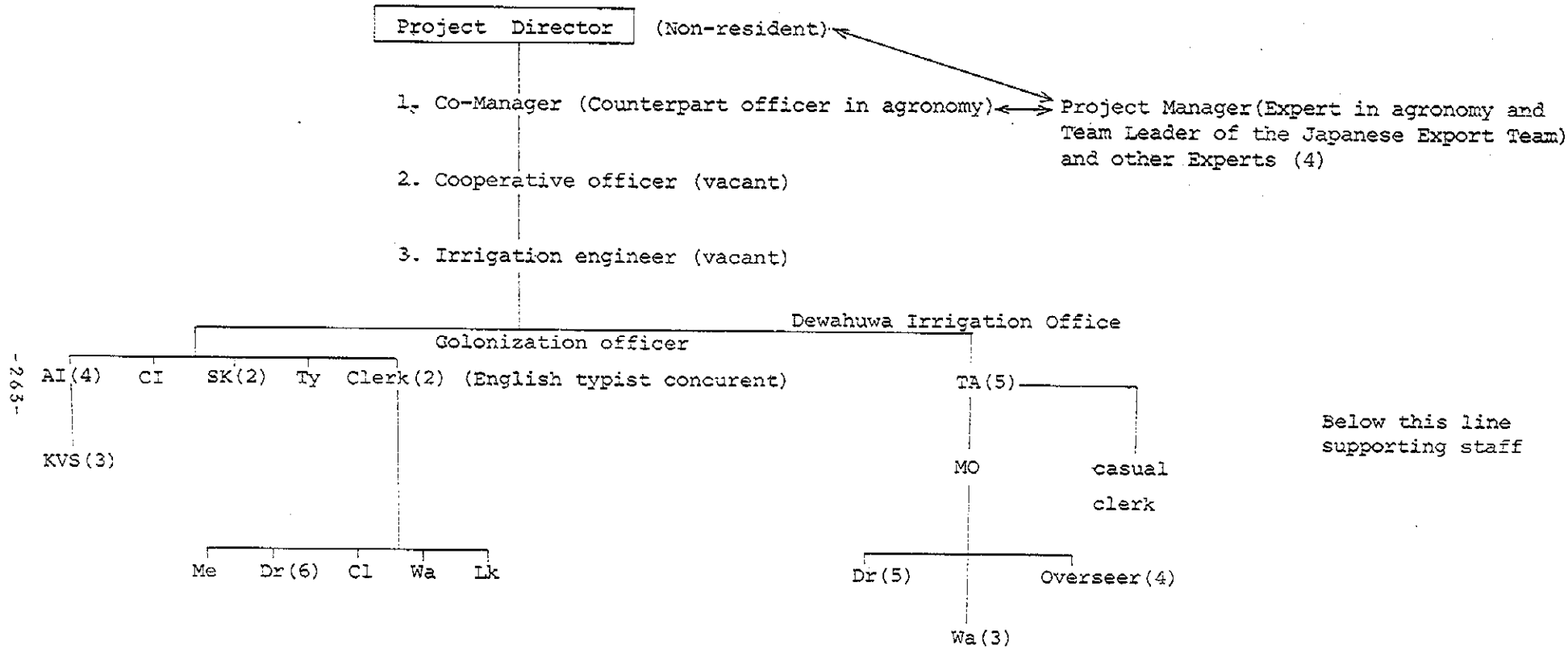
The Japanese side is,

1. Project Manager
2. Expert
3. Expert
4. One official appointed by the Embassy of Japan may attend the meetings of the Joint Committee as Liaison-officer
5. If necessary other experts would be co-opted

The Joint-Committee might appoint sub-committee to deal with specific matter.

(D) Organisation in Dewahuwa

Table A



Note

AI : Agricultural Instructor
CI : Cooperative Inspector
TA : Technical Assistant, Irrigation
SK : Store Keeper
KVS: Agricultural Extention Worker
Me : Messenger
Cl : Vehicle Cleaner
Wa : Watcher
Lk : Living Quarter Keeper
MO : Maintenance Overseer
Ty : Typist
Dr : Driver
( ) : number in plural

7-2 Actual Parformance of Management for the Past 5 years.

7-2-1 The Agreement clearly says Japanese cooperation is a technical cooperation. However, Government of Sri Lanka expected the Japanese Experts team not only to play a role of technical consultation and guidance also to become a pulling power to achieve the Project purpose. And she wanted the Dewahuwa Project to be a model 13 of Special Project in Sri Lanka.

It seems that the Japanese experts and its team, who were not well informed of the local social and economic conditions, and not well versed to the local climatic conditions, and administration systems and customs, have taken leadership in management of the Project.

Judging from the English context of the Agreement and from the international common sense, it would not be difficult for you to understand that the Japanese cooperation for the Project should be,

(1) to extend technical knowledge and advice to the Srilankian officers and government staff,

(2) to assist the local insufficiency by supplying from Japan necessary foods and equipment,

and that the Srilankian side should undertake the project management with a technical assistance of the Japanese experts.

The following chart would be the actual management system for the past 5 years.

Project Director (Non resident)

Project Manager (Team Leader of the Japanese Expert)

Project Co-Manager (Srilankian Project Manager, according to the Agreement)

Japanese Experts

Srilankian Supporting staff as counterparts to the Japanese Experts

For instance, the planning of the seasonal cultivation programme has been done, first of all, by the Japanese Expert Team, and them shown the drafts to the Srilankian Supporting Staff and discussed. After this planning was over, the plan signed by Project Manager, the Japanese Team Leader used to be submitted to the Project Director in Colombo. Then the Project Director would get approval at the Sub-Committee for the implementation of the planning concerned. And then, holding a farmers meeting, the Project Co-Manager would wxplain the farmers the planning for the season, accept farmer' opinions and amend the planning, if neccessary.

The order list of equipments and materials from Japan used to be made through the above mentioned route.

7-2-2 Japanese Experts.

According to the Agreement, the following 7 Experts were supposed to be dispatched by the Government of Japan to the Dewahuwa site.

(1) Expert on crop cultivation

(2) Expert on farm machinery

(3) Farm economist

(4) Irrigation engineer

(5) Hydrojist

(6) Expert on agricultural co-operatives

(7) Project coordinator

The Farm economist, however, was lacking for the most time. In other words, either Farm economist or Expert on agricultural co-operatives was always missing all the time. From April 1972 to May 1974, the Farm economist was concurrent expert of agricultural co-operatives. After May 1974, however, both have been lacking.

Expert on farm economy and agricultural co-operative development from both Srilanka and Japan should have been definitely indispensable, if you would refer to the purpose of the Dewahuwa Project mentioned in the Agreement, that reads "for the socio-economic development of Dewahuwa" Those experts from the both countries should have been the core and leading spirit in the Dewahuwa Project management and in execution.

7-2-3 The actual situation of the Joint Committee

The Agreement says "the Joint Committee will meet regularly and will be responsible for ensuring the successful implementation. However, in practice the Joint Committee usually met only twice or thrice a year, and on these occation usually the members of 1,2,4,5,6,13,14,15 and 16 mentioned in para 7-1-2 (C) attended the meetings. The tendency has been the same as in the case of the Sub-Committee (Art. 7-2). The Shb-Committee which was supposed to deal with specific matters and problems has been held whenever necessary. Therefore it can be said that the Sub-Committee would be substituted for the Joint Committee.

7-2-4 Analysis

It could not be denied that there has been a defect in the promoting system of management of the Dewahuwa Project and in the lack of the Srilankian counterpart officers, 2 out of the 3.

What made this defect ?

The following questions will come out.

(1) Whether or not the definition of international or bilateral cooperation was understood fully by both the Srilankian officials and Japanese Experts ?

(2) Whether the both sides referred carefully to the Agreement as "Project Bible" ?

(3) If the answer to the above questions is negative, therefore, the Japanese Expert Team has been conducting the Project management. In fact, in Dewahuwa, the Srilankian staff have been conducting themselves as assistant to the Japanese Experts. Especially the Go-Manager has been considered by the both sides as deputy Project Manager.

It cannot help being said that it would be beyond the technical cooperation for the Japanese Experts to have conducted the management of the Project, who are versed to the local administration and local socials and economic conditions.

In this sence, the Agreement is a fundamental and most important source for the both sides to judge each role. The Feasibility Study Report and the Definit Plan were very carefully referred to. But, those two are concerning the technical informations for the Project Promotion and nothing is mentioned in regard to the management of the Project.

7-3 Proposal

This may be beyond the category of project management, but, we should like to make a general and wide proposal for the sake of the agricultural and socio -economic development in the dry zone.

Referring to the past 5 years experiences of this Japanese Experts concerned in Dewahuwa, and in consideration of the climatic conditions, the farmers' character and temperament, the intensive agriculture of capital, labour and machinery, in other words, the Japanese type of intensive and highly precise, will not be suitable

To persue the benefits of extensive agriculture will be much more of importance in the dry zone of Sri Lanka. Especially in the development of agriculture and community the farmers' nature and temperament as well as climatic conditions and natural environments are first to be considered.

As for agricultural machinery, therefore, it will be far better to select the type of machines with a long durability and solidity and easiness of

repair and maintenance, which may have a less efficiency in operation. And we had better to choose machinery with a bigger power for the purpose of extensive agriculture.

※1. Annual Expenditure (Local Budget)

Item	Total estimation		'70 (10) ~ '71 (9)		'71 (10) ~ '72 (12)		'73		'74		'74 and before		'75 (expect)		
	Quantity	Cost	Quantity	Expenditure	Quantity	Expenditure	Quantity	Expenditure	Quantity	Expenditure	Quantity	Expenditure	Quantity	Expenditure	
Infrastructure			(5,000 cub)				*1				* *2				Cub = 100 ft³
Channel dialting	51,300 ft	204,157	55,600	41,719	Some	3,282	12,800	4,708	Some	0	68,400	49,708	Enlarge	100,000	*1 twice
Slope protection	6,105 "	125,000			1,480	28,000	1,900	68,250	2,854	72,037	6,234	178,287	1,074		*2 sum
Parshall flum	2 set	8,659			1	4,000	1	5,182		0	2	9,182			
Check gate	8 "	34,057					2	13,825	2	11,106	4	24,941	1	5,000	
Bridge	5 "	21,716			1/2	1,607	1/2	5,800	2	(1)7,411	3	14,318			
Outlet improvement	54 "	21,034					48	9,130	28	10,950*3	76	24,557	0	0*4	*3 T-5: 8
Contingency	15 %	62,180					Intake	24,717				24,717			*4 T-3: sub-lateral
Sub-total		476,803		41,718		46,389		131,122		105,981		325,710			*4 After project term some
Pumping station, weir		78,163								0		0	1 set		
Pipelines and others		62,173													
Contingency		21,050										0		161,386	
Sub-total		161,386										0		161,386	
Drainage improvement	ft Drainage 6,600	22,000					3	5,897	5	11,921	8	17,818			Am ou
Main road improvement	21,502 ft	77,207	16,000	36,915	11,860	33,035					27,860	69,950			
Field re-arrangement	771 Ac	308,578	27	1,410	60	28,785	155		47		288		43	45,000	
Farm road		311,647		945		4,555									
Sub-total		629,225		2,355		23,340		112,779		53,702		702,176			* Expenditure till September
Total		1,357,621		80,988		113,264		249,798		171,604		615,654		311,386	
Pilot Farm															
Paddy field		84,698				882				0		882			
Upland & mechanization		612,779	Temporary centre	10,736		75,633	P. F. M. C.	2,070 83,851	Tractor garage	8,079		2,070 178,299			
Total		697,477		10,736		76,615		85,921		8,079		181,251			
Operation & Maintenance															
Water observation station	With raingage 5 points	34,000	Rain-gauge 2	1,445	Water measuring G. A. budget	11,000	Water measuring	2,285	Water recorder 2	1,424	2	67,640 8,869*			
Labourer		100,000				92,040	machine	29,006	machine	2,622		15,907			
Others		184,500				103,040	repair	31,291	repair	38,239		57,199	Repair	30,000	
Sub-total		318,500		1,445								174,015			
Management		126,500	G.A. budget	90,195	Overseers	9,000	Pipe of drinking	6,825		7,174		23,025		* α	
Conveyance		150,000						2,284		0		2,284			
Total		595,000		91,640		112,040		40,430		45,413		90,195 289,523			
Offict & Headquarters															
Head quarters		360,000		423,802*1	Office staff store quaters	35,000		3,445			Store office	13,500 22,134*2			* Land Develop Dept's Budget
Office		55,000				13,500		14,525	Top --- manager	7,609	manager	22,124	Inside	* β	* Materials for M. C. is used.
Others		99,050				25,024		0 --- 2,487		12,114	house	62,511			
Total		514,050		423,802		73,524		30,457		19,723	others	547,506			
Better living															
Co-operative		14,000													
Transport		46,000													
Total		60,000													
Agro industry		24,000													
Ground Total		3,248,158		607,106		375,343		406,606		244,819		1,633,934		314,386	Transport fee in the is — land is not included.