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- March, 1980 -

# News Letter

CITRUS AND VEGETABLE RESEARCH CENTRE BARI

বাংলাদেশ জাতীয় উদ্ভিদ গবেষণা কেন্দ্র  
 国際協力事業団

## PROJECT DIGEST

### INTRODUCTION

The project entitled "Citrus and Vegetable Research Centre" has been drawn up for an initial period of 4 years commencing from September, 1977 at an estimated cost of Tk. 19.52 million by the Bangladesh Agricultural Research Institute in collaboration with the Government of Japan. The main purpose of this project is to promote citrus fruits and vegetable production in the country through intensive research. The Japanese assistance includes grant for the construction of Research Buildings, procurement of equipment and technical advisory service through Experts.

The scheme provides for the establishment of a main centre at Joydebpur, Dacca and three Sub-Centres, each at Jaintiapur (Sylhet), Ishurdi (Pabna), and Rangpur. The project is headed by a Principal Scientific Officer who is being assisted by 7 Senior Scientific Officers and 4 Scientific Officers. The Japanese Expert Team includes one Team Leader, one Expert for Citrus, one Expert for Vegetables and a Co-ordinator. All of the Japanese Experts joined the project in June, 1978.

Since the project is a joint venture of the Japanese and Bangladeshi scientists, it is felt necessary that the social scientists administrators, planners, extension workers and the inter-

ested growers be kept informed of its activities regularly. In view of this, activities of the project are being focused through this monthly bulletin.

### HISTORY

Some events that lead to the establishment of the Citrus and Vegetable Research Centre under the Bangladesh Agricultural Research Institute are enumerated below chronologically:

\* FAO advised Bangladesh Government to establish an institute for the promotion of fruits and vegetables production in the country. (1973).

\* Bangladesh Government requested the Government of Japan to study the problems and to recommend ways and means for the improvement of citrus fruit production and vegetable-seed multiplication. (Aug., 1975).

\* In response to the this request a Mission was sent from Japan to chalk out a plan for the improvement of citrus fruit and vegetable seed production. (Feb., 1976).

\* A second Mission came to Bangladesh to complete and confirm the recommendations of the first Mission. (Aug., 1976).

A long term investigation team comprising of two experts was sent to Bangladesh to formulate the cooperative research work of the project (Mar.—Oct., 1977).

\* Another Mission visited Bangladesh to finalize the land consolidation plan and cooperative research work of the project. (Sept—Nov., 1977).

\* Signing of Record of Discussion. (Nov. 3, 1977).

\* Construction of main building, net house and glass House. (Oct., 1977-Mar., 1978),

\* Joining of Japanese expert team. (June, 1978).

\* Sending of Japanese Mission for consulting and evaluating research programme of the project. (Sept., 1978).

## PHYSICAL FACILITIES

The Government of Japan has provided necessary fund for the construction of the Research Building, Net House, Glass House, Jabara (ware) House, Store-Room with compost pit, Guard-Room, Nursery House, installation

of Deep Tube-Well and Sprinkler Irrigation Set, making of irrigation channels & internal roads, land development (about 12.00 acres) and procurement of laboratory equipment, farm machinery & vehicles for the main centre at Joydebpur.

The Bangladesh Government has provided sufficient fund for the payment of custom duties & taxes against the imported materials. The construction works of the main gate of the Research Building and two roads one connecting the Research Building with the main field and the other with the main gate of the Bangladesh Agricultural Research Institute have been completed. The Government of Bangladesh has also supplied 300,000 nos. of bricks, 150 numbers of C. I. sheets, some strainers for Deep Tube-Well and a good quantity of iron bars and posts.

# PROGRAMME OF WORK

## CITRUS FRUITS

The main objective of the Citrus section of the Project is to carry out experiments to explore the possibility of growing sweet pulp citrus fruits and improvement of sour pulp ones. This section is also assigned to conduct experiments on the improvement of propagational techniques, management practices and to find out suitable rootstocks for Mandarin and Sweet orange varieties. Keeping these in view, the following experiments are proposed to be taken up during 1979-80.

(1)—Introduction of exotic varieties from all over the world particularly countries having similar climatic condition as that of Bangladesh.

(2)—Trial to find out a suitable rootstock for Mandarin and Sweet orange varieties under the agro-ecological condition of Bangladesh. Khasia orange and Kinnow will be tested on Trifoliate orange, Yuzu, Pomelo and Sour-orange rootstocks. The rootstock seedlings are being raised for this purpose.

(3)—Experiment to develop a suitable method/methods of training and pruning for lime and lemon plants.

(4)—Experiment to find out a suitable method of vegetative propagation to replace the existing method of air-layering in lime and lemon.

## VEGETABLES

In Bangladesh, the rice had been the main agricultural crop for a long time. In the agricultural sector, special emphasis was given to its increased production. In recent years, the demand for vegetables and fruit in the market are increasing. But except a few special farmers living in the suburbs of big cities, most of the farmers cultivate vegetable for self consumption, and only the excess quantity are being sent to the market for sale. Therefore, most of the farmers are not interested about improving their qualities.

In the advanced countries, the quality of vegetables is an important factor. Unlike rice and other cereal crops, the price of vegetable is greatly dependent upon their quality. At the present stage of vegetable production in this country, the problem of quantity should get priority over other factors. To make the diet of people a balanced one, the quality of vegetable must come into consideration. In the suburbs of big cities such as Dacca, the question of quality has already come into picture. From this point of view, it is not only the cultural method that should be improved but utmost effort should also be given to spread species of excellent quality by solidification of research organs and expanding the organizations for seed production.

In order to materialize the above objectives the following programmes have been chalked out for implementation :

### A. Breeding

- (a)—Collection of both local and exotic cultivates for testing and classification.
- (b)—Investigation of diseases and sorting out of resistant varieties.
- (c)—Selection of adaptable exotic varieties.
- (d)—Crossing between superior local fixed varieties and exotic fixed varieties.
- (e)—Breeding for  $F_1$  varieties.

### B. Seed Production.

- a)—Regulation of flowering by low temperature treatment.
- b)—Investigation of the flowering habit influenced by environmental and cultural factors.
- c)—Development of methods to prevent inter-varietal cross-pollination.
- d)—Improvement of cultural methods for seed production in relation to stage of maturity and method of harvesting.
- e)—Investigation into seed-borne-diseases and establishment of the method of seed-disinfection.
- f)—Improvement of storing, processing and packing devices in the laboratory as well as at growers level.

## PATHOLOGY

Plant disease is one of the greatest natural hazard which may sustain a loss varying from 5 to 100 percent depending upon the intensity of incidence to all agricultural crops including fruit and vegetables. The principal objective of this section is to look for high yielding disease resistant varieties of citrus and vegetable crops. Therefore, the following research programme have been drawn up for implementation.

- 1)—Survey on frequency of main diseases.
- 2)—Identification of virus diseases.
- 3)—Protection tests on virus and other diseases.
- 4)—Gradual elimination of virus through the process of non-poisonous conversion of virus and production of restable virus individual by vaccination of weak toxin in citrus plants.
- 5)—Screening of local and exotic varieties of different species of vegetables against main diseases.

- 6)—Studies on the seed borne diseases of vegetables and developing methods of control of them for package purpose.

## Training In Japan

There are four different types of training out of which individual training and academic training are important. Individual training is also known as on the job training or production training. This training may be imparted on individual basis or in groups. The objective of this type of training is to equip an individual in order to perform his duties in a better and efficient way. The academic training which is also known as developmental training is imparted to an individual for shouldering higher responsibility. This type of training may offer higher degrees leading to M. S. or Ph. D. to the individual.

All technical training facilities provided by the Government of Japan to the developing countries are administered by the Japan International Co-operation Agency under the direct supervision of the Ministry of Foreign Affairs. Both the Group training course and the Individual training course are being offered by the JICA to the scientist working in the Citrus and Vegetable Research Centre. The Group training courses are organized to cover those subjects which are favoured by the developing countries and the training is conducted under pre-arranged programme, while individual training course are conducted as per requirement of the individual trainee on specific subject desired by the recipient country.

In the year 1978-1979 six scientists have been sent to Japan for higher training from this project. Their names and places of training are as follows :—

- 1)—Group Training Course (Vegetable Crop Production)

Place : Uchihara International Agricultural Training Centre.

Name of Trainee :

ABUL HOSSAIN, S. O., BARI.

ASIT KUMAR SARKAR, S. O., C & V Project, BARI.

- 2)—Individual Course.

Place : Vegetable and Ornamental Crops Research Station in Mie-Prefecture.

Name of Trainee :

ABUL AHAD MIAH, S.S.O., C & V Project, BARI.

MOZAMMEL HOQUE, S. S. O., BARI.

Place : Fruit Research Station, Kuchinotsu Branch in Nagasaki Pref.

Name of Trainee :

ABUL BASHAR, Fruit Development Officer, BARI.

A.K. M. MAHTABUDDIN, S. S.O., BARI.

## New Collection

Three varieties of Pomelo namely Kawachi Bankan, Amanatsukan and Beni-Hassaku; 3 varieties of lemon namely villa-franka lemon, Lisbon-lemon and Ureka lemon; 5 varieties of Mandarin orange namely Miyaga wase, Mihowase, lokan, Hyuganatsu and Okitsu-wase and 2 varieties of sweet orange namely Yoshida Navel and Washington Naval have been collected from Japan. These varieties along with 11 other previously procured varieties have been planted in the field at Joydebpur during August, 1979. They are now under observation.

Edited by A.M. Abdullah, Senior Scientific Officer (Citrus)

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# **BARI** newsletter

CITRUS AND VEGETABLE RESEARCH CENTRE BARI

Bangladesh 園芸研究協力 国際協力事業団

## Importance and Prospect of Plant Introduction In Bangladesh

There are innumerable number of edible plants in the world. Dr. T. Tanaka has described more than ten thousand edible plants in his book "Tanaka's" Cyclopedia of Edible Plants of the World' (1979), and has classified them into species and varieties. The edible plants included there under are fruits and vegetables only. Again Dr. M. Nakamura listed more than eight hundred numbers of major and minor fruits in his book "An Iconograph of Fruit Trees of the World" (1978). Logically, the number of edible vegetable plants comes to about nine thousands which is arrived at simply by deducting the number of edible fruit plants from the total number of horticultural plants viz fruits and vegetables.

The present century is called the century of oil, but it is a common belief that the next one will be a century of energy. Again some people believe, it should be the century of agriculture/foodstuff because of the rapid increase in the world population. Thus the necessity of foodstuff will be felt more important than the energy. In case of Bangladesh, it seems that the country is stepping to the twenty-one century; twenty year ahead of the other countries of the world, from the view point of growth of population and shortage

of foodstuff. It is also observed that the people of Bangladesh are very much conservative about the choice of foodstuff in daily diet in spite of their profound knowledge about the importance and nutritional value of foodstuff.

According to various foreign experts there had been inadequate effort on the part of the Department of Agriculture to introduce edible plants from foreign countries. South-East Asia, India and Sri-Lanka are rich in plant resources which were introduced there during the last century by the Europeans. They procured many kinds of plant species from other countries which are being reared in their botanical gardens. The name of Calcutta Botanical Garden (India), Buitenzorg Botanical Garden (Java) and Peradeniya Botanical Garden (Ceylon) are worth mentioning.

Though Bangladesh is situated very close to Calcutta, the people of Bangladesh could not accept the benefit of the work done by the Calcutta Botanical Garden for the sake of geographical obstacles, existence of big rivers etc. This is why Bangladesh is now very poor in the number of crops as compared with other surrounding countries. In this country wheat has been accepted by people

as a major foodstuff very recently, Cassava is not yet domesticated enough as a crop because the demand is not enough at present; Kangkong and Winged Bean are still under trial cultivation. All such crops are domes-

ticated long before in other countries of the world. Considering the present condition of Bangladesh it is considered necessary that an introductory comments of the prospective crops will be of great help in this regard.

# Cassava

## A Real Substitute for Imported Starch

Cassava (*Manihot esculenta* Crantz.) is an important food and a major source of starch in many countries of the world particularly in the tropics. Cassava is of two kinds eg. sweet and bitter. The roots of sweet cassava can be eaten raw after peeling while bitter cassava roots are eaten after destroying the HCN (Hydrocyanic glucoside). Cassava starch is used in the manufacture of adhesive, cosmetics and in textile industry. It is also used in the confectionery for making biscuits etc. In some countries beer and some alcoholic drinks are also prepared from Cassava.

The cultivation of this crop is as old as 4000 years in Peru while it is 2000 years old in Mexico. The other important places of its cultivation are Brazil, Guatemala and the American tropics. Cassava was brought to Calcutta in the year 1794 and other important places of its cultivation in Asia are Ceylon, Indonesia and Thailand. All these countries export cassava products and earn huge amount of foreign exchange. In Bangladesh it has not yet found its place in the cropping pattern. It is found growing wild in the hills of Chittagong hill tracts. The tribal people already have developed some habit of eating cassava root.

Bangladesh import about 10 tons of patent starch in the form of Sagu and Barley annually by spending huge amount of foreign exchange. The successful cultivation and subsequent establishment of extracting plant will help the country to stop further import of processed starch.

Cassava can be grown in any type of soil of reasonable fertility with pH ranging from 5 to 8.5. It can withstand waterlogging. The soil should not be too shallow or too stony. It can not stand cold or frost. Any temperature below 18°C is not congenial for its growth. It can be successfully grown in regions having 20 to 200 inches rainfall per annum, it is therefore valuable in regions with low and uncertain rainfall.

Cassava can be classified into two groups viz sweet or short period cassava and bitter or long period Cassava. The short period cassava matures within 6 month after planting and can not be kept in the field for more than 10-11 month while the long period cassava takes at least a year to mature and some of them can be left in the field without serious deterioration of qualities. The sweet cassava is low in HCN content in comparison with bitter cassava.

Cassava is propagated by stem cuttings of 9-12 inches long for all economic plantation. Utmost care should be taken to plant cuttings free from any virus infection. It is preferable to have the cuttings from the middle of the stem, because the base of the stem are more likely to be infected with mosaic virus.

Since it a root crop, deep and through cultivation of soil is necessary to facilitate the root development. The planting is done in rows before the advent of rainy season with 3' to 5' spacing. The normal practice of growing

cassava is without manure. However, with the addition of manures and fertilizers its yield can be increased at least 2-fold. Weeding should be done during the early stages and the plants are usually earthed up 2-3 months after planting.

The tubers are usually dug individually as they start to rot within 48 hours after being taken from the ground. Yield varies with the care taken after planting, incidence of virus disease etc. In a crop with good management practices the yield of 20-26 tons per acres has been recorded.

## Joint Committee Meeting

This committee was formed at the time of signing of Record of Discussion between the Government of the Peoples Republic of Bangladesh and the Government of Japan with representatives of both the Government for formulating operational work plan for smooth implementation of the project. The committee held its first meeting on 22-11-79 in the room of Joint Secretary (Research), Ministry of Agriculture and Forests, Bangladesh Secretariat, Dacca. A thread-bare discussion was held on the past activities and future work plan of the project and the following decision were taken:—

\* Construction work including axillary facilities like fencing etc. for the development of Joydebpur Centre of the project should be expedited and maximum efforts be taken to complete the incomplete work by June, 1980 by utilizing all the fund allocated for the project. Ministry of Agriculture and Forests be moved to place all the fund provided by Planning Commission so that smooth implementation of the project could be effected.

\* Development of different sub-centres under the project should be taken up seriously and the Japanese Government may be approached for all possible assistance in this regard.

\* Research of field activities as per approved project be taken up simultaneously with the construction/development works for the main centre and sub-centres of the project.

\* The Committee felt that the programme given in the approved scheme is on broad out lines. Therefore, 2 separate technical sub-committees; one for citrus fruits and the other for vegetable be formed to prepare details of the experiment including title, methodology etc for the next five years.

\* All the vacant posts including the technical posts be filled up without further loss of time. Foreign training programme under the project be taken up in phases keeping in view the research activities of the project.



\* Japanese Government should be moved by Ministry of Agriculture & Forests through Planning Commission for extension of the Japanese assistance for the project during the second plan.

\* The progress report on the activities of the project (upto October, 1979) prepared for consideration in the Inter-Government Committee meeting along with the minutes of the meeting held on 22-11-79 should be sent to the Planning Commission to serve as an Evaluation Report for the purpose of taking up the issue of extension of the agreement with the Japanese Government upto 1985 by the Agriculture Division of Planning Commission.

\* A revised scheme in the expanded form for the second plan (1980-85) be prepared and submitted to the Planning Commission in order to meet the increased demand of fruits and vegetable of the country. Care should be taken to avoid duplication in research activities in these fields.

\* It was decided that every member of the Joint Committee should see the project area before the next Joint Committee meeting is convened. So the project should organise a half field day at a convenient time so that the member of the committee as well as other allied agencies may get a chance to see the project.

The meeting ended with vote of thanks from the Chairman.

## VISIT TO A NEIGHBOURING COUNTRY ( ASSAM )

Mandarin orange and other citrus fruits are being grown successfully in the Meghalaya State of India which is adjoining to the north-eastern part of Bangladesh. It is most likely that the varieties grown in the adjoining Indian State will be adaptable to Bangladesh climate. In order to have a first hand idea about the cultivation of mandarin orange and to collect some sapling of different citrus species; two experts working in the project visited the Indian State of Meghalaya recently. They visited quite a large number of orange orchards and had long discussion with a good number of orchardists / growers about the cultivation of mandarin orange there. On return from the visit the experts gave the following comments.

\* Mandarin Orange in general are cultivated through air-layering or from seeds.

\* The orange orchards under betelnut trees produce less, inferior quality and small sized fruits in comparison with the plants growing under open sun.

\* Good orchards are situated along the lower altitudes i.e. altitudes below 2000' is good for orange cultivation.

\* Die-back is also prevalent in the Indian State of Meghalaya which is gradually decreasing the production of mandarin orange.

# **BARI** newsletter

CITRUS AND VEGETABLE RESEARCH CENTRE BARI

বাংলাদেশ শেখ হাসিনা কৃষি গবেষণা কেন্দ্র  
 国際協力事業団

## Comparative Trial of Cabbage Varieties in Different Season

1. Objective : The study was undertaken to evaluate the performance of various cabbage varieties in different seasons to identify some of adaptable varieties for a particular period and to extend the cultivation in existing cropping pattern.

2. Materials : For the 1st trial, 9 cabbage varieties were used as shown below :

- (1) F-1 Express Cross (Takii Co., Japan)
- (2) F-1 K-Y Cross (Takii Co.,)
- (3) F-1 N-S Cross (Takii Co.,)
- (4) F-1 Green Cross (Takii Co.,)
- (5) F-1 All Season Cross (Takii Co.,)
- (6) F-1 Mori Shogun (Kyowa Seed Co. Japan)
- (7) F-1 O-S Cross (Takii Co.)
- (8) F-1 Ogocho (Ishii Seed Co. Japan)
- (9) F-1 Morikagayaki (Kyowa Seed Co.)

For the Second trial, 13 varieties of cabbage were used as follows ;

- (1) F-1 K-K Cross (Takii Co.)
- (2) F-1 K-Y Cross (Takii Co.)
- (3) F-1 N-S Cross (Takii Co.)
- (4) F-1 Green Cross (Takii Co.)
- (5) F-1 O-S Cross (Takii Co.)
- (6) F-1 Express Cross (Takii Co.)
- (7) F-1 Kinkie No. 201 (Sakata Seed Co. Japan)
- (8) Yoshin (Takii Co.)
- (9) F-1 Morikagayaki (Kyowa Seed Co.)
- (10) F-1 Ogocho (Ishii Seed Co.)
- (11) F-1 Mori Shogun (Kyowa Seed Co.)
- (12) Golden Acre (India)
- (13) F-1 Atlas No. 70 (Sakata Seed Co.)

3. Method : (1) Raising of seedlings : The first sowing for trial was done on 23-6-79, and the second one was on 26-9-79. The size of the seed bed was 10' x 3', and the surface soil was mixed with fully fermented compost (Water Hyacinth), then the mixed soil was treated with fungicide to protect from damping off disease of the young seedlings. Next the soil was covered with polyethylene sheet for making the soil warm to control the soil born diseases. No chemical fertilizer was applied. Seven days after the preparation of seed bed, seeds were sown in lines and covered with light soil about 3mm in depth. Water was supplied with a watering can at need and the necessary care was taken to avoid excessive wet or dry condition of the soil surface.

The size of transplanting bed was also 10' x 3'. These beds were prepared at the same time as the seed bed. Compost and chemical fertilizers were mixed uniformly with the soil at the time of 5-7 days before transplanting. The soil was treated with fungicide to avoid damping off disease. Then the seedling under cotyledon stage (7 days after germination) were transplanted at the distance of 4' x 3' in line. Irrigation was done with watering can

Fertilizer	Total quantity (kg)	Basic dose (kg)
Compost	500	500
Urea	80	40
T.S.P.	50	50
M.P.	70	40

5) Time of fertilizer application :

1st application : 7 days after planting.

2nd application : 15 days after 1st application.

3rd application : At the beginning of head formation.

6) Irrigation : Irrigation was given immediately after planting. The frequency of irrigation was determined according to the

immediately after transplanting. Then the beds were covered with net screen to protect the plants against the direct sunlight.

The proper care was given during the period of seedlings in due consideration of following points—(a) Irrigation for the transplanting beds so as to maintain it in a desirable temperature. (b) Mulching between the rows. (c) Application of a small quantity of urea to the seedlings when they do not grow as they should be. (d) Spraying insecticide (Malathion) and fungicide to control insect pests and diseases.

2) Design : Randomized block design of 3 repeats was applied.

3) Planting into the main field : The seedlings of 5-6 leaf stage were planted on ridges in double row system. The width of the ridges was 3' and their space was 1' and plant to plant was 5". Before few hours of planting the irrigation was applied to the bed to make the soil adhesive enough.

4) Application of fertilizers : The following quantity of manure and fertilizer were applied per acre :

	1st top-dressing (kg)	2nd top-dressing (kg)	3rd top-dressing (kg)
—	—	—	—
10	10	20	—
—	—	—	—
—	—	—	—

nature and the dryness of the soil. Furrow irrigation was given through drains as and when required.

7) Inter-tillage : Inter-tillage was done immediately after each top dressing, and also given when the soil hardened after irrigation.

8) Plant protection : Malathion (insecticide) was sprayed (10cc/10 litre) at 7 day intervals.

4 Findings : In case of 1st trial, the variety F-1 Express Cross (1) was found to be early matured and showed the highest yield potential. F-1 Mori Shogun (6) was late variety which was resistive to insect pest and had a good yield and growth in rainy season.

In case of 2nd trial the variety F-1 K-K Cross (1) was the earliest and showed a good

yield potential. F-1 K-Y Cross (2), F-1 O-S Cross (5), F-1 Express Cross (6), F-1 Kinkie No. 201 (7), and F-1 Mori Kagayaki (9) seemed to be medium varieties and they showed very encouraging yield and growth performance. F-1 N-S Cross (3), F-1 Green Cross (4), F-1 Ogocho (10), F-1 Mori Shogun (11), and F-1 Atlas No. 70 (13) were late varieties but actually they had the highest yield and had good compactness of their head.

### Yield of the Varieties

Trial	Name of Variety	Yield per acre	
1st	1 F-1 Express Cross	10,781	kg.
	2 „ K-Y Cross	6,060	„
	3 „ N-S Cross	4,260	„
	4 „ Green Cross	3,994	„
	5 „ All season Cross	4,640	„
	6 „ Mori Shogun	9,936	„
	7 „ O-S Cross	3,680	„
	8 „ Ogocho	4,157	„
	9 „ Morikagayaki	4,963	„
2nd	1 F-1 K-K Cross	19,136	kg
	2 „ K-Y Cross	17,856	„
	3 „ N-S Cross	21,709	„
	4 „ Green Cross	24,346	„
	5 „ O-S Cross	18,128	„
	6 „ Express Cross	17,510	„
	7 „ Kinkie No. 201	21,114	„
	8 „ Yoshin	18,629	„
	9 „ Morikagayaki	21,043	„
	10 „ Ogocho	22,669	„
	11 „ Mori Shogun	26,400	„
	12 „ Golden Acre	10,803	„
	13 „ Atlas No. 70	17,523	„

# A Desirable Plant for Bangladesh

## Chinese lotus ( *Nelumbo nucifera* CAERTN )

Bangladesh is full of tanks, and almost all of them are now covered with waterhyacinth which is of no use for ordinary human life except for compost. As such there may be some ideas of utilizing these tanks for the production of crops like Chinese lotus. As the wild type of lotus is found in Bangladesh, it is evident that the cultivable type of the lotus also could be successfully grown in the innumerable unused tanks in Bangladesh. The swollen rhizomes of Chinese lotus is starchy and can be eatable after boiling as vegetables. The seeds (fruit in fact) are also edible as like as that of nuts.

In China as well as Japan, Chinese lotus is much consumed. In Southeast Asia it is said that some people eat the lotus as they could escape from the troubles in their daily life. The reason depends upon a misunderstanding on lotus. Western people did not know about Chinese lotus, and the word 'lotus' has been applied to some other plants. The most famous plant under the name of lotus is a imaginary plant which appeared in Odyssey, the wellknown historical poem written by the great poet, Homer in ancient Greece. In the story of Odyssey, it is said that by eating lotus fruit, a man can be free from every suffering in this worldly life. People who

gave themselves up to pleasure by eating lotus fruits were named 'Lotophagi'. It is strange to say that there is a plausible tradition that the Lotophagi was a tribe who had lived near around Syrtis Minor in North Africa, where Odysseus, the host of Odyssey had visited, and the tree bearing lotus fruits might be a kind of jujube (*Zizyphus lotus* LAM.) grown in North Africa.

As such there is a different recognition on lotus between European and Eastern people. The lotus of Europe is imaginary plant, but that of China and Japan is a real plant which may be useful for the people of Bangladesh when its cultivation is actualized.

### Trainees returned from Japan

Six trainees who were sent to Japan under the individual and group training courses by JICA in 1979 for Citrus and Vegetable production returned to Bangladesh. They resume their duties as shown below :

1. Mr. Abdul Ahad Miah, S.S.O (CVRC)
2. Mr. Mozzammel Hoque, S S.O (BARI)
3. Mr. Abul Bashir, S.S.O (BARI)
4. Mr. Mahtabuddin Ahmed, S S.O. (BARI)
5. Mr. Asit Kumar Sarker, S.O. (CVRP)
6. Mt. Abul. Hossain, S. O. (CVRP)

# **BARI** newsletter

**CITRUS AND VEGETABLE RESEARCH CENTRE BARI**

**バングラデシュ園芸研究協力 国際協力事業団**

## 1. Japanese Evaluation Team

The Japanese Evaluation Team consisting of five members headed by Mr. YUKOH SUGAHARA evaluated the Citrus & Vegetable Seed Research Centre with effect from 18.5.80 for a fortnight whose Record of Discussion will expire on November 2, 1980. During their stay here, they reviewed the results of the research cooperation project so far achieved since the beginning of the project.

Evaluation was made on i) dispatch of Japanese experts and training of Bangladeshi researchers in Japan, ii) equipment supply, iii) land reclamation and iv) present situation of research work and others.

The team recommended that technical co-operation period should be extended for another three years after the expiry of present Record of Discussion period and the research programmes should be revised in the light to their discussion for the 2nd Five Years Plan.

## 2. Departure and arrival of Japanese Expert.

Dr. Shunkichi IWASA, Team leader and Mr. Takao KITAJIMA, Co-ordinator left for Japan on June 25, 1980 on completion of their assignment for two years in Bangladesh.

Mr. Shiro AIHARA, the successor of Dr. S. IWASA arrived Bangladesh on June 24, 1980 as a new Team Leader of Citrus and Vegetable Seed Research Centre.

## 3. Desirable Fruits in Bangladesh

The tropics is a treasury of fruits. In Bangladesh however, there is no such a phase though Bangladesh belongs to the subtropical zone as well as the tropics. One of the reason is that in other tropical countries, viz. India, Sri Lanka, Malaysia and Indonesia, there were famous botanical gardens into which many fruits have been introduced by the efforts of the suleran countries from all over the world along with other useful plants. Calcutta Botanical Garden in India, Peradeniya and Hokkala Garden in Sri Lanka, Singapore Botanical Garden in Malaysian Peninsula, Buitensorg (present Bogor) Botanical Garden in Indonesia etc. are famous for having the role of introducing work in the past. Accordingly in these countries, people enjoy various kinds of fruit. Compared with this countries, in Bangladesh market there can be seen only a limited number of fruits, viz. banana, guava, pineapple, coconut, litchi, jack-fruit, mango, papaya, and some of citrus as the major fruit.

It can be said that some other kinds of fruit which belong to the same group of existing fruits in Bangladesh, will be easily domesticated under the circumstances of this country. For example, longan and rambutan belong to the same genus of litchi, salak belongs to the same family of coconut as the tropical origin in both.

Not only the introduction of new species but there is a room to introduced better variety in place of existing one, for example sweet tasted carambola, bigger sized guava etc.

The tables shown below are the lists of desirable fruits to be introduced in Bangladesh which consist of new species for increasing the number of fruit kind, and varieties for improving the quality of existing variety, with the consideration about the resemblance of circumstances.

(Part—1) LIST OF DESIRABLE FRUITS TO BE INTRODUCED IN BANGLADESH

Name of fruit (Scientific name)	Reason of introduction	Region to be introduced from ( Originated place )	Allied fruit existing in Bangladesh
1. Avocado ( <i>Persea americana</i> MILL.)	o World wide famous nutritious fruit	o Taiwan, Philippines (Tropical America)	o
2. Bread-fruit ( <i>Artocarpus incisa</i> LINN. f.)	o For foodstuff	o Sri Lanka (Polynesia)	o Jackfruit (Kattal)
3. Chinese date ( <i>Zyzyphus jujuba</i> MILL.)	o To expand the demand of jujube	o China (India)	o Indian Jujube (Boroi)
4. Duku ( <i>Lansium domesticum</i> JACQ. var. <i>duku</i> JACQ.)	o As a new type of fruit	o Indonesia (Malay)	o
5. Feijoa ( <i>Feijoa sellowiana</i> BERG.)	o Excellent texture	o California, Japan (South America)	o Guava (Peyara)
6. Fig <i>Ficus carica</i> LINN.)	o One of common fruit in the world	o Japan, Europe (South America)	o Jackfruit (Kattal)
7. Gandaria ( <i>Bouea gandaria</i> BLUME)	o As a hopeful fruit in future	o Indonesia (Malay, Sumatra)	o Hog plum (Amra)
8. Granadilla ( <i>Passiflora quadrangularis</i> LINN.)	o As a new type of fruit	o Indonesia (South America)	o
9. Great hog plum ( <i>Spondias cytherea</i> SONN.)	o To expand the demand for Amra	o Malay, Java (Polynesia)	o Hog plum (Amra)
10. Kiwi ( <i>Actinidia chinensis</i> PLANCH.)	o As a new type of fruit	o New Zealand (China)	o
11. Lambutan ( <i>Nupheliium lappaceum</i> MIH.)	o To expand the fruiting season of litchi	o Malay, Indonesia (Malay)	o Litchi (Lichu)
12. Longan ( <i>Euphoria longana</i> LAM.)	o To expand the season of litchi's family-fruits, especially with fragrance	o Taiwan, Java (South China ?)	o Litchi (Lichu)
13. Macadamia ( <i>Macadamia ternifolia</i> F. V. MUELL.)	o One of superior nuts	o Hawaii (Eastern Australia)	o
14. Madras thorn ( <i>Pithecellobium dulce</i> BENTH.)	o As a sweet pulp type of tamarind	o Thailand (Mexico)	o Tamarind (Tetuf)
15. Malay apple ( <i>Eugenia malaccensis</i> LINN.)	o Good flavour	o Java, Malay (Malay)	o Guava (Peyara)

16. Monkey jack ( <i>Artocarpus rigida</i> BL.)	o Moderate size, better quality than jackfruit o For jelly as well as hedge	Malay, Java (South-east Asia)	o Jackfruit (Katthal)
17. Natal plum ( <i>Carissa grandiflora</i> A. D. C.)	o As a new type of fruits.	o India, Sri Lanka (Africa)	o Carissa (Karamcha)
18. Passion fruit ( <i>Passiflora edulis</i> SIMS.)	o As one of nuts	o India, Hawaii (Brazil)	o
19. Pimpon ( <i>Sterculia monosperma</i> VENTENAT.)	o Small but beautiful good for juice	o Taiwan (South-China)	o
20. Pitanga ( <i>Eugenia michelii</i> LAM.)	o Moderate size for eating flesh	o India (Brazil)	o Guava (Peyara)
21. Salak ( <i>Zalacca edulis</i> BLUME.)	o To prevent the import	o Java (Java)	o Coconut (Narical)
22. Sapodilla ( <i>Achras zapota</i> LINN)	o Moderate size, better quality than jackfruit	o India (Tropical America)	o
23. Small jack (Champedak)	o For juice, and desert	o Malay, Java (Malay)	o
24. Soursop ( <i>Annona muricata</i> LINN.)	o One of famous fruits in tropics	o Sri Lanka (West Indies)	o Sugar apple (Ataphal)
25. Tree tomato ( <i>Cyphomandra betacea</i> MERS.)		o Sri Lanka, India (Peru)	o

Part - 2 LIST OF DESIRABLE VARIETY OF FRUITS TO BE INTRODUCED IN BANGLADESH

26. Guava ( <i>Psidium guayava</i> LINN.)	o Fruit size	o Thailand (Tropical America)	o Guava (peyara)
27. Lime ( <i>Citrus aurantifolia</i> SWINGLE)	o Fruit size and quality	o California (India)	o Lime (Lebu)
28. Calambola ( <i>Averrhoa carambola</i> LINN)	o Sweet pulp	o Indonesia (Tropical Asia)	o Calambola (Kamaranga)
29. Emblic ( <i>Emblca officinalis</i> GAERTN)	o Fruit	o India, Philippine (South-east Asia)	o Star gooseberry (Loi)
30. Velvet apple ( <i>Diospyros discolor</i> WILLDENOW)	o Texture	o India (Philippine)	o Velvet apple (Belati gab)



# Prospect of fruits industry in Bangladesh

Bangladesh is an agricultural country, but her (per unit) production of various crops are one of the lowest in the world. The people of this country suffering from malnutrition due to insufficient quantities of fruits, vegetables etc.

There are only two agricultural based export oriented industry in the country and they are jute and tea industry. In case of horticultural crops there is not yet any large scale export oriented industry (few small factories processed some types of fruits for small scale production and almost all of them are consumed locally,) even these are not enough to feed large masses of people). On the other hand these factories cannot produce international standard canned fruits. Before commercial production of any fruits industry there should be extensive research for the production of good qualities and quantities of fruits.

Plants require light, temperature and sufficient water for their growth and development. The climate condition of Bangladesh is favourable for growing many horticultural crops, as light is intensity, and yet temperature and water are more than enough for proper plant growth. Draught and flood during dry and rainy season respectively cause heavy damage to the crops. This can be easily overcome by using irrigation water during season and by making good drainage system during rainy season. There are some fruit crops like pineapple and mango which are already established in certain areas and grow better under adverse climatic condition like flood, storm and draught.

A project has been already started to raise the production of citrus fruits to minimize the import of citrus fruits from abroad. In addition to that, if we think about processing of

fruits other than citrus in the canning factory we can supply sufficient quantities of fruit on the table throughout the year. Due to lack of processing plants in Bangladesh a lot of fruits specially mango and pineapple decayed during the harvesting season. If we can process the harvested fruits in the canning factory we can save huge quantities of fruits from rotting. This will help to feed our masses and can also earn foreign currency. In developed and developing countries a lot of canned fruits are produced and used for local consumption throughout the year and also for export. If we have such factories is also prospect to export the canned fruits to the Middle East countries. Installation of fruits canning factory does not cost much and as such there is a good scope for canning various fruits like mango, pineapple etc., in Bangladesh. The Horticultural Division of BARI and BCSIR (Bangladesh Council of Scientific and Industrial Research) can take up a joint programme to study different aspects of fruits processing in Bangladesh as BCSIR has already working on fruits processing and canning technology for commercial production.

## VARIETAL TRIAL ON CUCUMBER

Ten exotic and one local varieties were tried in this experiment. The variety 'AMERICAN YARD LONG' was found to be earliest flowering and maturity. The varieties 'WASE FUSHINARI' and 'SUYO FUSHINARI' and 'ASAHIKOHAI CHIKANARI SANTO' were found to be promising and superior to the other varieties in respect of fruit quality and yield per unit area. The strain 'LOCAL NO. 2-1' and 'THAI NO. 18' were found to be very late in respect of maturity period but the yield of these two varieties were identical with those of promising exotic varieties.

**BULLETIN EXTRA NO.-1**

**COMMENTS ON CITRUS**

*March, 1980*

**Citrus and Vegetable Research Centre,  
BARI, Joydebpur, Dacca,  
Bangladesh**

## COMMENTS ON CITRUS

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## 1. Citrus Production in Bangladesh

The major part of Bangladesh territory is flat, where only sour pulp citrus fruits viz. lemon, lime and pomelo can be grown. Northeastern part of this country is surrounded by hills, where sweet pulp citrus fruits can be cultivated economically. The southeastern part of the country comprises of hilly areas which could be productive area for citrus fruits, but Tropic of Cancer is running over that part making it a tropical zone with annual mean temperature of 20–30° C (68–86° F), which is something higher for sweet pulp citrus fruits (sweet and mandarin orange). The northeastern part of the country seems to be suitable, theoretically, for sweet and mandarin orange cultivation from the viewpoint of drop of temperature in autumn which occurs due to blowing of cool air from the Himalayan Mountains. But this area again has several disadvantages to be perfectly suitable for citrus culture, long distance from commercial centre of Dacca, a handicap on transportation by ferries, lack of interest to produce horticultural plants among peasants. Furthermore, the gusty wind and storm which are a common phenomenon in Bangladesh also passes through Sylhet area which is the most productive place for citrus fruits causing damage to the fruits. Thus, in Bangladesh there exists a very unfavourable situation in respect of citrus fruit cultivation.

Under such adverse climatic condition, Bangladesh Government have taken up a plan to promote citrus cultivation with the aid of Japanese Government by undertaking a joint project named Citrus Research Centre. As such, "research" has a very important meaning, because without research, Citrus cultivation cannot be made successfully under such a unfavourable natural condition like Bangladesh. In Bangladesh there is a possibility that some completely different types of citrus fruit production might be established which is not seen in the other citrus producing areas of the world.

There are two types of citrus fruits; one of them is sour pulp citrus fruits like lemon, lime and pomelo which are extensively grown in this country, and the other one is sweet pulp citrus fruits like sweet and mandarin orange, which constitute the key industry of citrus in the warmer part of Temperate Zone. The ultimate purpose of this research project is (1) To supply citrus fruits to the people as a source of vitamins and minerals, (2) To promote citrus production so as to make it a crop for increasing farmer's income, (3) To cut down importation of citrus fruits from neighboring countries. The most endeavour to attain those objectives may be directed to establish a standard cultivation method, for acid pulp citrus fruits at the beginning which are used for culinary purposes. But the national desire for the production of citrus fruits is apparently directed to sweet pulp only. For the successful cultivation of sweet pulp citrus, dropping down of temperature in autumn and

at least 10° C variation in daily temperature is necessary for the accumulation of sweetness especially for citrus fruits originating in Temperate Zone. So for the cultivation of sweet pulp citrus fruits in this country, the location where has low temperature in autumn should be found out by detailed survey. But it will be difficult to find out a location of having 10° C variation in daily temperature in this country. Therefore, introduction of sweet pulp of citrus fruit varieties suitable for tropical areas will be helpful to fulfil this purpose. In the tropical areas of the world, there are many sweet pulp citrus fruit varieties which have originated in the tropics. If the citrus industry of Bangladesh could be replenished with tropical varieties of sweet and mandarin oranges it can find a place in the list of citrus producing countries of the world. The ultimate purpose of citrus research in this country is to establish the cultivation of sweet pulp citrus fruits somehow.

## 2. Present Status

Citrus fruits are generally considered to be an important part of the fruit community that are grown in Bangladesh. They, however, constitute a small part of the total area of land under different fruits and also a small part of the total production of fruits of the country. Again Bangladesh's position in respect of production of this fruits is exceedingly poor in comparison with other countries of the world. According to available statistics, Bangladesh produced (1974-75) only 20,000 tons of different Citrus fruits including 4,000 tons of oranges, 4,000 tons of limes and lemons and 3,000 tons of pomeloes.

Citrus fruits of Bangladesh are generally put under four groups, namely, (1) Limes and Lemons, (2) Pomelo, (3) Mandarin and sweet orange, (4) Other citrus fruits.

### (1) Limes and Lemons

There are two types of lime grown in Bangladesh, namely, Kagzi and Pati lebu. Kagzi is roundish or oval in shape while Pati lebu is either oval or elliptical. There are many kinds of lemons, but they are not classified. However, there are two well-known varieties, such as Elachi, which is scented, and the other one is seedless. The seedless lemon was selected by the Division of Horticulture and recommended by the Department of Agriculture. These kind of citrus fruits are generally grown in homestead all over Bangladesh particularly in the district of Sylhet, Chittagong, Kustia, Rajshahi, Rangpur and Faridpur.

### (2) Pomello

Pomeloes are grown all over the country in homestead gardens. There is no recognized

variety of pomelo in Bangladesh but they belong to two general groups, such as red-fleshed and white-fleshed ones.

### (3) Oranges

There is only one recognized variety of mandarin orange which is known as Chattak or Khasia orange. The cultivation of this type of orange is confined to Sajek valley and Ruma region of Chittagong Hill Tract and Jaintiapur, Srimongal, Beani-bazar, Baraleka, Kulaura, Gowainghat police station of Sylhet district. Malta is only a variety of sweet orange in this country.

### (4) Other Citrus Fruits

These include citron and rough lemon besides others. They spread all over the country. They are yet to be collected and classified.

### (5) Research Work Already Done

The Division of Horticulture of the Bangladesh Agricultural Research Institute was responsible for carrying out research in the field of citrus fruits. As the division has many other major fruits like Banana, Mango, Pineapple, Papaya, Jackfruit, etc., it has not been possible to pay exclusive attention to undertake research in citrus fruits. A modest attempt was, however, made to do some experimental work particularly pertaining to trial of some exotic varieties of mandarin and sweet oranges at Jaintiapur in the district of Sylhet.

A number of varieties of both sweet and mandarin orange were obtained from the West Pakistan in 1961 and planted out at the Citrus Research Station at Jaintiapur, Sylhet. The varieties of sweet orange, comprised Blood Red, Decibre, Jaffa, Mosambi, Pineapple Ruby Red, Suckery and Washington Neval and the mandarin oranges were Fuétrell's Early, Kinnow and Nagpuri. Plants grew and produced fruits profusely very early. In the beginning the taste was not generally sweet, but with age plants produced fruits sweeter than before. At Jaintiapur, orange plantations were extended to large areas in 1967. Most of the later planted trees have since been bearing pretty well, and some varieties have excelled others in respect of quality of fruit, and yielding ability.

The varieties have recently been studied rather thoroughly, and the results written up in the form of a thesis (Nazimuddin and Ahmed 1974). These results have clearly shown that some varieties are worth recommending for growing in Bangladesh. Of the eight varieties of sweet orange, three varieties, such as Decibre, Mosambi and Pineapple, and of the four varieties of mandarin orange, three varieties such as, Fuetrell's Early, Nagpuri and Kinnow were found to be worth recommending.

### (6) Other Works

A comparative root-stock trial between pomelo and khattl which showed the former much superior to the latter: propagational studies to compare normal T-budding with inverted T-budding which proved normal T-budding better than the other: determination of proper time of budding of orange which established two periods, such as, mid-October to mid-November (Kartik) and mid-February to mid-March (Falgun) as the best time, % observation on effect of girdling on the fruiting orange which indicated favourable effect of girdling without unfavourably effecting lateral growth or yield: studies on the effect of storage on germination of seed of Khange which showed gradual decrease in the viability of seeds with the increase in the storage time, the viability having reduced to only 22.4 percent at the end of storage for a month: and some propagational studies with lemon cuttings with the use of growth regulators.

### 3. Future Strategy of Research

The ultimate objective of research on Citrus is to establish "The Citrus industry" which includes all aspects concerning citrus. But whatever might be citrus is valuable economically, any profit can not be obtained unless the production is boost up. The fundamental outcome of research should be focused on this point. The development of citrus research work in all advanced countries had passed through four stages viz. 1) Collection of varieties, 2) Selection of collected varieties, 3) Cultivation of selected varieties, and 4) Breeding of more desirable varieties. Thus the present condition of research work in Bangladesh seems to be in the middle of the first stage, so that the emphasis of research work should be laid still on the collection of exotic varieties.

There exists many citrus varieties in the world. But generally speaking, they can be divided into two groups: one of which thrive well under wet climate and the other in arid climate. The former type of citrus can be found in eastern half of the old-continent, and the latter in western half from India. Under the present condition of research on citrus fruits in Bangladesh, emphasis should be laid for the collection of the former type of citrus which is tolerant against humid weather, especially the loose-skin citrus (mandarins), from the stand point of market demand, location, and the value of the produce. But the necessity to collect sweet orange, lime, lemon and pomelo varieties which are acclimatized to arid climate still remains to have the required nutrients for the nation. Introduction of varieties is a fundamental stage of research work in citrus, but it should be continued even when the research work has been shifted into the next stage.

#### 4. Some Consideration of Citriculture

The cultivation of Citrus fruits in Bangladesh is being done under the condition of no care after planting, in order to have normal yield, citrus fruit should get the treatment of a cultivated fruit tree. The essential points to care fruit tree is to establish the frame work of the tree, and to maintain the vigor of it. The former point precedes the latter and is more important, as the fruitfulness would be controlled by the way how the tree is trained in that period.

The citrus tree grows by maintaining the balance between root and aerial part viz. Trunk, branches and crown. So, for vigorous growth of aerial part, the development of the strong root system must be encouraged. The growth during early stages of the tree will decide the growth and vigor of the tree afterward. Practically, to dig out enough sized pit accompanied by drainage system from the bottom of the pit is important when citrus sapling is planted in the orchard. In Bangladesh almost all pits dug up for citrus seem to be less than two feet in diameter and depth. If the size of pit is more, it is better for the expansion of young roots, but practically three feet should be the limit, considering the efficiency of earthwork at the time of planting. For further extension of the roots, secondary digging up adjacent side to old pit could be done afterwards. About the depth of the pit, three feet is maximum. Previous observation about vertical distribution of roots is that the majority of roots are distributed between one to two feet depth under the ground. The most important point of digging up pit is to take an appropriate measure for drainage from the pit, otherwise the pit will become a water jar and will frustrate the effect of digging-up and the planter's effort. In order to drain out excess water from the pit, a culvert or an underdrain should be provided from the bottom of each pit, sometimes underdrains can be united in one by connecting each pits at their bottom. Underdrain work is easier when each citrus tree is planted on the slope, but in the case of flat area a deep ditch should be there surrounding the orchard. In anyway water should not be stagnant at the bottom of the pit. The next essential point for growing citrus is the training of planted sapling. An index to make up a frame work of the tree is to develop a trunk at least two feet length. So as to attain this purpose all buds which put forth shoots from the trunk up to two feet high should be removed in their early stage. Lateral twig should be also cut off, but when it is so much vigorous, bending down toward the ground is useful to check vigor, using twisting if necessary. This weakened twig can be removed in the following year after supplying upper twigs with nutrient.

For growing citrus, there are many treatments other than points mentioned above. But if these two points were put into practice, citrus culture in Bangladesh would be much improved,



and the necessary period to take care of these essential points is at most one and a half to two years after the time of getting ready for planting.

## 5. Classification of Citrus

Citrus originally belongs to the genus *Citrinae* SWINGLE, a subtribe in Rutaceae (orange family). But this name is now used as the representative of *Citrinae* which includes not only citrus but other three genera viz, *Fortunella*, *Clymeria*, and *Poncirus* closely associated with *Citrus*. The property of each genus mentioned above is as follows: 1) *Poncirus* RAF, compound leaf with three leaflets, deciduous, flower solitary, ovary hairy, fruit juice contains resin, 2) *Citrus* LINN, leaf single, evergreen, distinct netted vein, flower in cluster or solitary, fruit includes six or more segments, juice contains no resin, embryo white, or pale green, 3) *Fortunella* SWINGLE, leaf single, evergreen, netted vein indistinct, flower in cluster or solitary, fruit includes less than six segments, juice has no resin, peel bitter, embryo dark green, polyembryony, and 4) *Clymeria* Swingle, leaf single, with many lateral veins, no wing, flower solitary, fruit contains fourteen to sixteen segments, embryo green, polyembryony. It is useful for a researcher to have an idea about the classification of *Citrus*.

According to the latest citrology, *Citrus* is classified as follows:

- A. *Archicitrus* (Subgenus) – Flower bears on cluster-like inflorescence, fruit is difficult to peel, as the peel and flesh are tightly adhered to; embryo is usually white.
  - (1) *Papeda* (HASSKARL) TANAKA (Section) – Wing is almost similar to lamina in size, flower somewhat purplish.
  - (2) *Limonellus* (RUMPH) TANAKA (Section) – Wing is remarkable, flower white, fruit is lemon-like and small size (Lime, Sweet Lime, Bergamot, etc.)
  - (3) *Citrophorum* (NECKER) TANAKA (Section) – Usually no wing, flower purple seldom white, fruit much bigger than that of *Limonellus*. (Lemon, Rough Lemon; *Ponderosa*, etc.)
  - (4) *Cephalocitrus* TANAKA (Section) – Wing remarkable, flower often with four petals, calyx hairy, fruit very big, pale coloured. (Pomelo, Grapefruit, Hassaku, etc.)
  - (5) *Aurantium* (TURN.) TANAKA (Section) – Wing smaller or somewhat larger; flower medium size, petal white, elongated, fruit without nipple, not so small size, dark green since bearing stage, orange or yellow coloured when matured, both sour and

sweet in taste: seed oblong with many creases. (Sambockan, Tizon; Sour orange, Sweet orange, Tankan, Temple orange, etc.)

B. *Metacitrus* TANAKA (Subgenus) – Flower solitary or gregariously, without inflorescence, fruit is easy to peel, seed roundish, embryo green except *Osmocitrus*, polyembryony.

(6) *Osmocitrus* TANAKA (Section) – Wing usually large, fruit medium in size, yellow coloured having a clear dent circle at the top, flesh yellowish, very soft, seed large, embryo white; tree is armed with many thorns, most hardy. (Ichan lemon, Yunos, etc.)

(7) *Acrumen* (GALLESIO) TANAKA (Section) – Leaf almost without wing, flower small to medium in size, white in colour, fruit commonly pressed global shape, with dense colour, small to medium in size, roundish, smooth, embryo green. (King orange, Kuneb, Unshu, Santra, Tangerine, Cleopatra, etc.)

(8) *Pseud-fortunella* TANAKA (Section) – Leaf small, netted vein not remarkable, wing narrow and linear, flower small, fruit small with globular shape, flesh soft, acid with Kumquat like fragrant, with less number of segments, seed small. (Calamondin)

## 6. Exotic Citrus Varieties

### (1) UNSHU (*Citrus unshu* MARC.):

This is the leading mandarin orange variety in Japanese citrus industry. The origin of Unshu is unknown, it had supposedly appeared by chance seedling from a seed which was brought from middle China, because at the coast of middle China there is a place with the same name where the production of several mandarin varieties much alike to Unshu exist. It's birthplace is believed to be Kyushu, the southwest island of Japan, where was a protocol of China and there Unshu had been called Rifujing (Madam Lee, Chinese name of a woman) for a long time. But during the feudal age, Unshu could not be accepted by the people, because of the reason that seedless characteristic of Unshu symbolizes a sterile woman. In Kyushu island there were citrus trees of about three-hundred years old. Consequently, appearance of Unshu seems to be more than three hundred years ago, but Unshu industry has been developed only during the past one hundred year. Manufacturing of processed produce (canned flesh in syrup) and its exportation had also begun since 1926. The destination was England and this exportation continued up to the time of world war II. In England

there was popular custom to have Japanese canned Unshu in syrup at their breakfast. For this purpose, a small segment of Unshu pulp was preferred. After the War Japanese canned Unshu was exported to the U.S.A. The American people prefer a big sized flesh, as they used Unshu pulp for decoration of confectionery. Unshu is a kind of mandarin, one of loose-skin fruits, belonging to Acrumean section in the classification of citrus. Some good points of the Unshu fruits are i) can be peeled by finger, without any implements, ii) juicy and good taste by balance of sweetness and acidity, iii) seedlessness, iv) fruit size is medium. It's only drawback is that it has no flavour in the pulp, and as such the fruit juice of Unshu is to be mixed with that of some other citrus (desirable Aurantium) such as Trovita orange. There is a group of varieties named Wase-unshu which appeared by bud mutation of Unshu. It matures about one month earlier than common Unshu. Wase-unshu blooms in the later part of May, simultaneously with common Unshu, and the fruits ripen toward the end of September, that is to say, the maturing period is only four months. Wase-unshu is a citrus of the most early maturing type in the world, in other words, it possesses the most excellent productive ability of ingredient accumulation.

**(2) SAMBOKAN (*Citrus sulcata* HORT. ex TANAKA):**

This is a Japanese typical variety originated in Wakayama, the middle-southmost area of Honshu Island. "Sambo" means one of Japanese traditional wooden tray of square shape with same shape of the leg, "Kan" means orange in Japanese language. The outlook of Sambokan fruit gives the idea that it is made up of two circular parts. There is a saying that when a farmer first presented Sambokan fruits to the lord of Wakayama, the lord was much delighted with it, and gave the name of sambo which reminds Japanese people of the traditional vessel and the three treasures. Sambo was a vessel which is only used when one makes some offering to God or to the lord. So in any way Sambo is a lucky name.

Sambokan is classified as one of citrus fruit belonging to Aurantium group, but it seems to be a hybrid of orange and a variety belonging to Osmocitrus section. The fruit is about 3.5 inches in diameter having much rugged rind which turns yellow when matured. The flesh has refreshing taste, but to our disappointment, the fruit has so many seeds compared with fruit size, usually thirty, sometimes fifty seeds can be found in a fruit. The merit of this variety in this country is doubtful, but introduction of Osmocitrus will have some interest scientifically.

**(3) HASSAKU (*Citrus hassaku* HORT. ex Y. TANAKA):**

This is also Japanese typical variety originated in Hiroshima, western part of Honshu Island where it was found about one hundred years ago. Hassaku means the beginning of August.

and thus suggests maturing season of this fruit. The major citrus fruit in Japan is Unshu, and other varieties become economically important only when Unshu disappeared from the market. Hassaku fruit is medium or slightly bigger than medium size, four inches or so in diameter and pressed globe in shape. The rind is somewhat thick and difficult to peel.

#### 7. Pomelo and Trifoliolate Orange as Rootstock

Pomelo is the only rootstock of citrus in Bangladesh and that of Japan is trifoliolate orange. Every Citrus variety under cultivation should have the most suitable rootstock. But the rootstock trial is so troublesome that even in advanced countries the trials are not yet completed. The main rootstock used nowadays is only a provisional stock.

The seeding of pomelo shows very rapid growth, and reaches the optimum size for budding very quickly. But the root system consists of only taproot having scanty lateral roots. Accordingly the transplanting is very difficult in the nursery bed as well as at the time of plantation in the orchard. Furthermore, compatibility between pomelo and other group of Citrus (oranges, mandarins, etc.) seems to be something difficult as revealed in previous trials and observation. As pomelo seed is monoembryony, each seeding shows different character caused by the influence of father plant. The seeding of trifoliolate orange shows slow growth, so it is difficult to perform budding operation on them after a year except twig-grafting. The roots system of trifoliolate orange consists of only lateral root having no taproot, that is to say, the Citrus plants on trifoliolate orange is tolerant against transplanting. Trifoliolate orange is good rootstock for some of loose skin mandarins, especially good for Satsuma orange, but not for Santra.

The trial to find the best rootstock should be a long term work, because even if the compatibility between stock and scion at the time of grafting seemed to be good, the condition might be changed on the progress of the growth as observed in rootstock trial. Seeds of trifoliolate orange has been introduced from Japan in Bangladesh as a new rootstock for citrus fruits. To forecast the result of rootstock trial is quite impossible. But the rootstock trial should be started immediately as a permanent work, including pomelo as a standard, trifoliolate orange, and other citrus species. Some plants related to citrus viz. Beal (Woodapple), Lime-berry, Calamondin, etc. which could be obtained in local area may also be tried as rootstock. The rootstock trial should be always a new experiment and there is almost no data to referred.

#### 8. Karatachi (Trifoliolate Orange)

Karatachi is a very familiar plant with Japanese people. The Karatachi plants have snow white flowers. The plants are characterized with green needle like and very painful thorns. The hedges with karatachi bushes at the side of roads people always walk with caution. Its fruit ripens in autumn. Karatachi (Trifoliolate orange) originated in Middle China, especially in the middle of the Yangtzu River area. It was imported into Japan before 8th century, and has been used as a hedge plant. Trifoliolate orange is a deciduous shrub armed strictly by sharp thorns of one to two inches in length. It blooms one month earlier than other usual oranges. The leaf is divided into three leaflets, that is the reason why it is called trifoliolate orange. In autumn it bears perfectly globose fruit of about one inch diameter, which turns to golden colour when matured. The fruit is pubescent outside, and includes more than thirty big seeds inside. Pulp is scanty and contains a resinous substance with an offensive odour.

Trifoliolate orange has been utilized as a main rootstock of Unshu since last one hundred years, when Unshu has become popular citrus fruit in Japan. The nursery men used trifoliolate orange as rootstock without having any knowledge about its usefulness. They used it only for the reasons that the seeds of trifoliolate orange could be collected very easily from the nearby places, and the collecting efficiency is also very high, because its fruit is full of seeds. Furthermore, another advantage of trifoliolate orange that encouraged the nurserymen was its good root system. The root system of trifoliolate orange consists of lateral roots without tap root and root hair. Seeding with such type of root is good for transplanting, which is very advantageous point for nurserymen to sell their saplings. Although nurserymen did not think about it at the beginning, but it was found later that the compatibility between Karatachi rootstock and Unshu scion was excellent not only in the nursery stage but in adult stages too. In spite of wide gap between Unshu and trifoliolate orange on the classification list, these two plants shows moderate compatibility, giving not so much vegetative growth on Unshu so as to inhibit the fruiting. Investigation was made to find out better rootstock than trifoliolate orange for Unshu, but this trial did not succeed.

## 9. Development of Japanese Citrus Varieties

Japan is situated at the northmost part of citrus belt of the world. It is a common belief that citrus originated in the tropical zone, that is why there are many principal species in the tropics. But in Japan which belongs to Temperate Zone, some physiological differences can be seen on the same variety. For example a seedless variety in tropics makes so many seeds when it is cultivated under Japanese climate (Bangkok Seedless pomelo bears seeded fruits). Under the severe dryness in summer, and earlier dropping of temperature in full season, producing of the seeds would be much

promoted. This is the reason that Japan has a number of so called miscellaneous citrus (Hybrid citrus) appeared by the hybridization between the groups in classification of citrus; for example some hybrids between pomelo group (Cephalocitrus) and mandarin group (Acumen), hybrids between pomelo and orange group (Aurantium), between Yunos group (Osmocitrus) and orange group, etc. In the country site of Japan, especially in the south-west area of Japanese Islands, there can be found many hybrid citrus varieties which were grown naturally at the beginning, and then have been taken care by local farmers being given some nomenclature. But some of them had received attention for their specific character like good texture, strange shape, brilliant peel colour, etc. In general their maturing season are later compared with Unshu mandarin, the only economical variety of citrus in Japan, Natsudaidai (perhaps pomelo x sour orange), Hassaku (pomelo x mandarin), Iyokan (yunos x mandarin), etc. are the notable miscellaneous citrus varieties/species in Japan. All the miscellaneous citrus mentioned above were originated naturally by chance seedling under the condition of Japan. But there are several varieties which are considered to be originated by artificial grafting unexpectedly. In general they seem to have compound characters in their peel and pulp. Kobayashi-mikan is said to be a graft-hybrid of Unshu on Natsudaidai. The original tree of Kobayashi-mikan was in the garden of a farmer Mr. K. Kobayashi in Fukuoka prefecture, Kyushu island. Once he tried to graft Unshu scion on Natsudaidai stock, but it was unsuccessful. Few years later, a new shoot came up from the portion where the grafting operation was done. The fruits produced on the new shoot had the appearance of Natsudaidai, but the pulp was much different from Natsudaidai, rather resembled to Unshu. Considering the result, the Natsudaidai tissue put forth a bud covering a bit of Unshu tissue which remained at the portion where once a grafting operation had be done. The construction of new variety Kobayashimikan fruit shows so-called periclinal chimera. Other varieties which might be originated by the process of periclinal chimera are kinkoji-Unshu whose pericarp seems to be Kinkoji (Orange), and the pulp seems to be Unshu, and another one is Fukuhara-orange which was composed of Yunos (peel) and Joppa-sweet orange (pulp).

It is very much interesting to note that there exists in nature some possibility to make a periclinal chimera, if there are some artificial methods to induce bud growth including tissue of another kind of citrus tissue, we could establish a new system of citrus breeding by means of grafting.

— NOTE —

Citrus and Vegetable Research Center, BARI had been established in 1977, but actually it started when Japanese expert team arrived in Bangladesh in the following year, and set to work to consolidate field and facilities for carrying out necessary experiments.

This booklet consists of several comments on citrus which were reported by the Japanese experts during the time of the land consolidation.

The principal bulletin will be published after collecting data through the experiments. This is the reason to title this booklet "BULLETIN EXTRA NO. 1".

# バングラデシュ 第二次五ヶ年計画

## 第 1 部

### 事業摘要

#### 1.(a) 事業名

実施中のかんきつ、野菜研究所の強化事業及びシルヘット地区アクバルプールでのかんきつ、野菜類地方試験場の設立とチッタゴン地区バハトリ、での研究支所新規建設事業

#### (b) 事業目的

上記諸施設を強力な国立かんきつ、野菜種子研究所として活用各種の応用、適応の面から研究を行う。

#### (c) 事業費

48,800,000 タカ (外貨分 240,000 Taka)

#### 2.(a) 現行の 5 ヶ年計画との関係

5 ヶ年計画に含まれている。

#### (b) 含まれている場合の資金割当 (単位 10 万タカ)

195.22

#### 3. 監督官庁

- (i) 主務官庁 バングラデッシュ農業省
- (ii) 実施担当責任者 バングラデッシュ農業研究所長
- (iii) 継持管理 かんきつ、野菜、種子研究所事業担当

#### 4. 事業所在地

- A 中央研究所 ダッカ地区ジョイデブプール 25 エーカ
- B 地方試験場 シルヘット地区アクバルプール 1,1000 エーカ
- C 研究支所
  - (i) パブナ地区イシュルディ 10 エーカ
  - (ii) ラングプール地区マヒガンジュ 20 エーカ
  - (iii) チッタゴン地区 バハトリ 30 エーカ

#### 5. 予定期日

- (i) 着工 1980年7月 1日
- (ii) 完工 1985年6月30日

#### 6.(a) 事業投資額 (10 万タカ)



	既支出分	予定分	合計
(i) 現地通貨	0	248.00	248.00
(ii) 外貨	0	240.00	240.00
合計	0	488.00	488.00

(b) 海外援助 外貨全額は日本政府の資金援助あるいは資材の無償供与。

7. 事業完成後の年間運営／償還費用（10万タカ）

現地通貨 22.00 外貨 0.50

8.(a) 事業の事前調査，踏査，妥当性調査等を実施しているか

（右の欄の何れかに印を付す若し実施しているならその報告書を添付すること。

実施した	実施しなかった
✓	

(b) 上記調査，踏査に要した費用

現地通貨 : 0  
外貨 : 0  
合計 : 0

9. 事業実施に建設業者／

コンサルタントが参加している場合にはその明細を記せ

(a) コンサルタント名

(i) 現地 : なし  
(ii) 海外コンサルタント : 日本のコンサルタント

(b) 所要経費 現地通貨 外貨 会計

(i) 現地コンサルタント : 0 0 0  
(ii) : 0 0 0

(c) 建設業者名

(i) 現地業者 : バングラデッシュ農業研究所建設部  
(ii) 海外業者 : 日本の建設業者

(d) 契約の種類（右のいずれかに印をつける）：ターンキナベーツ  その他

10. 当該事業の予算積算 (i) アブドル ラザク氏

主任技官

(ii) A.M. アブドラ氏

上級技官

署 名

カシ・M・バドローザ博士

バングラデッシュ農業研究所長

(主務官庁責任者署名及び所属)

## 第 2 部

### 事業の明細

#### 事業の性格と目的

序論：バングラデッシュの国民は多くのビタミン類（例えばビタミンAとかC等）や鉱物質（例えばカルシウム、鉄、燐等）の欠乏にひどく悩まされている。しかし、このような栄養不足の問題も国民がビタミンや鉱物を豊富に含んだいろいろな果実、特にかんきつ類や野菜をもっと沢山食べるようになれば解決するか、かなり改善されるのではないかと思われるし、また、バングラデッシュの直面している食糧不足を緩和する上で、果実や野菜の果す役割はいいようのない程主要なものである。

このような背景のもとで「かんきつ、野菜種子研究所」の名のもとに計画をたて、中央研究所をダッカ地区ジョイデプールに、3ヶ所の研究支所をバブナ地区のイシュルデ（10エーカー）シルヘト地区ジャインチャプール（20エーカー）及びラングプール（10エーカー）を立案し目下建設中である。事業はバングラデッシュ及び日本の協同事業である。中央研究所は主任技官により又それぞれの支所は上級技官によって管理運営される。この事業では全部で主任技官2名、上級技官6名、技官4名と補助要員44名を配置することになっている。更に4名の日本人専門家の長期滞在を予定し必要に応じて短期専門家の参加も見込まれている。本事業は1977年9月に開始されていたのだが、実際の研究活動が始められたのは、1979年7月主要基幹施設が完工してからのことであった。研究所施設の建設、研究資器材の購入、農地整備、深井戸の設置などといった主要施設構造物の整備完了までには2年という長い時間を要した。

バングラデッシュ、日本両国の承認による公式「議事録」にもとづく両国の第1回合同委員会は1979年11月22日に開かれている。合同委員会としては、日本政府が行う本事業に対する技術協力及び無償供与などの事業が完全に使益を発生するまで期間延長する必要があると感じた。

本計画で立案された既存の農業諸施設は充分とはいえず、日本の援助を導入しバングラデッシュ各地で近代技術による種子生産に必要な研究の可能性を開発するには不適當であると考えられた。

こういう見地から、急ぎで計画の修正が必要となり、更に5年間をかけて、シルヘト地区のアクバルプールに地方試験場（ジャインチャプール支所を併合）とチッタゴン地区にパハルトノ支

所を設けることを含めて改められた。このように計画変更がおこなわれたのは次の諸理由によるものである。

(1) ジョイデブール中央研究所の建築、農地整備、機械、研究器材等の購入、及び種子の収集。外来かんきつ種のサンプリング、およびすでに大規模に実施されている野菜種子のサブリングなどには完了までかなりの時間を要する。従って、漸くその形をととのえはじめたばかりの研究活動を続けると同時に研究支所の整備も完成させるには、本計画を第2次5ヶ年計画の期間にまで延長する必要がある、延長することによって長期研究活動を可能にし生産的な結果が得られるというものである。

(2) 現地技術者は日本人専門家が帰国した後にその研究業務を引き続いて実施する。従って現地技術者は日本人専門家と密接に提携し十分に経験をつみ、将来の研究活動の責任を負わねばならない。本来業に従事する現地技術者はたいていまだ、この種の特殊な研究活動に対して未経験である。更にグループ毎に、日本に渡り研究を受け本事業達成に必要な技術水準に達することが望まれる。

(3) 公式「議事録」の効力を更に5ヶ年延長することが望まれる。日本政府は事業に必要な全外貨分を無償供与で提供することに同意し、各研究支所を中央研究所と同様な研究機能を有する独立した機関に育成できるようにする。更に事業に従事している専門家もシルヘト地区アクバルプールに地方試験場をチッタゴンに研究支所を新設することに同意の意向を示している。

(4) 本計画によるマウルピバザール近くのアクバルプールに地方試験場を新設する件及び既存のジャインチャプールの試験場を昇格する件については国内外の数多くの専門家の技術的な意見を聞いてから提案されたものである。専門家の多くは、ジャインプールの土壌は均一質でなく、かんきつ類栽培地区としては代表的な地区とは云えず、従って正確な研究を実施するにはふさわしくない。という意見を持っている。かつまた、そこは、国境地帯にあり、そこは、過去の戦争の時には国境紛争にまきこまれ果実園の被害が甚大であった地帯である。一方アクバルプールは、シルヘト地区、マウリピバザールから5マイルばかり離れた所で平坦部と緩急いろいろの傾斜のある丘陵地とから成りこのような地域は多くの園芸作物に適すると同様にかんきつ類の栽培にも適している。土壌はローム質で肥沃である。この地帯には河が一本流れており、通平水があるからこれをかんがい利用できるであろう。国内ではその場所によって気候、土壌に相異があり、北東地区殊にシルヘト地区は他の地区との差が激しい。この地区は、他の地区と極めて著しい対称を示しているが、この地域の土地の多くは、小さな丘陵が入りくんでおり、その間に平坦な谷が介在している。この地の土壌は高透水性の砂質ロームラテライトで酸性土壌を含んでいる。

このような土壌特性のある地区は他に見当たらない。気候は年間2000インチを越す多量の降雨が特徴であり、シルヘトの近辺で国内最低気温を記録した所もある。このようないろいろな条件が組み合わさって他の地域とは全く異った作用体系が行われている。明らかに、他の地域にある

試験場を調査した結果からみて、この地域は野菜栽培には適していない。従って、現在あるジャンチャプールの研究支所を合併して新しい試験場を創立するのは良策である。こうすることによって、中央の研究所が、異った種類の果樹、野菜の栽培試験を大規模に実施することができる。およそ100エーカーの土地全体でこの種の実験を行うようになるであろう。

多種のかんきつ類の中で特にレモン栽培にはチッタゴンとその丘陵地帯が適当である。

そこでレモン栽培の促進のためには、研究支所を設けてパハトリにある農業研究所の農場を使って研究を行う必要がある。事業に参加している日本人専門家もこの件に同様の意見を持っている。

上記の内容に従って、以下に述べるように提案し、既設の農業研究所の運営下にあるかんきつ野菜研究所を発展した形で、第2次5ヶ年計画中にも推進し、増大してゆく需要に応えんとするものである。

#### 事業の達成目録

進行中の事業の活動内容については、その概略を添付書類Ⅱに示す。

#### 目的

かんきつ類-(i)強力な国家かんきつ研究計画に応用・適応の広い面からこれを活用し、特に生産に直結した実用的問題に力点をおく。

(ii) オレンジ及びその他のかんきつ類で高収量、対病性があり、広い地域で栽培可能な品種の選択と開発を行い、各地試験場のみならず国内のいろいろな生態系の地域にある農場、果樹園で協同して、試験を実施してゆく。

(iii) 産物の食味性、栄養価、保存性及びその利用法などについて研究する。

(iv) 労働者に現場訓練を実施し研究会、セミナー、品評会などを催し研究事項の発表、普及のために出版物を刊行する。

#### 野菜

(i) 強力な国家野菜種子研究計画に応用、適用の広い面からこれを活用し、特に生産に直結した実用的問題に重点をおく。

(ii) 高性能対病性品種を交配育成し他育種事業と協調してゆく。

(iii) 肥料、水及び病害虫予防措置をも含む、各種手段による育種技術の問題を集中的に研究する。

(iv) 野菜、種子の貯だう、加工、包装、利用法及び販売などについて検討する。

(v) 作業員の現場訓練を行い、研究会、セミナー、品評会を催し(研究事項の発表普及のための出版物を刊行する。

#### 組織構成

(1) 地方技術職員：事業はこれを事業担当理事が統括し、それぞれの分野の5名の主任技官、

14名の上級技官と14名の技官がこれを補在し、育種、植物栄養、ウイルス学、昆虫学などの専門分野を分掌する。アクバルプールの地方試験場とラングプールの研究支所はそれぞれ1名の主任技官が統括し、パハルトリ及びインシュルディの試験場はそれぞれ、上級技官が統括する。

事業担当理事

(中央研究所—ジョイデプール)

主任技官 3名

上級技官 4名

技 官 2名

地方試験場

アクバルプール	研 究 所		
	パハルトリ	ラングプール	インシュルディ
主任技官 1	1	1	2
上級技官 4	1	1	2
技 官 4		1	

(ii) 外国専門家：経験豊かな外国人専門家の援助があれば現地職員の活動に役立つと思われるので4名の長期滞在専門家、4名の海外青年協力隊員及び数名の短期滞在専門家の参加を予定している。これらの外国人専門家は現地のそれぞれの担当分野の技術者と共に業務に従事する。これら専門家は自己の専門分野に関する豊かな知識と経験を持つ者でなければならず、特に育種と生産に直結した分野の専門的技術が要求される。

Ⅶ 業務計画

A 研究計画の概略を示せば次のようになる。

A かんきつ類

1. バングラデシュに既存のかんきつ類生産の現況全面調査（例えば生産地帯、樹種、品質、収量、用途等）
2. 現地かんきつ類の資料の収集とその分類（組織的）及びその評価（例えば、生育、開花の生態、環境適当、品質など）
3. 近隣諸国あるいは気候の数似する海外諸国から多種類のかんきつ類を導入し、それらのバングラデシュにおける、適応性、育成生態を調査する。その際マンダリンオレンジ、スイートオレンジ、接木用の台木などを優先的に導入する。
4. かんきつ類の立ち枯れ病の原因の究明とその防除対策の開発、立ち枯れ病はバングラディッシュのスイートオレンジ、マンダリンオレンジ栽培上の重大問題である。
5. かんきつ類の最適接木台木の種類を究明する。
6. かんきつ類の病害虫を調査し、その防除対策を開発する。

7. 各種かんきつ類の栽培促進法の開発と栽培基準の確立を行う。特に次の点に留意する。

- (a) 苗畑技術の開発
- (b) 繁殖方法の標準化
- (c) 整枝、伐枝技術の標準化
- (d) 施肥、かんがい、農薬散布、その他農作技術の体系化と計画化。
- (e) 葉柄分析によるかんきつ類の栄養不良診断方法の確立。
- (f) かんきつ類の生育、収量、品質にえいきょうを与える要因の把握
- (g) 各種かんきつ類の級別方法の開発

8. 集積した経験にもとづき、最終勧告書を作成し、(1)かんきつ栽培開発適地 (2)そこに栽培される最適品種 (3)農民に市場性のあるものとして、推せんできる、品種等々を明示する。

9. かんきつ類栽培上の技術をあらゆる面から農民に指導する。

## B 野菜

現在バングラデシュで栽培されている野菜は無数にあるが、栄養価の高い野菜はほとんど短い冬季に栽培されている。5月から10月までの間は野菜の供給料は極めて少く手には入るものでもその食品価値は低袋である。

これが全国的にみる栄養不良の大きな原因となっている。O V S R Oの野菜研究計画も基本的にこの問題解決の方向に沿って行われている。以下にその大略を示す。

- 1. 既存野菜の選種、交配によって夏まき野菜の優良品種を改良開発し、これを導入する。
- 2. 夏まき野菜の新品種を導入し、その生産方法を開発する。
- 3. 冬場の早まき及びおそまき野菜の新品種を育生し冬物野菜の栽培可能期間を延長させる。
- 4. 夏物の野菜不足の問題を解決し得るような品種の種子生産方法を開発する。
- 5. 上記野菜の病害虫を研究し、防除対策を確立する。

この計画の詳細実施計画は以上順次説明してゆく

## C 研修と教育

(i) 毎年研究所員で本事業関係の技術者の中から3名内至4名と2名の上級技術者を選び専門職業教育計画の一環として日本に派遣し専門分野での訓練、研修旅行を実施する。

(ii) 一般技術者の国内訓練を必要に応じて中央研究所において開き、最技術の教育と訓練生間での意見交換を行う。

(iii) 普及員の訓練—農業弓(普及部)、園芸開発局、バングラデシュ農業開発公社及びその他普及事業関係当局より人を選び訓練する計画を立案し、訓練生間の意見情報の交換を行う。

(iv) 園芸家、栽培家の訓練—民間園芸家や栽培家に対して、短期技術教育を行うために半年に一度の割合で一週間の訓練を実施する計画を立案し1978-79年度当初より中央研究所において、これを実施する。毎回の受講者数は15名程度とする。研究支所も施設が整備された時には

こゝでも同様の訓練を行う。受講者には片道二等旅費と一 1 5 タカの食費を支給し訓練参加者の自己負担費用を必要しないようにする。

## 施 設 計 画 ( 目 標 )

### 工 事 内 容

- ( i ) 建設予定地の選択
- ( ii ) 開拓及び土地の均平
- ( iii ) ショイデブプール中央研究所建物の建設
- ( iv ) 研究支所での作業棟及び居住棟の建設
- ( v ) 職員の採用
- ( vi ) 外国人専門家のカウンターパート決定
- ( vii ) 実験室の建設
- ( viii ) 材機類の購入
- ( ix ) 車輛及びその他器材の購入
- ( x ) 研究活動の確立
- ( xi ) 技術者、普及員の国内研修
- ( xii ) 園芸家、栽培家の訓練
- ( xiii ) 研究会、セミナー、品評会などの開催
- ( xiv ) 研究成果の発表出版
- ( xv ) 普及のための印刷物出版

12. (a) 上記施設の建設、資材購入、行事の実行にあたって各種の代替案、代替方法を検討したか？（該当するものに印をつけよ）

検討した

✓ 検討しなかった

(d) 検討したなら、こゝに示された事業の決定を裏付けとなるような研究結果を示せ  
問題はない。

13. (a) その事業は前に予定された事業をその内容、目的両面から修正したものである？（該当のものに印をつけなさい）

修正した

✓ 修正しなかった

(b) 修正した場合、その修正した主な特性を示せ。

問題はない。

14. 次の点に関する詳細説明を付して事業の所在場所が正しいことを説明せよ。

(a) 周辺地区との関連、特に交通機関の問題につき、原料、資材の確保はどうか、市場が近くにあるか、経済的な労働力が確保できるか等々多くの事業が上記の点に関しては、非常によ

い交通条件に恵まれた場所にある。

(b) 特別の地域へのサービスの提供—必要とせず

(c) その他—必要とせず

第 3 部

費用算定

15. (a) 事業総投資額

(10万タカ)

現地通貨	外貨	合計
248.00	240.00	480.00

(b) 費用算定は何時したか：

1980年1月

(c) 6ヶ月以上前に

費用を算定した時には、当該金額が現在も有効か不かを確認せよ

問題なし

16. 表1に従って全期間を通じての年間投資明細を示せ。

17. 外貨費用の換算レートを示せ。

(原稿不明確)

18. 商業/工業事業の場合は、運転資本需要の見積りを示せ。

問題なし

19. 事業が以前からの計画を修正したものの場合は添付書類-Bに必要事項を記入せよ

問題なし

20. 事業耐用年数間の運転資金の明細を表IIに従って示せ。

表 - 1

投資費用

単位：10万タカ

費用細目	初年度 (1980-81)			2年度 (1981-82)			3年度 (1982-83)			4年度 (1983-84)			5年度 (1984-85)		
	内貨	外貨	計	内貨	外貨	計	内貨	外貨	計	内貨	外貨	計	内貨	外貨	計
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1.工事前費用															
(a)整地	=	5.00	5.00	-	5.00	5.00	-	-	-	-	-	-	-	-	-
(b)取付道路	2.00	-	2.00	-	-	-	-	-	-	-	-	-	-	-	-
Iの小計	2.00	5.00	7.00	-	5.00	5.00	-	-	-	-	-	-	-	-	-
2.建設工事費															
(a)作業棟	50.00	50.00	5.00	-	-	-	-	-	-	-	-	-	-	-	-
(b)居住棟	26.00	26.00	52.00	24.00	24.00	48.00	-	-	-	-	-	-	-	-	-
(c)日本より輸入資材の関税	30.00	-	30.00	12.00	-	12.00	-	-	-	-	-	-	-	-	-



(d)チックコン、 ジョイデフル 間運送費	1.00	-	1.00	1.00	-	1.00	-	-	-	-	-	-	-	-	-	-	-
(e)場内道路	=	5.00	5.00	-	5.00	5.00	-	-	-	-	-	-	-	-	-	-	-
(f)開 い	-	-	-	-	25.00	25.00	-	-	-	-	-	-	-	-	-	-	-
Ⅱの小計	57.00	91.00	148.00	37.00	54.00	91.00	-	-	-	-	-	-	-	-	-	-	-
3.機器類																	
(a)機器類関税 (運賃込)	20.00	-	20.00	20.00	-	20.00	15.00	-	15.00	-	-	-	-	-	-	-	-
Ⅲの小計	20.00	-	20.00	20.00	-	20.00	15.00	-	15.00	-	-	-	-	-	-	-	-
4.機器類	-		20.00	-	20.00	20.00	-	15.00	15.00	-	-	-	-	-	-	-	-
Ⅳの小計	-	20.00	20.00	-	20.00	20.00	-	15.00	15.00	-	-	-	-	-	-	-	-
1から4までの合計	79.00	116.00	195.00	57.00	79.00	136.00	15.00	15.00	15.00	-	-	-	-	-	-	-	-

表 Ⅱ  
運 営 費

明 細	年度(1980-1981)			年度(1980-1981)			年度(1982-1983)			年度(1983-1984)			年度(1984-1985)			合 計		
	内貨	外貨	計	内貨	外貨	計	内貨	外貨	計	内貨	外貨	計	内貨	外貨	計	内貨	外貨	計
1.原料資材	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2.燃料・動力	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1.2の小計	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3.労務員																		
(a)外国人	-	5.00	5.00	-	5.00	5.00	-	5.50	5.00	-	6.00	6.00	-	6.00	6.00	-	27.50	27.50
(b)現地人技 術者。事務 職員	9.67	-	9.67	10.24	-	10.24	10.70	-	10.27	11.17	-	11.17	11.64	-	11.64	53.42	-	53.42
小 計	9.67	5.00	14.67	10.24	5.00	15.24	10.70	5.50	67.20	11.17	6.00	17.17	11.64	6.00	17.64	53.42	27.50	
4.その他予備 費	6.84	0.50	7.34	8.78	0.50	9.28	9.26	0.50	9.76	9.32	0.50	9.82	9.38	0.50	9.88	43.58	2.50	46.00
1.から4まで の合計	16.51	5.50	22.01	19.02	5.50	24.52	19.96	6.00	25.96	20.49	6.50	26.99	21.02	6.50	27.52	97.00	30.00	127.00

第 4 部

事業の財政

21. 当該事業は現行の5ケ年

計画中に含まれているか：含まれている

(a) 含まれている場合

割当実績を示せ：19.52百万タカ

(b) 含まれていない場合、現在

申請中なのか（部門間調整による割当か、その他の源資によるものか区別を示せ）

問題なし

22. 当該事業は前期5ヶ年計画に含まれていたか？

含まれていた場合は明細を示せ。：含まれていなかった。

(a) 計画における割当は：問題なし

(b) 実際に要した支出は：問題なし

23. 事業の現地通貨資貨金源を示せ

(a) 政府資金：10万タカ

(i) 無償供与：248.00

24. 事業の外貨分予算の資金源とその金額を示せ。

(a) 資金源：日本政府

金額：240.00

25. 費用償還は受益者負担とするのか、若しそうなら、どのようにして償還するか。

受益者不担ではない。

## 第 5 部

### 事業の使 益

26. 当該事は次のいずれのグループに属するか（該当するものに印をつけなさい）

グループ “ X ” ……	<input type="checkbox"/>
“ Y ” ……	<input type="checkbox"/>
“ Z ” ……	<input checked="" type="checkbox"/>

27. (a) 平均産出高を達成しうると思われる年度を示せ。：1982-83

(b) 事業の経済的耐用年数を示す：事業完成後最低10年間

28. グループ “ X ” に属する事業の場合は、表-Ⅲに示す1年間のモデルに一致するように事業の全耐用年数期間中の年産出高を示せ。

表-Ⅲ

本事業には必要なし

29. 上記以外の直接、間接便益をあげよ：問題なし

30. グループ “ Y ” に属する事業の場合は、表-Ⅳに示す。モデルの如く事業の全耐用年数期間中、他の事業への波及的便益を算出せよ。

表-Ⅳ

本事業には必要なし

31. 上記以外の直接、間接便益を挙げよ：問題なし

32. “ X ” か “ Y ” の何れかのグループに属する場合、下表に示すような外貨獲得の見込があればそれを示せよ。：本事業には必要なし

33. グループ「Z」に属する場合、事業のサービス便益、受益者の数とその種類及び国内経済に及ぶ、その効果を詳述せよ。できる限り数値をあげてくわしく説明せよ。

事業の効果

- (i) 本事業を成させることにより、果実（特にかんきつ類）および野菜に関する研究が強化される。オレンジをはじめとする各種かんきつ類の高収量、耐病性で適応の広い品種を選択し開発することにより、この国のかんきつ類生産に新時代を開くことになるであろう。農民がこのような品種を導入し、新しい生産技術を適用すればかんきつ類栽培の拡大に役立つ、この有用果実の自給目標達成に貢献するであろう。
- (ii) 優良種子は農業の分野における全生産活動の基盤をなすもので、野菜増産計画にもられている野菜の優良種子開発技術の研究とも併行して果実種子の開発を行えば、短期間であっても、国民待望の事業を達成することが可能であろう。
- (iii) 野菜、かんきつ類共にその貯蔵性、加工法、包装性、利用法、栄養価を研究すれば、問題の産物の生産過程と収穫後の処理の合理化をすゝめることができ、全体的、生産者、消費者に役立つこととなる。
- (iv) この事業の結果として一般的生産水準の向上が見込まれ、この国にみられる全般的な食糧不足と栄養不良の問題を緩和するのに役立つことであろう。

第 6 部

労働 需 要

34. 年間を通じて研究を受ける人員の概数およびその職種は次の通りである。3ヶ月研修コース5名、6ヶ月コース10名、24ヶ月修士研修コース6名、40ヶ月博士研修コース3名、日本留学コース10名となっている。

表 - V

35. (a) 事業実施関係

単位：10万タカ

	人 員	人件費/賃金 (月額)	期間中年人件費/賃金	期間中、人件費、賃金総額
(i)一般事務職(事業担当理事の管理に属する)				
(ii)技術・専門職				
担 当 理 事	1	2.50	30.00	150.00
主 任 技 官	5	2.10	126.00	630.00
上 級 技 官	12	1.40	201.60	1008.00
技 官	10	0.75	90.00	450.00
その他の職務	6	0.50	36.00	180.00
(iii)熟練労働者				

XIV級労働者	1	0.40	4.80	24.00
XV "	2	0.40	9.60	48.00
XVI "	1	0.33	3.96	19.80
XVII "	23	0.30	82.80	414.00
XX "	5	0.24	14.40	72.00
XXI "	32	0.23	88.32	441.60
	98	-	687.48	3437.40

表 - VII

35. 事業運営関係

単位：1.0万タカ

雇 備 の 種 類	人 員	人件費(月額)	人件費総額(完工後) 初年度(1985-86)	2年度(1986-87)
1.担当理事	1	2.75	33.00	34.00
2.一般事務職/技術専門家				
主任技官	5	2.55	153.00	159.00
上級技官	12	1.78	256.32	267.12
技官	10	1.00	120.00	126.00
その他の職務	6	0.56	40.32	42.48
3.熟練労働者				
XIV級労働者	1	0.50	6.00	6.30
XV "	2	0.50	12.00	12.60
XVI "	1	0.40	4.80	5.04
XVII "	23	0.35	96.60	100.74
XX "	5	0.30	18.00	18.72
XXI "	32	0.28	107.52	111.36
合 計	98	-	847.56	883.56

36. 研修計画とその準備予定を簡単に記せ。一添付書類No.4参照

37. 労働力の不足が見込まれる時は、その不足を捕うのにどのような対策を講じて必要労働力を確保しようとするのか、その対策を述べよ。

労働力不足は見込まれない。

第 7 部

事業の建設、財政計画

38. 予定期日

(a) 事業着工 : 1980年7月

(b) 完 工 : 1985年6月

39. (a) 事業に必要な国産、輸送器資材の購入予定を述べよ。

(棒線図表を用いて、主要品目別の購入予定を示せよ)添付書類№6.1参照  
 (b) 次表に従い会計年度別建設工事の段階的予定を全投資期間にわたって記せ。

表 - VII

工事施工計画(百分率)

年 度	測量設計	用地買収/整地	居住棟	作業棟	機器設置	その他
1980~1981	-	54	52	6.5	3.5	-
1981~1982	-	46	48	3.5	3.5	-
1982~1983	-	-	-	-	3.0	-
1983~1984	-	-	-	-	-	-
1984~1985	-	-	-	-	-	-
	-	100	100	100	100	-

主要項目別建設予定を示す棒グラフを添付せよ。添付書類№9を参照

次表の如く工事に対する財政計画を示せ。

表 - XI

事業の財政計画

単位：10万タカ

年 度	内 貨	外 貨	合 計	備 考
1980~1981	95.51	121.50	217.01	-
1981~1982	76.02	84.50	160.52	-
1982~1983	34.96	21.00	55.96	-
1983~1984	20.49	6.50	26.99	-
1984~1985	21.02	6.50	27.52	-
合 計	248.00	240.00	488.00	

付 属 書 - A

事 業 実 施 用 機 器 購 入

単位：10万タカ

品 目	国 内 産		輸 入		合 計	
	数 量	価 格	数 量	価 格	数 量	価 格
I 機 械						
1 トラクター(備品付)	—	—	3	3.00	3	3.00
2 深井戸資材	—	—	3	6.00	3	6.00
3 発電機	—	—	4	4.00	4	4.00
4 動力噴霧機及び散布機	—	—	4	0.40	4	0.40
小 計 - I	—	—	14	13.40	14	13.40
II 補修用備品	—	—			L.S.	2.00
小 計 - II	—	—			L.S.一式	2.00
III 輸 送						
1 ダンプカー	—	—	4	8.00	4	8.00
小 計 - III	—	—	4	8.00	4	8.00
IV その他						
1 成育箱	—	—	4	4.00	4	4.00
2 培養器	—	—	4	1.60	4	1.60
3 スペクトルフォトメーター	—	—	4	0.80	4	0.80
4 発芽器	—	—	3	0.75	3	0.75
5 水分計	—	—	5	0.25	5	0.25
6 顕微鏡	—	—	6	1.20	6	1.20
7 さお秤	—	—	6	0.30	6	0.30
8 振動式種子選別器	—	—	3	0.90	3	0.90
9 テトロフォリウム試験器	—	—	4	0.80	4	0.80
10 屈折計	—	—	6	0.12	6	0.12
11 比色計	—	—	2	0.40	2	0.40
12 果汁抽出器兼遠心分離器	—	—	5	1.25	5	1.25
13 オートクレーブ	—	—	3	0.40	3	0.40
14 照度計	—	—	1	0.02	1	0.02
15 計算器	—	—	6	0.60	6	0.60
16 複写器	—	—	3	0.60	3	0.60
17 タイプライター	—	—	6	0.60	6	0.60
18 写真機	—	—	4	0.80	4	0.80

19	冷蔵庫	—	—	4	0.40	4	0.40
20	園芸用品	—	—	L.S.	1.00	L.S.一式	1.00
21	家具類	—	—	L.S.一式	1.00	〃	1.00
22	写真複写機	—	—	2	0.30	2	0.30
23	電気秤	—	—	4	2.00	4	2.00
24	化学天秤	—	—	4	1.20	4	1.20
25	スプリングラかんがい用具セット	—	—	4	4.00	4	4.00
26	自記水分・温度記録計	—	—	4	0.10	4	0.10
27	変圧器	—	—	2	2.00	2	2.00
28	雑器具・ガラス器	—	—	L.S.一式	5.00	L.S.一式	5.00
小計 - IV		—	—		31.67		31.67
総計 (IからIVまで)		—	—		55.07		55.07

付 属 書 - B

事業運営用必要資器材

単位：10万タカ

品 目	国 産 品		輸 入		合 計	
	数 量	価 格	数 量	価 格	数 量	価 格
1 資 材						
(a) 農 具	L.S.一式	1.25	L.S.一式	2.00	L.S.一式	3.25
(b) 消費材	L.S. 〃	2.25	—	—	L.S. 〃	2.25
2 物 資						
(a) 肥 料	L.S. 〃	1.50	—	—	L.S. 〃	1.50
(b) その他雑用品	—	—	L.S. 〃	1.91	L.S. 〃	1.91
薬品, 書籍, 雑誌, ガラス器, 栽培用具						
(c) 補修部品及び取替備品	—	—	L.S. 〃	1.20	L.S. 〃	1.20
3 燃料・動力	L.S. 〃	5.60	—	—	L.S. 〃	5.60

添付書類 - 1

人員構成

給与別職務	中央研究所		地方試験場		研究支所						合計	
	現行	追加	アクバルプール(シレット)		イシュルディ(バブナ)		ラングプール		バハルトリ(チッタゴン)			
			現行	追加	現行	追加	現行	追加	現行	追加		
A 技官												
1 担当理事	—	1	—	—	—	—	—	—	—	—	—	1
2 主任技官(野菜)	1	—	—	—	—	—	—	1	—	—	—	2
3 " (かんきつ)	1	—	—	1	—	—	—	—	—	—	—	2
4 " (病理)	—	1	—	—	—	—	—	—	—	—	—	1
5 上級技官(野菜)	1	—	—	1	—	1	1	—	—	—	—	4
6 " (かんきつ)	—	1	1	—	1	—	—	—	—	—	1	4
7 " (果実)	—	—	—	1	—	—	—	—	—	—	—	1
8 " (ウィールス)	1	—	1	—	—	—	—	—	—	—	—	2
9 " (統計)	1	—	—	—	—	—	—	—	—	—	—	1
10 技官(野菜)	—	1	—	1	1	—	1	—	—	—	—	4
11 " (かんきつ)	—	1	—	1	—	—	—	—	—	—	1	3
12 " (栄養)	—	—	1	—	—	—	—	—	—	—	—	1
13 " (農業)	—	—	—	1	—	—	—	—	—	—	—	1
14 " (昆虫)	—	—	—	—	—	1	—	—	—	—	—	1
A の合計	5	5	3	6	2	2	2	1	—	2	28	

現行統計官の職務は技官(統計担当)職として提案されている。



## 添付書類 - 1

## 人員構成

給与別職務	中央 研究所		地方試験場		研究支所						合計
			アクバルプ ール(シレ ット)		イシュルディ (バブナ)		ラングプール		パハルトリ (チッタゴ ン)		
	現行	追加	現行	追加	現行	追加	現行	追加	現行	追加	
B 一般職員											
1 現場助手	1	1	-	1	1	-	1	-	-	1	6
2 速記者	1	-	-	-	-	-	-	-	-	-	1
3 庶務兼会計主任	1	-	-	-	-	-	-	-	-	-	1
4 機械工	-	1	-	-	-	-	-	-	-	-	1
5 庶務兼タイピスト	1	-	1	-	1	-	1	-	-	1	5
6 倉庫番	1	-	1	-	1	-	1	-	-	1	5
7 ジープ運転手	4	-	-	1	-	1	-	1	-	1	8
8 トラック運転手	-	1	-	-	-	-	-	-	-	-	1
9 耕運機・ポンプ運転手	1	-	1	-	1	-	1	-	-	1	5
10 実験助手	2	-	-	1	-	-	-	1	-	1	5
11 庭師	2	-	2	-	2	-	2	-	-	2	10
12 日雇人夫	1	1	1	-	1	-	1	-	-	1	6
13 警備係	2	-	2	-	2	-	2	-	-	2	10
14 車輛清掃夫	-	1	-	-	-	-	-	-	-	-	1
15 掃除夫	-	1	-	1	-	1	-	1	-	1	5
B の合計	17	6	8	4	9	2	9	3	-	12	70
A・Bの総計	22	11	11	10	11	4	11	4	-	14	98

添 付 書 類 - 2

追 加 人 員 採 用 予 定

職 務	追加分	初 年 度 1980-1981	2 年 度 1981-1982	1982-1985
A 技 官				
1 担当理事	1	1	-	-
2 主任技官	3	2	1	-
3 上級技官	5	3	2	-
4 技 官	7	4	3	-
A の 合 計	16	10	6	-

B 一般職員				
1 現場助手	3	3	-	-
2 機械工	1	1	-	-
3 庶務兼タイピスト	1	1	-	-
4 倉庫兼庶務係	1	1	-	-
5 ジョブ運転手	4	4	-	-
6 トラック運転手	1	1	-	-
7 耕運機・ポンプ運転手	1	1	-	-
8 実験助手	3	3	-	-
9 庭 師	2	2	-	-
10 日雇人夫	2	2	-	-
11 警備係	2	2	-	-
12 車輛清掃人夫	1	1	-	-
13 掃除人夫	5	5	-	-
B の 合 計	27	27	-	-
A・B の 総 計	43	37	6	-

添 付 書 類 - 3

職 務 と 必 要 経 費 明 細

単位：10万タカ

職務とその人員数	月当人 件費率	1980-81	1981-82	1982-83	1983-84	1984-85	合 計
<b>A 技 官</b>							
1 担当理事	2.45	29.40	30.60	31.80	33.00	34.20	159.00
2 主任技官	2.10	126.00	132.00	138.00	144.00	150.00	690.00
3 上級技官	1.40	201.60	212.40	223.20	234.00	244.00	1,116.00
4 技 官	0.75	90.00	96.00	102.00	108.00	114.00	510.00
A の 合 計		447.00	471.00	495.00	519.00	543.00	2,475.00
<b>B 一般職員</b>							
1 現場助手	0.50	36.00	38.16	40.32	42.48	44.64	201.60
2 速記者	0.40	4.80	5.10	5.40	5.70	6.00	27.00
3 庶務兼会計主任	0.40	4.80	5.10	5.40	5.70	6.00	27.00
4 機械工	0.40	4.80	5.10	5.40	5.70	6.00	27.00
5 庶務兼タイピスト	0.30	18.00	18.72	19.44	20.16	20.88	97.20
6 倉庫番兼庶務係	0.30	18.00	18.72	19.44	20.16	20.88	97.20
7 ジープ運転手	0.30	28.80	31.20	33.60	36.00	38.40	168.00
8 トラック運転手	0.33	3.96	4.14	4.32	4.50	4.68	21.60
9 耕運機兼ポンプ運転手	0.30	18.00	18.72	19.44	20.16	20.88	97.20
10 実験助手	0.24	14.40	14.82	15.24	15.66	16.18	76.30
11 庭 師	0.23	27.60	28.32	29.04	29.76	30.48	145.20
12 日雇人	0.23	16.56	16.99	17.42	17.92	18.35	87.24
13 警備品	0.23	27.60	28.32	29.04	29.76	30.48	145.20
14 車輛清掃夫	0.23	2.76	2.83	2.90	3.04	3.11	14.64
15 掃除夫	0.23	13.80	14.16	14.52	14.88	15.24	72.60
B の 合 計		239.88	250.40	260.92	271.58	282.20	1,304.98
A・B の 総 計		686.88	721.40	755.92	790.58	825.20	3,779.98

手 当 と 報 酬

	年 度 1980- 1981	年 度 1981- 1982	年 度 1982- 1983	年 度 1983- 1984	年 度 1984- 1985	合 計
C						
1 技官・職員住宅手当 平均35%	240.41	252.49	264.57	276.70	288.82	1,322.99
2 技術手当	40.00	50.00	50.00	50.00	50.00	240.00
C の 合 計	280.41	302.49	314.57	326.70	338.82	1,562.99
A・B・Cの総計	967.29	1,023.89	1,070.49	1,117.28	1,164.02	5,347.97

添 付 書 類 - 4

研 究 制 度 と 研 修 旅 行 計 画

項 目	年 度 1980- 1981	年 度 1981- 1982	年 度 1982- 1983	年 度 1983- 1984	年 度 1984- 1985	総 計
A 研究制度						
1 博士コース (各40ヶ月)	-	1	2	-	-	3
2 修士コース (各24ヶ月)	1	2	1	1	1	6
3 研修コース (各6ヶ月)	2	2	2	2	2	10
4 研修コース (各3ヶ月)	1	1	1	1	1	5
B 研修旅行	2	2	2	2	2	10
合 計	6	8	8	6	6	34

## 添付書類 - 5

予備費の算定(経常的)

単位: 10万タカ

項 目	年 度		1982- 1983	1983- 1984	1984- 1985	合 計
	1980- 1981	1981- 1982				
A 現地通貨						
1 労務費	260.00	380.00	400.00	400.00	400.00	1,840.00
2 種子・肥料・農具	50.00	70.00	80.00	80.00	80.00	360.00
3 事務所経費	175.00	224.00	225.00	230.00	230.00	1,084.00
4 オイル・燃料	125.00	124.00	130.00	130.00	135.00	644.00
5 ゼミナール・研修	10.00	10.00	11.00	12.00	12.00	55.00
6 修理・更新	24.00	30.00	35.00	35.00	35.00	159.00
7 雑費	40.00	40.00	45.00	45.00	46.00	216.00
合 計	684.00	878.00	926.00	932.00	938.00	4,358.00

B 外貨						
1 事務所経費	10.00	10.00	10.00	10.00	10.00	50.00
2 農具	10.00	10.00	10.00	10.00	10.00	50.00
3 部品・取換部品	20.00	20.00	20.00	20.00	20.00	100.00
4 書籍・雑誌等	10.00	10.00	10.00	10.00	10.00	50.00
合 計	50.00	50.00	50.00	50.00	50.00	250.00

添付書類 - 6 A

機械施設

機械の種類	中央 研究所	地方試験場	研究支所			合計
		アクバルプ ール(シレ ット)	イジュルディ (パブナ)	マヒゴンジュ ラングプール	パハルトリ (チッタゴ ン)	
1 トラクタ-(備品付)	-	1	1	1	1	4
2 深井戸	-	1	-	1	1	3
3 発電機	-	1	1	1	1	4
4 動力・噴霧器・散布機	-	1	1	1	1	4
5 部品	-	L.S.一式	L.S.一式	L.S.一式	L.S.一式	L.S.一式
6 ダンプカー	-	1	1	1	1	4
7 成育箱	-	1	1	1	1	4
8 培養器	-	1	1	1	1	4
9 スペクトルフォトメータ	-	1	1	1	1	4
10 発芽器	-	-	1	1	1	3
11 水分器	-	2	1	1	1	5
12 顕微鏡	-	2	2	1	1	6
13 さお秤	-	2	1	2	1	6
14 振動式種子選別器	-	1	-	1	1	3
15 テトラゾリウム実験具	-	1	1	1	1	4
16 屈折計	-	3	1	1	1	6
17 比色計	-	1	1	-	-	2
18 果汁抽出兼遠心分離器	-	2	1	1	1	5
19 オートクレーブ	-	1	1	1	-	3
20 照度計	-	1	-	-	-	1
21 計算器	2	1	1	1	1	6
22 複写器	-	1	1	1	-	3
23 タイプライタ	1	2	1	1	1	6
24 写真機	-	1	1	1	1	4
25 冷蔵庫	-	1	1	1	1	4
26 園芸用具	-	L.S.一式	L.S.一式	L.S.一式	L.S.一式	L.S.一式
27 家具	-	L.S.一式	L.S.一式	L.S.一式	L.S.一式	L.S.一式
28 写真複写機	-	1	-	1	-	2
29 電気秤	-	1	1	1	1	4

30	化学天秤(微調整可)	-	1	1	1	1	4
31	スプリンクラーかんがい設備	-	1	1	1	1	4
32	自記水分・温度計	-	1	1	1	1	4
33	雑用品・ガラス器	-	L.S.一式	L.S.一式	L.S.一式	L.S.一式	L.S.一式
34	変圧器	-	1	1	-	-	2

添付書類 - 6 B

機械・施設購入計画

単位：10万タカ

品目	数量	単価	1980-1981		1981-1982		1982-1983		1983-1984		1984-1985		合計
			数量	金額	数量	金額	数量	金額	数量	金額	数量	金額	
I 機械													
1	トラクター(備品付)	3	100	2	2.00	1	1.00	-	-	-	-	-	3.00
2	深井戸	3	200	2	4.00	1	2.00	-	-	-	-	-	4.00
3	発電機	4	100	-	-	2	2.00	2	2.00	-	-	-	4.00
4	動力・噴霧器・散布機	4	0.10	1	0.10	3	0.30	-	-	-	-	-	0.40
	小計 I	14	-	5	6.10	7	5.30	2	2.00	-	-	-	13.40
II 散布機	L.S.	-	-	-	L.S.	1.00	L.S.	1.00	-	-	-	-	2.00
	小計 II	一式	一式	-	-	一式	1.00	一式	1.00	-	-	-	2.00
	L.S.	L.S.			L.S.		L.S.						
III 輸送													
1	ダンブカー	4	200	2	4.00	2	4.00	2	4.00	-	-	-	8.00
	小計 III	4	-	2	4.00	2	4.00	2	4.00	-	-	-	8.00
IV その他													
1	成育箱	4	100	2	2.00	1	1.00	1	1.00	-	-	-	4.00
2	培養器	4	0.40	2	0.80	2	0.80	-	-	-	-	-	1.60
3	スペクトルフォトメータ	4	0.20	-	-	2	0.40	2	0.40	-	-	-	0.80
4	発芽器	3	0.25	-	-	-	-	3	0.75	-	-	-	0.75
5	水分計	5	0.05	2	0.10	2	0.10	1	0.05	-	-	-	0.25
6	顕微鏡	6	0.20	2	0.40	2	0.40	2	0.40	-	-	-	1.20
7	さお秤	6	0.05	-	-	6	0.30	-	-	-	-	-	0.30
8	種子選別器	3	0.30	1	0.30	1	0.30	1	0.30	-	-	-	0.90

9	テトロゾリウム実験具	4	0.02	-	-	2	0.04	2	0.04	-	-	-	-	0.80
10	屈折計	5	0.02	-	-	3	0.06	3	0.06	-	-	-	-	0.12
11	比色計	2	0.20	1	0.20	1	0.20	-	-	-	-	-	-	0.40
12	果汁抽出兼遠心分離器	5	0.25	2	0.30	2	0.30	1	0.25	-	-	-	-	1.25
13	オートクレーブ	3	0.13	3	0.40	-	-	-	-	-	-	-	-	0.40
14	照度計	1	0.02	-	-	-	-	1	0.02	-	-	-	-	0.02
15	計算器	6	0.10	3	0.30	3	0.30	-	-	-	-	-	-	0.60
16	複写機	3	0.20	1	0.20	1	0.20	1	0.20	-	-	-	-	0.60
17	タイプライター	6	0.10	3	0.30	3	0.30	-	-	-	-	-	-	0.60
18	写真機	4	0.20	2	0.40	2	0.40	-	-	-	-	-	-	0.80
19	冷蔵庫	4	0.10	2	0.20	2	0.20	-	-	-	-	-	-	0.40
20	園芸用具	L.S.	一式 L.S.	-	-	一式 L.S.	0.50	一式 L.S.	0.50	-	-	-	-	1.00
21	家具	L.S.	一式 L.S.	L.S.	0.50	L.S.	0.50	-	-	-	-	-	-	1.00
22	写真複写機	2	0.15	1	0.15	1	0.15	-	-	-	-	-	-	0.30
23	電気秤	4	0.50	1	0.50	1	0.50	2	1.00	-	-	-	-	2.00
24	化学天秤	4	0.30	1	0.30	2	0.60	1	0.30	-	-	-	-	1.20
25	スプリンクラーかんがい用具	4	1.00	1	1.00	2	2.00	1	1.00	-	-	-	-	4.00
26	自記水分温度計	4	0.25	4	0.20	-	-	-	-	-	-	-	-	0.10
27	変圧器	5	0.25	5	1.25	-	-	3	0.75	-	-	-	-	2.00
28	雑用品・ガラス器	L.S.	-	-	-	-	-	L.S.	5.00	-	-	-	-	5.00
小計Ⅳ				-	9.90		9.75	-	12.02					31.67
ⅠからⅣの総計					20.00		20.05	-	15.02					55.07



添 事 書 類 7

作業棟・居住棟の建設計画（支出明細と年度別明細付）

単位：10万タカ

項 目	年 度 1980-1981	年 度 1981-1982	年 度 1982-83-84-85	合 計
<b>A 作業棟</b>				
1 研究施設3棟	30.00	-	-	30.00
(1) ジョイデプール				
(2) アクバルプール				
(3) パハルトリ				
(各5,000平方フィート 100.00タカ/平方フィート)				
2 倉庫（アクバルプール、ラングプ ール、パハルトリ、イシュルディ）	12.00	-	-	12.00
各2,000平方フィート 200.00タカ/平方フィート				
3 農器具小屋兼車庫	18.00	-	-	18.00
各3,000フィート （各研究支所毎 1,200平方フィート 150.00タカ/平方フィート				
計	60.00	-	-	60.00
<b>B 居住棟</b>				
1 居住棟建設2棟	7.50	-	-	7.50
(1) アクバルプール				
(2) ラングプール				
主任技官用 各1,500平方フィート 計3,000平方フィート 250.00タカ/平方フィート				
2 5棟, 上級技官用	15.25	-	-	15.25
4棟 アクバルプール				
1棟 ラングプール				
各1,250平方フィート 計6,100平方フィート 250.00タカ/平方フィート				

3	7棟 技官用 アクバルプール 4棟 ラングプール 2棟 バハトリ 1棟 各1,000平方フィート 計7,000平方フィート 230.00タカ/平方フィート	17.50	—	—	17.50
4	4棟 現場助手用 アクバルプール 2棟 バハトリ・ラングプール 各1棟 各 850平方フィート 計3,400平方フィート 250.00タカ/平方フィート	8.50	—	—	8.50
5	仮設住宅 12棟 庶務・タイピスト・ドライバ用 アクバルプール 4棟 バハトリ 4棟 ラングプール 4棟 各 800平方フィート 計1,200平方フィート 150.00タカ/平方フィート			15.25	15.25
6	仮設住宅 32棟 警備係・庭師等用 バハトリ 6棟 ラングプール 6棟 アクバルプール 20棟 各 750平方フィート 計2,400平方フィート 150.00タカ/平方フィート	36.00	—	—	36.00
	総計	52.00		48.00	100.00

添付書類 - 8 (A)

支出明細

単位：10万タカ

項 目	年度 1980- 1981	年度 1981- 1982	年度 1982- 1983	年度 1983- 1984	年度 1984- 1985	合 計
現地通貨						
A 資本支出						
1) 取付道路	2.00	-	-	-	-	2.00
2) 居住棟	26.00	24.00	-	-	-	50.00
3) 日本より輸入建設資材関税	30.00	12.00	-	-	-	42.00
4) チッタゴン-ジョイデププール間運送費	1.00	1.00	-	-	-	2.00
5) 機械類輸入関税(通関・運送費込)	20.00	20.00	15.00	-	-	55.00
合 計	79.00	57.00	15.00	-	-	151.00
B 収益支出						
1) 一般入件費	9.67					
2) 手当・報酬	9.67	10.24	10.70	11.17	11.64	53.42
3) 予備費	6.84	8.78	9.26	9.32	9.58	43.58
合 計	16.51	19.02	19.96	20.49	21.02	97.00
現 地 通 貨 総 計	95.51	76.02	34.96	20.49	21.02	248.00

## 添付書類 - 8 (A)

## 支出計画

単位：10万タカ

項 目	年度	年度	年度	年度	年度	合計
	1980- 1981	1981- 1982	1982- 1983	1983- 1984	1984- 1985	
外 貨						
A 資本支出						
1) 整地	5.00	5.00	-	-	-	10.00
2) 作業棟	60.00	-	-	-	-	60.00
3) 居住棟	26.00	24.00	-	-	-	50.00
4) 内部道路	5.00	5.00	-	-	-	10.00
5) 囲い	-	25.00	-	-	-	25.00
6) 機器類	20.00	20.00	15.00	-	-	55.00
合 計	116.00	79.00	15.00			210.00
B 収益支出						
1) 予備費	0.50	0.50	0.50	0.50	0.50	2.50
2) コンサルタント人件費諸手当	5.00	5.00	5.50	6.00	6.00	27.50
合 計	5.50	5.50	6.00	6.50	6.50	30.00
外 貨 総 計	121.50	84.50	21.00	6.50	6.50	240.00
内・外貨総合計	217.01	160.52	55.96	26.99	27.52	488.00

## 添付書類 - 8 (B)

## 総支出の概要

単位：10万タカ

項 目	年度 1980- 1981	年度 1981- 1982	年度 1982- 1983	年度 1983- 1984	年度 1984- 1985	合 計
資本支出						
現地通貨	79.00	57.00	15.00	-	-	151.00
外 貨	116.00	79.00	15.00	-	-	210.00
合 計	195.00	136.00	30.00	-	-	361.00
収益支出						
現地通貨	16.51	19.02	19.96	20.49	21.02	97.00
外 貨	5.50	5.50	6.00	6.50	6.50	30.00
合 計	22.01	24.52	25.96	26.99	27.52	127.00
資本・収益両支出の総計	217.01	160.52	55.96	26.99	27.52	488.00

## 総支出の概要

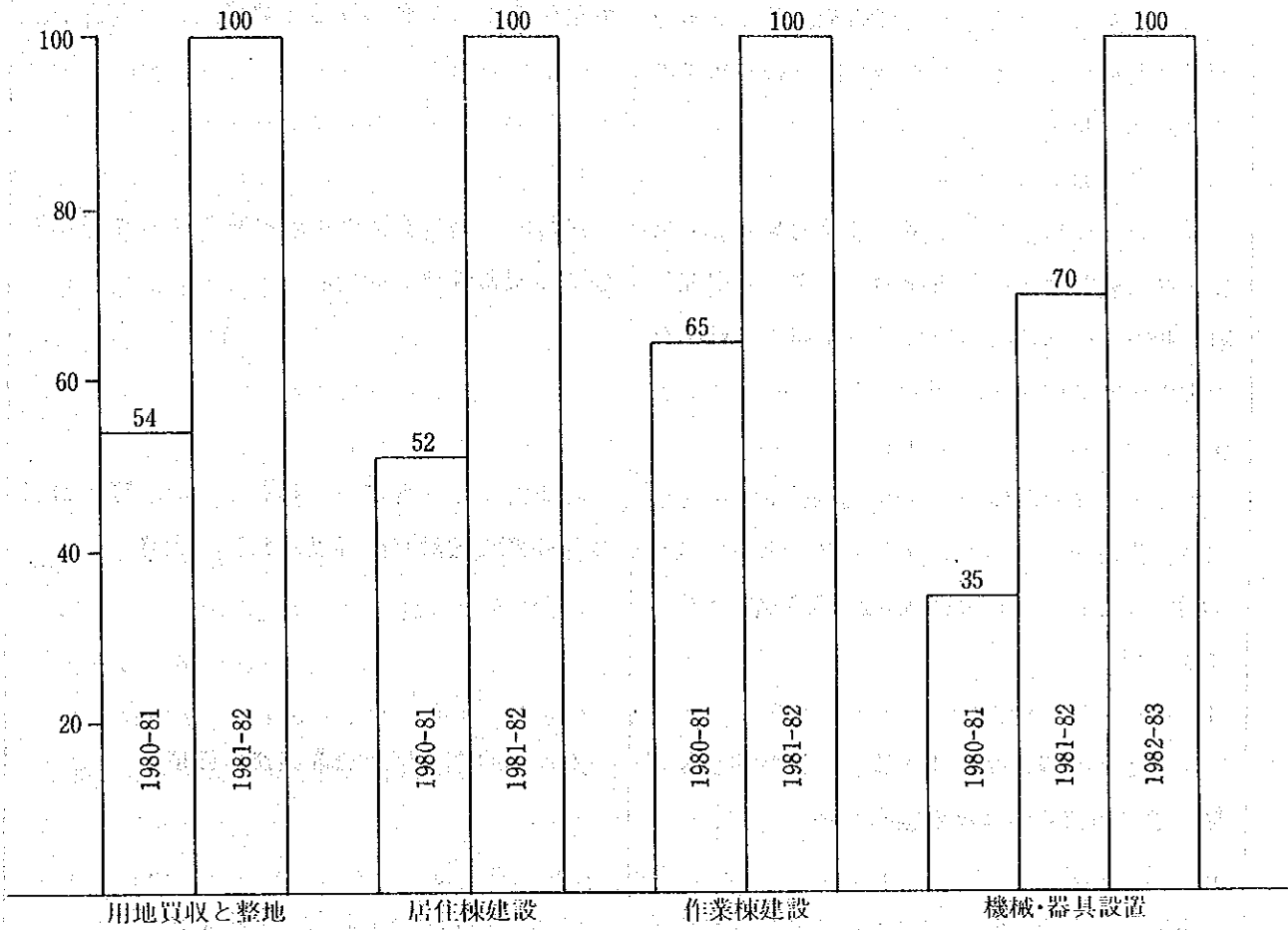
単位：10万タカ

項 目	年度 1980- 1981	年度 1981- 1982	年度 1982- 1983	年度 1983- 1984	年度 1984- 1985	合 計
現地通貨						
A 資本支出	79.00	57.00	15.00	-	-	151.00
B 収益支出	16.51	19.02	19.96	20.49	21.02	97.00
合 計	95.51	76.02	34.96	20.49	21.02	248.00
外 貨						
A 資本支出	116.00	79.00	15.00	-	-	210.00
B 収益支出	5.50	5.50	6.00	6.50	6.50	30.00
合 計	121.50	84.50	21.00	6.50	6.50	240.00
内・外貨総合計	217.01	160.52	55.96	26.99	27.52	488.00

外 貨 総 額 240.00

内 貨 総 額 248.00

添付書類— 9



添付書類一10

事業各加技官の資格及び業務内容説明

職 名	資 格
<p>1. 事業担当理事</p> <p>少くとも2級理学士(農)で研究経験15年のもの、又は海外留学修士で研究経験10年を有するものあるいは理学博士で園芸の分野での研究経験7年以上のもの。</p>	<p>技術的計画の立案とその実施、及びかんきつ野菜研究の各分野の管理と調整。</p>
<p>2. 主任技官</p> <p>少くとも2級理学士(農)で研究経験10年以上のもの又は、海外留学の理学修士で研究経験7年以上のものあるいは、理学博士で園芸分野での研究経験4年以上のもの。</p>	<p>技術的計画の立案とその実施及び夫々の担当分野の業務管理と調整。</p>
<p>3. 上級技官</p> <p>少くとも2級理学修士で研究経験5年のもの又は、海外留学理学修士で経験2年あるいは理学博士でこの場合植物病理学/農芸化学専攻が望ましい</p>	<p>研究計画の実務に従事しかんきつ、野菜研究の各分野実施計画の推進、管理、調整。</p>
<p>4. 技 官</p> <p>少くとも2級理学修士で園芸/植物病理学/昆虫学/農芸化学専攻が望ましい</p>	<p>夫々の専門分野で研究実務に従事。</p>
<p>5. 技 官</p> <p>少くとも2級理学士で事業関連分野専攻の要あり。</p>	<p>研究のレイアウト設計、分析業務。</p>
<p>6. 現場助手</p> <p>農業専攻の学士で研究経験5年以上のもの。</p>	<p>研究実務の補助、農場の管理。</p>

添付書類一11

事業の成果

A 施設、設備

研究棟11棟、温室1棟、ネットハウス1棟はそれぞれ1977年10月から1978年3月までの間に完成している。その後、ジャバラハウス(倉庫)1棟、貯蔵室、門、育苗所も建設された。

約13エーカーの土地が整備され、1978年10月から1979年5月までの間に連絡道路、かんがい排水の施設も設けられた。深井戸が1本、主農場に掘られ、スプリンクラーかんがい設備も研究所本館の脇に設置された。

大量の実験器具、農機具、車輛、各種用具植物も日本の無償援助によつて提供された。

## B 実 験

### 1. かんきつ類

(1) 調査：バングラデッシュに既存の多種類にわたるかんきつ類の調査が本事業によつて行われている。くわしい実験方法が事業計画の線に沿って確立されている。

調査の主目的はバングラデッシュで見つけられているいろいろなかんきつ類の系統、品種を知ることであり、その中の優良種を収集幾種し今後の研究に供することである。

(2) 収集：かんきつ類の中でも主要な4種（ポメロ、ライムとレモン、マイダリン、オレンジ及びスイート、オレンジ）に属する品種がジャイチャプール研究支所、その他各地から大量に収集されている。その内容はマンダリン、オレンジ種が7種類、即ちフュートルズダリー、サツメール、ナギュリ、ダネイ、カシア及びミノールで、スイート、オレンジ種が、ルビーレッド、パインアップル、ブラッドレッド、バックアリー、メサンビ、デンプレ、バレンシア及びジャファで、レモン種は3品種即ちマチ、種なすレモン及びアデレブ、それにライム種が1品種、マグジなどとなっている。すべてこれらの品種は1979年8月に果樹園に植えて今後詳細な研究をすゝめることになっている。

(3) 品種導入：1978年11月にかんきつ類及びその類似系統の品種の接木771本と19品種の苗木が日本から提供された。その中には、ポメロ種（シトラス、グランディ）のハッサク、カワチバンカン、アマナッカン、ベニハッサク及びシンアマナツがあり、レモン種（シトラス・リモン）のピラーフランラ、ウレカ及びリスボン更にスイート・オレンジ種（シトラス・シネンシス）のワシントン・ネーブル、ウンダ・ネーブル及びタクハラ、マンダリン・オレンジ種（シトラス・レリクラタノ）のミヤガワセ、ミホワセ及びオキツワセなどが含まれている。これらの品種はすべて既に夫々別々の圃場に植えられ、バングラデッシュの環境条件でどのように成育してゆくか調査が行われている。更に1980年1月には新たな苗木が海外より取りよせられたが、これらは3種類の異った系統の品種である。

(4) 接木試験：接木に適したソイオン種を見つけるために、トリフォリオレイト・オレンジ、ユゾ、ポメロ、サワ・オレンジを台木として接木試験を計画し実行に着手した。

(5) その他の果実：上記以外に桃、プラム、食用イチヂク、カキ、ブドウ、ビワ、ランブータン、リンゴ等々の外来種果実が多種にわたり世界各地から集められ、適応試験が行われている。

### 2. 野 菜

(1) 調査—国内各地にある。多くの野菜の栽培調査を行い特に、作付体系、作付期間、栽培法



現在の種子生産方法などが主点的に、調査され多岐多様な問題、農民の直面している野菜生産における緊急改善を要す点など 究明することになっている。

(2) 収集：ナス(12品種)、カリフラワー(4品種)、豆(8品種)カボチャ(7品種)キュウリ(8品種)大根(5品種)ホーレン草(4品種)オクラ(5品種)チリ(6品種)ヘチマ(3品種)など有望種が国内各地から沢山集められ評価され、品種改良がすすめられている。

(3) 品種導入：キャベツ(32品種)、カリフラワ(22品種)、大根(12品種)、ブロッコリー(17品種)カブ(14品種)チャイニーズ、カイロン(6品種)、キュウリ(25品種)カボチャ(20品種)ウリ(23品種)トマト(8品種)ナス(7品種)豆(5品種)など大量の野菜の品種が海外から導入され、土地適応試験が行われ、品種改良のためにつかわれている。

(4) その他の研究活動：多品種の野菜について、いろいろな研究分野で試験が行われて来たり又現在も行われている。そのうちですでに行われた試験の結果をいくつか下記する。

(1) グリーン・エクスプレス・クロスというキャベツは1977年雨期に14品種と収量試験を行った結果、現在最もなじまれている、雨期作品種「K-Kクロス」を作り出した。

(2) 大根の2品種即ち「43種」と「55日種」は栽培結果もよく、雨期作に適していることがわかった。

(3) 大根のチャイニーズ品種2種の種子生産はバングラデッシュにおいても可能という見通しがついた。

(4) 豆のうちの「アーリーホワイト」という種類は非常に有望で特別早熟である。(在来種よりも45日早い)

(5) 葉菜類の1種「カイラン」は成育もよく雨期の豪雨にも耐え今後夏場野菜の1つとして普及することが期待されるものである。

(6) よく普及している「サウス、イースト、エイジア」と「サイシン都アンド、タイサイ」という2種の葉菜は雨期の環境条件にもよく成育し、その種子も冬期の条件下でも十分に生産されるものである。







JICA