EGYPT–JAPAN TECHNICAL COOPERATION

RICE MECHANIZATION PILOT PROJECT IN ARAB REPUBLIC OF EGYPT

ANNUAL REPORT 1984/85

AGRICULTURAL MECHANIZATION RESEARCH INSTITUTE, MINISTRY OF AGRICULTURE, A.R. EGYPT

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA), GOVERNMENT OF JAPAN

EGYPT–JAPAN TECHNICAL COOPERATION

RICE MECHANIZATION PILOT PROJECT IN ARAB REPUBLIC OF EGYPT

ANNUAL REPORT 1984/85

AGRICULTURAL MECHANIZATION RESEARCH INSTITUTE, MINISTRY OF AGRICULTURE, A.R. EGYPT

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA), GOVERNMENT OF JAPAN

P R E F A C E

The widening gap between the consumption and production of food in Egypt is a problem of major concern to agricultural policy makers. As a result, his excellency the Minister of Agriculture has instructed that special attention be given to all projects and programs designed to promote the vertical and horizontal expansion of cereal production. Highest priority is to be given to increase production through improved varieties and adapting and transferring appropriate technologies to farmers. Self-sufficiency in grain production may be better realized with new technologies in mechanized agriculture which are designed to optimize operational timeliness and promote improved tillage and harvesting practices.

The Rice Mechanization Pilot Project, being implemented with the assistance and technical cooperation of the Japanese Government, is currently introducing an alternative technological approach. As with other project inputs, we are throughly examining those proven technological methods from other countries and modifying them to suit local conditions. Following this period of adaptation, the techniques will be replicated on a large scale.

The Rice Mechanization Pilot Project has embarked an ambitious five years plan for experimentation of planting and harvesting methods to determine which are the most suitable for Egyptian conditions. These techniques will then be demonstrated to those participating agronomists, agricultural engineers, farmers and local manufacturers. The training program of the project is being augmented with particpant training in Japan. Through the combination of practical field experience, on-site training, and direct exposure to expertese, in the participating countries, we plan to meet our objective of developing a capacity to plan, execute, and continue this movement toward self-sufficiency in grain production.

Dr. AHMED F. EL SAHRIGI,

Director
Agricultural Mechanization Research
Institute and Agricultural Mechanization
Projects.

I N T R O D U C T I O N

The Egypt Rice Mechanization Pilot Project was started in August 1981 under a plan to accomplish its objective in 5 years by August 1986, and its activities are divided into the former period of 2 years and the latter period of 3 years.

In the former period, provisional experiments were conducted utilizing existing facilities at Kallin Experimental Field with the late Dr. Toyoo TOMITA as team leader, and valuable achievements were obtained, which constructed the foundation of this project. In the latter half, the team leader changed and experiments were started in full scale at the Rice Mechanization Center which completed at Meet El Dyba.

In 1984, the first year of the latter period, activities were earnestly developed based on the basic plan toward accomplishment of objectives through cooperation with the Egyptian side cultivated in the former period, taking achievements in the former period into consideration. However, we encountered a problem of water shortage unexpectedly and were compelled to change the plan in the middle of experiments in many cases.

I would like to mention specifically that this report has been prepared by unusual efforts of experts and Egyptian counterparts concerted and cooperation in coping with severe water shortage in dry districts.

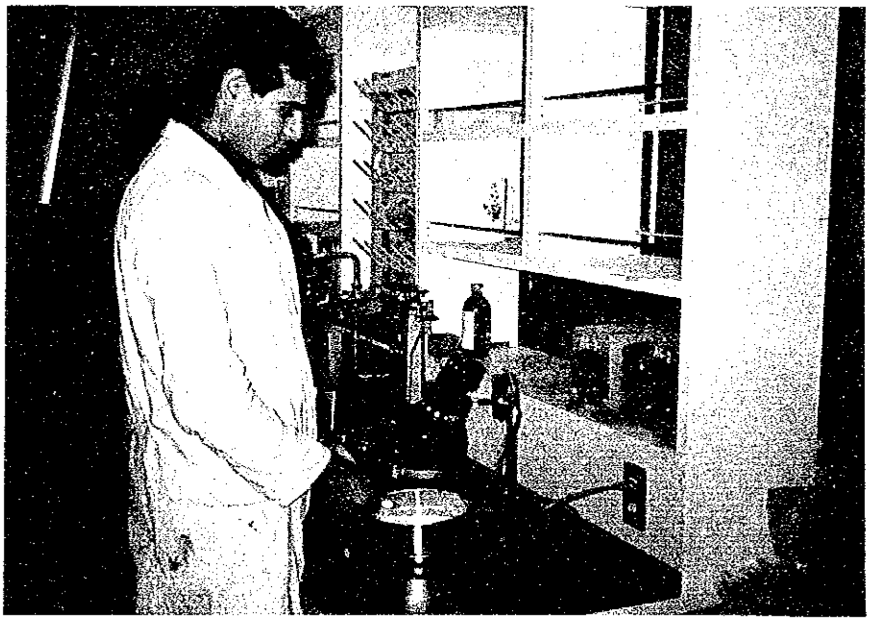
I wish to express my deep appreciation for kind cooperation of the Egyptian authorities concerned. Egyptian counterpart personnel, and kind assistance of Japanese Government, JICA Headquarters, the Japanese Embassy in Egypt and JICA Cairo Office.

September 1985

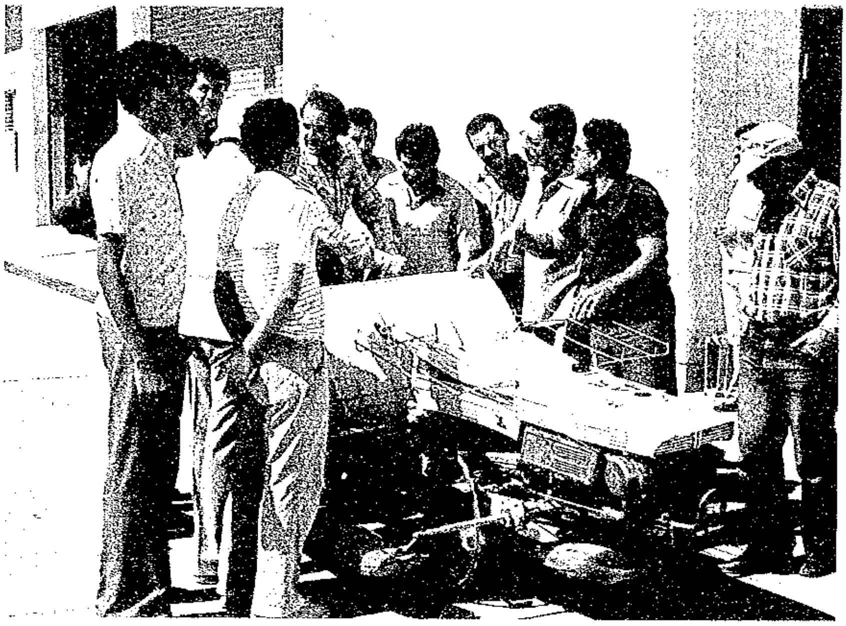
Dr. TAKAYUKI TANAKA

Team Leader of Japanese Experts,
Rice Mechanization Pilot Project

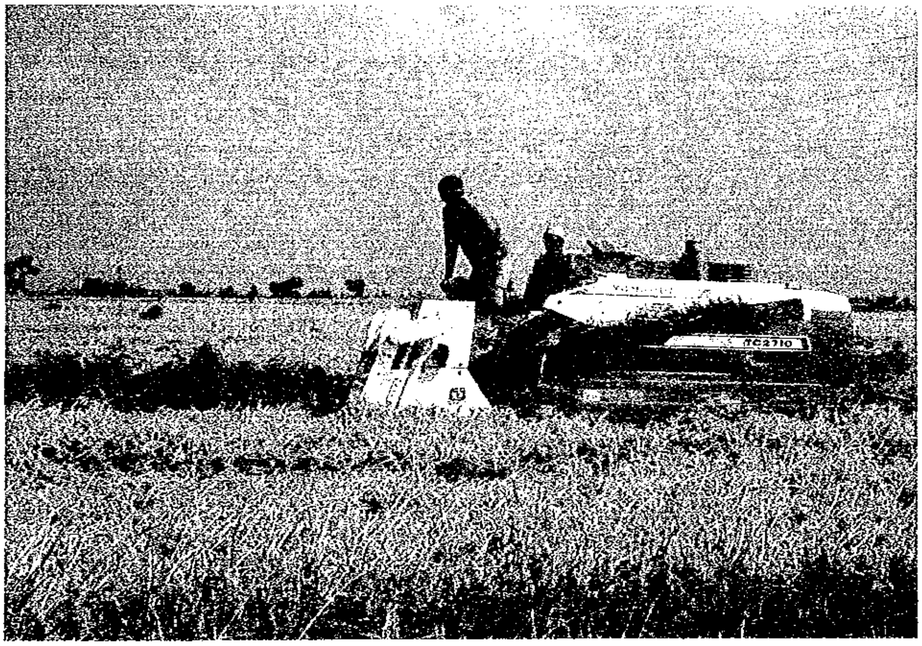
RMC Monthly Seminar



Laboratory Works by a Counterpart



Training Activities (Explanation of
Transplanter's Operation)



Harvesting by Combine

CONTENTS

Outline of Project Operational Result
(1982 - 1984)

I. Verification Experiment on Mechanized Rice Farming

1. Improvement of Experimental Paddy Field

1) Kallin Experimental Field (11 Feddan)

Improvement of experimental field by model infra-structure was completed in May 1982, and verification experiment on mechanized rice farming for Phase I was conducted twice in 1982 and 1983, which showed high yields (Akihikari: 12.0 t/ha, Nipponbare: 11.8 t/ha) and suggested the possibility of mechanized rice farming.

2) Meet El Dyba Mechanization Experimental Field (100 Feddan)

Improvement of the field was completed by pilot infra-structure in June 1983, and uniform plantation was implemented for 30 Feddan in the same year, starting a full-scale experiment in April 1984. Soil condition showed high pH (8.0-9.1) and salt concentration. In addition, shortage of irrigation water caused a considerable obstacle to the implementation of experiments. Therefore, experts on irrigation and desalting were dispatched in August '84, and irrigation works were carried out based on their improvement recommendation during the period of Dec. '84 - Apr. '85 with Phase II model infra-structure, which functions as the nucleus of Phase II activities at present.

2. Verification Experiment on Mechanization

1) Selection of Suitable Variety for Mechanized Rice Cultivation

Experiments of suitable variety for mechanization were continued on three prospective varieties of Japanese rice (Akihikari, Reiho and Nipponbare) and one traditional variety (GIZA 172), each variety showing much yield, but Reiho and GIZA 172 were verified to have a disadvantage regarding resistant to blast disease for the former and resistant to lodging for the latter.

2) Establishment of Plowing and Puddling Method

The dry condition of Nile Delta soil shows high hardness, but it carries nature of heavy cray when it contains water, making plowing and puddling method a special one.

A) Plowing tractor of 50 pH and above is more suitable and chisel plow attachment is more practical than rotary.

B) Puddling should be carried out immediately after irrigation, and work to the extent of smoothing with leveling board is desirable, because soil clod easily collapses by irrigation. It becomes clear that special attention should be paid to the puddling with rotary, which tends to be over puddling and lowers transplanting accuracy.

C) Improvement of planting mechanism and transplanting finger of transplanter

An important problem for Nile Delta soil which has very strong stickness is to reduce the ratio of missing hills and the slip ratio to upgrade transplanting accuracy. It was found out that a transplanting mechanism which forcibly claws off and inserts seedlings is very suitable. It was verified that transplanting accuracy is remarkably enhanced by changing crank type push rod to spring type push rod and reforming the seedling claw-off finger into hook shape.

4) Suitable Working Method for Riding Type and Walking Type Transplanters

Transplanting is suitable on and after the third day after mechanized puddling for riding type transplanter. Farmers prefer riding type to walking type which causes more fatigue from walking, but there is a big difference in price between the two types. As selection of the type is necessary according to the scope of operation, a working method suitable for walking type transplanter has been studied. As a result, it has been made clear that the second day after mechanized puddling has high planting accuracy with considerably less fatigue for operators as compared with the third day in the case of plowing depth of 15 cm.

5) Establishment of Raising Seedling Method

Nursing healthy seedling is one of the important points in mechanized transplanting for securing yield capacity. The method for nursing healthy seedling has been studied and nearly completed using Nile Delta soil which is considerably different in soil texture and properties from Japanese soil. The Nile Delta soil often delays initial growth due to defficiency of zink, particularly so in the case of salty injury soil. In such a case, addition of sulfate zink to seedling box is very effective, promoting rooting and initial growth. A clear effect of harvest increase has been confirmed by an increase in the number of panicles.

6) Expansion for the Duration of Suitable Cropping Season

Rice farming at Nile Delta is incorporated in a complete rotation system, and the cropping season is greatly restricted by the harvesting period of previous crops and the planting period of next crops. Expansion for the duration of cropping season is a very important problem in view of effective utilization of machines and allocation of labor.

A) A change in total growing days in connection with cropping seasonal change differs according to early and late varieties and the late variety has higher shortening rate. It was also made clear that growing days are subject to 2 elements; heading days and ripening days.

B) As for the most suitable cropping season, all the 3 trial varieties, Nipponbare, Reiho and GIZA 172, showed the highest yield (10 t/ha and above) when planted on May, 30. As cropping season is away from the most suitable cropping season either before or after it, yield becomes less. It has been cleared that changes in yield according to cropping seasonal change are primarily subject to the number of spikelets per m^2.

C) Cropping season which secures yield more than 6 t/ha is May 15 - June 15 planting for early and medium varieties, and May 15 - July 5 planting for late variety. Harvest season is August 23 - October 21 for early variety, September 24 - October 23 for medium variety and October 6 - November 15 for late variety. It was further made clear that the operation period of transplanter through combination of early/medium/late varieties and cropping season is 50 days, and the operation period of harvester is 82 days.

7) Suitable Planting Density

It has become cleared that the larger number of planting hills /m^2 increases more yield up to 27 hills, the highest rate transplanter. This is due to the weather condition of Egypt, under which amount of solar radiation is remarkably higher than Japan, and this fact is worth notice. The experiment results in the past 3 years have all been arranged to indicate relationship between the spikelets number/m^2 and yield, and an extremely high positive co-relation between the two has been confirmed. As spikelets number becomes larger up to 60,000/m^2, yield increases in a straight line, namely, more dense planting increases higher yield. In Japan, spikelets number per m^2 is usually 30,000 - 35,000 grains when the highest harvest is obtained, and in the case of more increase in spikelets number, harvest tends to decline conversely. In Egypt, even in the case of increasing spikelets number beyond 60,000 grains, there is the possibility that harvest will increase furthermore. Thus, the possibility of more dense planting is an important factor in considering the future of mechanized rice cultivation.

8) Determination of Suitable Number of Seedling per Hill

The traditional transplanting of rice plant in Egypt, large and old seedling are used, and the number of seedling per hill often exceeds 20. This is a traditional technique which has been employed in salt injury areas originally and widely spread to all Delta areas. It becames clear that 4 - 6 seedlings per hill is most suitable for young seedling mechanized transplanting in the case of ordinary soil of pH 8 - 9 under satisfactory water management in the initial period of growing.

9) Establishment of Fertilization Method

The 3 elements of fertilizer have been studied, and absolute necessity of N, P and K and the amount of suitable fertilizer application and fertilization method have been clarified, including the amount of total nitrogen application of 100 - 150 kg/ha, which is the highest yield, and the necessity of adopting different split fertilization method according to the characteristics of varieties.

10) Mechanical Harvesting Technique

Mechanical harvesting system has been studied on A) a system which pairs binder or reaper with movable harvester and B) a combine system. In A), comparison of binder with reaper proved that binder has a problem of slow working speed requiring 7.1 hours per feddan, but the working speed of reaper is 1.5 hours per feddan, a high working efficiency (88.8%), which is promising as a system together with movable harvester. In B), the combine system harvesting had a problem of stuffing with strow in the case of long culm variety (GIZA 172), but the problem was eliminated by reducing working speed to 0.4/sec, under which harvesting became easy within the total grain loss of 5%.

11) Weed Control

As a result of investigation of the kinds of weed in the paddy field of ordinary farmers near the experimental field of Rice Mechanization Center including and the Center's field, there were 10 kinds of weeds, which can be classified 6 kinds of Echinochloa and 2 kinds of rotundus. Of these weeds, 2 dominants are Echinochloa Crusgalli and Cyprus Rotundus, both having a characteristic of C_4 photosynthesis.

A) Both Echinochloa Crusgalli and Cyprus Rotundus grow faster than rice plant, restricting increase of tiller and reducing the number of panicles.

Especially, yield sharply decrease according to the density of the weeds, it has been clarified.

B) Cyprus Rotundus grows in tuber, and is a kind of perenial upland weed. It is most difficult to eliminate the weed with herbicide due to its strong resistance to herbicides. As a result of the study, it has proved that burying of tubes in soil by puddling is most effective.

4) Studies were made on the effect and chemical injury of various kinds of herbicides in the young seedling transplanting cultivation and the direct seedling cultivation with flooded condition, and effective weed control systems for respective cultivation methods have been made clear.

II. Economic Study on Mechanized Farming

1. Economic Advantages of Mechanization

1) Plowing and Puddling

In case of using tractor in stead of animal cultivation using water buffalo, use of a rental tractor is more advantageous than animal power for farmers with more than 3 feddans. It was also made clear that rental plowing using a tractor of the Agricultural Cooperative Association is more economical than using own tractor for farmers with 51 feddans or less.

2) Nursing Seedling and Transplanting

When traditional techniques are compared with young seedling transplanting techniques using transplanter, the latter is more advantageous in both effects of increasing yield and less expenses. However, it becames clear that the Contract Operation system by the Agricultural Cooperative Association is more advantageous than indivisual owning of tractor for the farmers of medium/small scale in view of the economical use (break even point) of transplanter's; 20 feddans for the four row walking type transplanter and 52 feddans for six row riding type transplanter.

3) Harvesting Work

Traditional techniques have a large harvesting loss, and the use of combine is more advantageous, but its break even point is 158 feddans. So, utilization of the Agricultural Cooperative Association's rental system is much more economical, according to the results of studies.

2. The Possibility of Mechanized Rice Farming in Egypt

1) Factors of Promoting Mechanization

A) Land utilization in Egypt, is being carried out a rotation system mainly for rice, cotton and corn and complex farming over 50 Feddan in each district. This is an advantage as compared with Japan, where scattering and complexity of paddy fields that obstruct the promotion of mechanization.

B) Respective farmers have small farms, but the extension of Mechanization System has been established through the Agricultural Cooperative Association.

C) The family labor in Egypt functions differently very much from that in Japan, and magnitude of family labor is not a factor which directly regulates to the scale of farming. Even small farmers depend largely on employed labor and the effect of mechanization is directly connected with reduction in their employed labors as well as the saving labor, making it easier for farmers to understand advantages of mechanization.

D) As traditional techniques are used heavy works in view of cultivation techniques, rationalized rice mechanization system brings about an effect of increase in yield as well as an effect of labor saving in the local area, a fact which is an impulse to mechanization.

E) Control of irrigation water promoters the mechanization. Namely, agricultural water for irrigation has more great importance in Egypt than in Japan, so that field works must be completed within a fixed period based on water supply plan. Mechanized rice cultivation has displayed its greater power than traditional method in such circumstances and made possible to cultivate in suitable season.

2) Obstructing Factors of the Mechanization

A) Supply of spare parts, check and repair of machines are incomplete and there is fear of being unable to have enough merits of mechanization.

B) Mechanization in Egypt is developed on a governmental basis rather than on a voluntary basis of individual farmers, so, risk-bearing and financial assistance should be arranged by the government.

C) Mechanized rice cultivation should be followed by an increase in yield, and it is a question how deeply mechanization will establish in this country. For this purpose, supply of herbicide and Agricultural Chemical for diseases and insect pests and the seeds suitable for mechanized rice cultivation is important including related guidance.

III. Establishment of Mechanized Rice Farming System

The characteristics of agricultural conditions, analyzed from 3 viewpoints of soil, climate and irrigation factors and various mechanized work and farming methods have been studied covering medium/small farming as a result of I. Verifying Experiment on Mechanized Rice Farming, and II. Economic Study on Mechanized Rice Farming. Based on the above, kinds and sizes of machines suitable for respective scales have been selected roughly and determined the following mechanized rice farming and will conduct verification experiment in 1985.

(1) Chisel plow
- Rotary plow - Eight row riding type transplanter - Combine - Solar dryer
- Plow by cow - Four row walking type transplanter - Reaper - Binder

(2) Chisel plow
- Leveling by eight row riding type transplanter - Transplanting by eight row riding type transplanter - Combine - Solar dryer
- Simultaneous leveling and transplanting by eight row riding type transplanter - Combine - Solar dryer

(3) Non plow - Rotary puddle
- Transplanting by eight row riding type transplanter - Combine - Solar dryer
- Transplanting by four row walking type transplanter - Combine - Solar dryer

IV. Advice and Guidance on Training for Operation and Maintenance of Agricultural Machinery

Agricultural mechanization in Egypt is one of the important government policies, and each Governorate in Nile Delta are conducting the demonstration of mechanized transplanting independently. On the other hand, the Ministry of Agriculture and governorates strongly requested the Project to give training to the field leaders of demonstration. Therefore, the Project made curriculums for a series of training in mechanized rice cultivation and started training by counterparts. The training includes lectures and practice and text books are revised every year based on the achievement of each division of the center. Training was given to 498 persons for primary and advanced courses of rice mechanization from Oct. '82 to Feb. '85.

V. Advice and Guidance for the Demonstration Activities of Mechanized Rice Farming

The Government of Egypt has formulated Food Security Plan for Five Years considering the nation's agricultural and social situations and mechanized rice farming is regarded as one of the important policies. Following this governmental policy, the Ministry of Agriculture and major rice farming governorate started demonstration of mechanized transplanting techniques to farmers independently in 1982 and at the same time requested the Project to give guidance and advice.

Through the Project's activities were just started and not in the stage of demonstration for popularization, the Project could not neglect independent demonstration promoted by Egyptian side and was compelled to give advice and guidance to the demonstration by Kafr El Sheikh governorate.

Contents of guidance on the demonstration of mechanized rice cultivation so far given are as follows:

1) Nursing young seedling techniques
2) Fertilization method of mechanized rice cultivation
3) Herbicide utilization
4) Management, maintenance, operation and adjustment of transplanters
5) Formulation of work schedule

RESULTS OF SURVEY, VERIFICATION TRIAL, TRAINING ACTIVITY AND ADVICE AND GUIDANCE FOR MECHANIZED RICE CULTIVATION IN KAFR EL SHEIKH GOVERNORATE IN MECHANIZATION DIVISION, 1984

RESULT OF SURVEY, VERIFICATION TRIAL, TRAINING ACTIVITY AND ADVICE AND GUIDANCE FOR MECHANIZED RICE CULTIVATION IN KAFR EL SHEIKH GOVERNORATE IN MECHANIZATION DIVISION, 1984

I. Nursing of Seedling Experiment

1. Reinvestigation for the effects of pH Adjustment by Sulphuric Acid for Bed Soil of Seedling Box
2. Effect of Different Kinds of Bed Soil for Seedling Growth
3. Relation between Sowing per Seedling Box and Seedling Character under the Different Kinds of Bed Soil Condition
4. Effect of Zinc Application for Seedling Growth

II. Cropping Seasonal Change

1. Effect of Cropping Seasonal Change for Growth and Yield on Paddy Field

III. Rice Transplanter Trials

1. Comparison Study for Effective Field Efficiency of Different Type Rice Transplanter
2. Rice Transplanter's Planting Accuracy

IV. Training

V. Advice and Guidance Activity for Mechanized Rice Cultivation Area in Kafr El Sheikh Governorate

VI. Paddy Weeds in the Experimental Field of Meet El Dyba, Rice Mechanization Center

I. Nursing of Seedling Experiment

1. Reinvestigation for the Effects of pH Value Adjustment by Sulphuric Acid for Bed Soil of Seedling Box

Object

Establishment of good seedling nursing method is one of the most important tasks for the mechanized rice transplanting in Egypt.

Optimum value for growth is 4 - 5 from germination to emergence of seedling and greening, but Nile Delta soil pH is around 8. Therefore, adjustment of pH value with additional sulphuric acid is essential to the growth of good seedling. On the other hand, there are some cases where additional sulphuric acid plot had growth inferior to no additional sulphuric acid plot when post-wheat soil of pH 8 is used for bed soil in the young seedling nursing performed by Kafr El Sheikh Governorate, posing a question as to the adjustment of pH value by additional sulphuric acid. Reinvestigation has been made to resolve the above question.

Method

1) Experimental soil:
   Both bed soil for seedling box and covering soil were taken from Egyptian clover field which shows good growth.
2) Variety: Giza - 172
3) Date of sowing: May 3, 1984
4) Method of raising seedling:
   Bed soil is sieved with 5 mm mesh and covering soil is sieved with 3 mm mesh. Depth of bed soil is 1.5 cm. Covering soil is spread just enough to cover seeds. Sowing quantity is 200 g (dry seed weight) per box. Irrigation is supplied from the bottom of seedling box (osmotic method) because of dry condition of bed soil containing much clay.
5) Quantity of additional sulphuric acid:
   The trial 1 - additional quantity is divided into 20 stages from 0.25 cc to 5 cc at 0.25 cc for each stage of concentrated sulphuric acid (97%) per 1 liter of soaking water for seedling box. Bed soil's pH and EC just after irrigation were investigated and plant height and dry matter weight of seedlings at the end of 2 weeks from seedling were measured.
   The trial 2 - Additional quantity is divided into 20 stages from 1 cc to 20 cc at 1 cc for each stage of concentrated sulphuric acid per 1 liter of soaking water for seedling box. Bed soil's pH and EC were investigated without seedling.

Result

Fig. 1 shows the effect of quantity of concentrated sulphuric acid added to soaking water for seedling box on bed soil's pH and EC after irrigation. According to it, pH indicated a lineal decline in proportion to

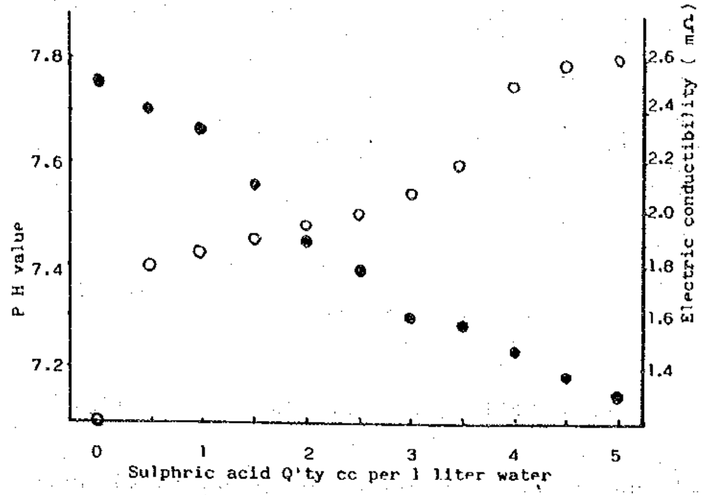


Fig. 1 Relation between sulphuric acid (H_2SO_4 97%) addition to soaking water and pH, EC value for bed soil of seedling box

increase in additional quantity of concentrated sulphuric acid to pH 7.25 at maximum additional quantity of 5 cc in the treatment plot against pH 7.85 in the no treatment standard plot. EC value showed a tendency to rise gradually as additional quantity of concentrated sulphuric acid increased, and EC 1.20 m℧ in the no treatment standard plot rose to 2.60 m℧ in the 5 cc concentrated sulphuric acid plot. Fig.2 and 3 indicate the effect of pH value adjustment by additional sulphuric acid on the growth of seedlings.

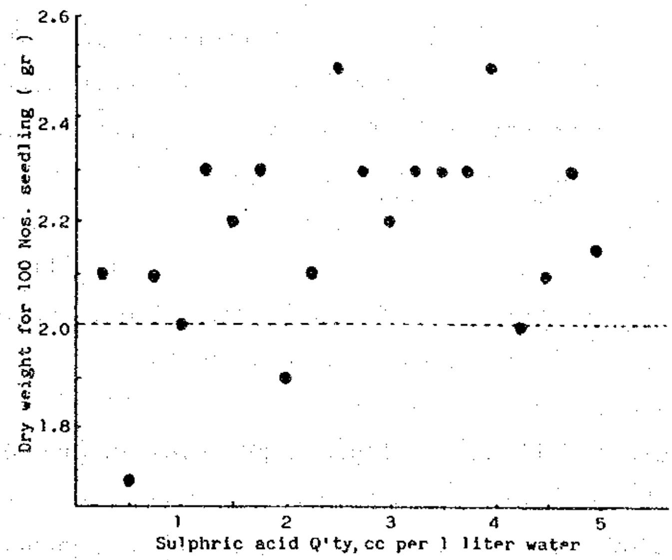


Fig. 2 The effect of sulphuric acid for dry weight of seedling

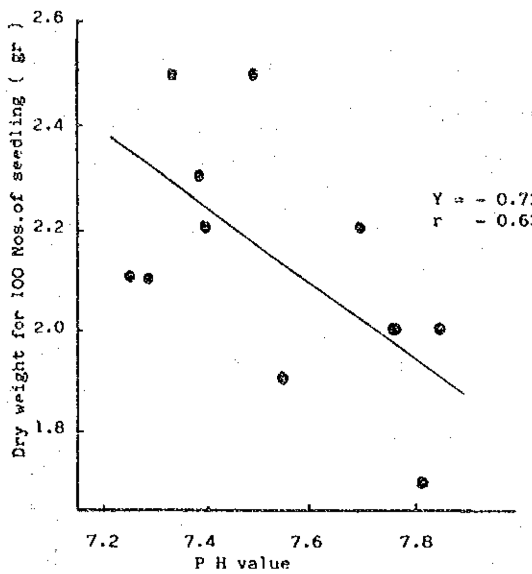


Fig. 3 Relation between pH value and dry weight of seedling

Looking into the relation between the quantity of additional concentrated sulphuric acid and the dry matter weight of seedling in Fig. 2, the effect of additional concentrated sulphuric acid is recognized, though measured dry matter weight variance is considerably large.

There are 2 cases of decreased dry matter weight of seedling and 2 cases of decreased dry matter weight of seedling and 2 cases of equal dry matter weight in the additional concentrated sulphuric acid plot as compared with the no additional standard plot, but dry matter weight increased by addition of concentrated sulphuric in 16 the other cases. Fig. 3 shows the relation between pH value just after sowing and seedling dry matter weight. According to it, highly minus correlation is recognized between bed soil pH value and seedling dry matter weight, and existence of pH value adjustment effect by additional concentrated sulphuric acid has been reconfirmed.

Trial 1 showed that additional concentrated sulphuric acid is effective for the growth of seedling, but pH in the stage of additional quantity of 5 cc is still 7.25, a remarkably high value as compared with pH 4 - 5 for young seedling nursing in Japan. Fig. 4 presents the results of investigation on pH and EC values just after bed soil irrigation, increasing additional quantity of concentrated sulphuric acid furthermore to 20 cc per 1 liter of soaking water.

It clearly indicated lineal decline in pH value in proportion to increase in additional concentrated sulphuric acid quantity, simultaneously showing increase in EC value. In this trial, pH value reached 5.8 at the maximum additional quantity of 20 cc, but it is considered necessary to add about 10 cc of concentrated sulphuric acid to attain optimum pH value for seedling nursing.

As for EC value, it reached 3.95 m℧ in the 20 cc additional quantity plot and damage for seedling growth by high consistence of base is feared in Nile Delta which contains much salinity soil.

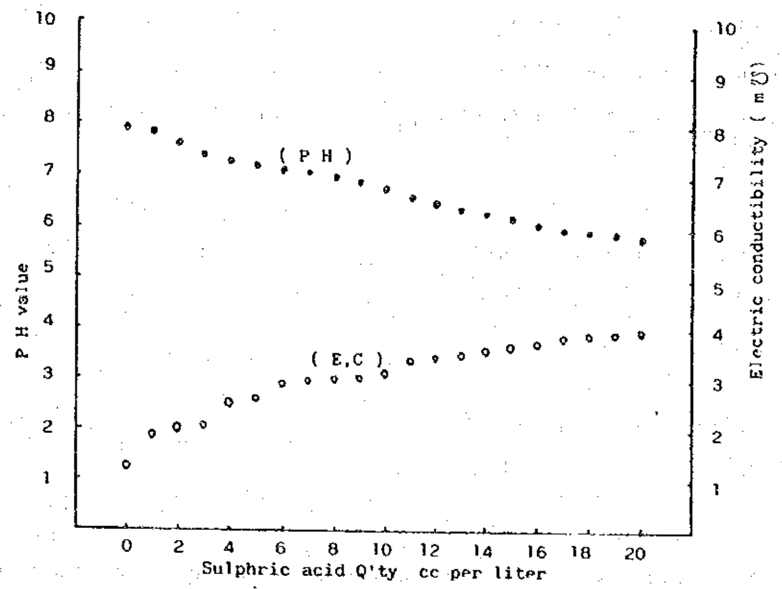


Fig. 4 Relation between sulphuric acid (H_2SO_4 97%) addition to soaking water and pH, EC value for bed soil of seedling box

It is necessary to determine optimum additional concentrated sulphuric acid quantity after conducting practical experiment on raising of seedling. In conclusion, pH value adjustment by additonal concentrated sulphuric acid is a very effective means for raising good seedling, using normal cultivation soil in the Nile Delta as seedling box bed soil, and it was made clear that the optimum additional quantity is requested to be studied furthermore.

2. Effect of Different Kinds of Bed Soil for Seedling Growth

Object

Delta soil has great heavy stickness when it contains water and sticks to planting fingers at the time of transplanting by rice transplanter, ratio of vacant hill reaching 20% in the beginning. So, an applied technique was employed, mixing Tameiya (dredged soil of main irrigation channel) by 50%. Later planting finger push rod was modified from crank type to spring type which enabled forcible separation from seedling. As a result, perfect

According to it, Tameiya shows very characteristic growth as compared with other kinds of soil, i.e., the initial growth in Tameiya plot (1 week from seeding) is most remarkably superior to those in other plots, but the growth stops in and after middle period, presenting nutrient deficiency symptoms. The initial growth in 3 other plots of different kinds of soil is inferior to Tameiya's, but the growth in the middle and later periods all excell Tameiya plot. Especially, the growth in later period of heavy stickness plot is characteristically great. As for dry matter weight, Tameiya < normal field soil ≒ mixed soil of Tameiya and normal field soil < heavy stickness soil.

In view of the above results, it is desirable to use the soil of normal field, where wheat or clover show good growth and most easily obtainable, as bed soil, and it is unnecessary to use a special kind of soil, Tameiya, as bed soil.

3. Relation between Sowing per Seedling Box and Seedling Character under the Different Kinds of Bed Soil Condition

Object

In the mechanized rice transplanting area being developed by Kafr El Sheikh Governorate, there are some cases where high yield can not be expected due to obstruction to rooting and delay in initial growth, using Tameiya as bed soil and sowing very densely for fear of vacant hill. Therefore, investigation was made regarding the effect of the kinds of bed soil and sowing quantity on seedling character.

Method

Experimental soil for nursing seedling:

1) Tameiya

Dredged soil from main irrigation channel containing much silt.

2) Normal field soil

The soil taken from the field where Egyptian clover shows good growth.

3) Variety: Giza - 172

4) Sowing quantity: 1) 175 g, 2) 200 g, 3) 250 g, 4) 300 g of dry seed weight per seedling box

5) Date of sowing: May 23, 1984

6) Method of raising seedling: It was the same as 1

planting became possible even when normal soil with heavy stickness is used for bed soil. Therefore, studies on the kinds of bed soil were made again in order to search for soil suitable for nursing seedling.

Method

Nursing seedling soil for experiment:

1) Tamaiya

Dredged soil of main irrigation channel containing much silt.

2) Normal cultivation field soil

The soil taken from the field where Egyptian clover shows good growth.

3) Mixed soil

Mixed with 1) and 2) and ratio is 1 : 1

4) Heavy clay soil

The soil taken from the field with heavy stickness in Kallin District, Kafr El Sheikh Governorate.

5) Variety: Giza - 172

6) Date of seeding: May 23, 1984

7) Nursing seedling method: It was the same as 1

Result

The soil texture of each experimental soil and nursing seedling conditions are shown in Table 1.

Table 1. Relationship between kinds of bed soil for seedling box and seedling condition

Kinds of bed soil Items	Tameiya (dredged soil from irrigation canal)	Normal soil (soil from normal field)	Mixed soil (Tameiya 50% + normal soil 50%)	Heavy clay soil
Content of soil (%)				
Silt	40	13	23	8.5
Clay	60	87	77	91.5
Height of seedling after sowing (cm)				
7 days	8.04	6.63	6.14	6.96
15 days	9.35	9.53	6.14	6.96
21 days	9.37	10.66	11.92	13.66
Dry matter weight of seedling (g/20 Nos. of seedling.)	0.19	0.22	0.22	0.23

Note ; Variety, Giza-172. Sowing Q'ty per box, 200 g.
Leaf age, 2.5, without fertilizer application condition.

Result

Table 2 indicates the effect of the kinds of bed soil and the change in sowing quantity on plant height and dry matter weight.

Table 2. Relationship between seedling condition and sowing Q'ty/box

Sowing Q'ty/box (Dry weight, gr)	No. of seeds/cm²	No. of plant established/cm²	Dry weight/plat, gr		Remarks
			Tameiya	Normal soil	
175	4.14	3.23	0.0114	0.028	Checked after 21 days sowing
200	4.74	3.69	0.0010	0.023	
250	5.92	4.52	0.0098	0.020	with out fertilizer application.
300	7.10	5.21	0.0088	0.018	

Variety, Giza 172.
1000 seeds weight, 26.0 gr.

According to the Table, seedling's dry matter weight in both Tameiya and normal field soil shows a tendency to decrease as sowing quantity increases, becoming spindly seedling, and the degree differs very much according to the kinds of bed soil. The sowing quantity which satisfies the standard of dry matter weight (1.00 g per 100 seedlings) showing young seedling characteristic is 200 g - sowing for Tameiya (dry matter weight, 1.00 g per 100 seedling) and 300 g - sowing (dry matter weight, 1.80 g per 100 seedlings) for normal cultivation field plot.

Generally, there is a lot of amout of solar radiation in Nile Delta, and it is unlikely that dense sowing to some degree causes a decline in seedling character. However, special attention should be paid not to exceed the sowing quantity of 200 g (dry matter weight) per box in the case of Tameiya of low soil fertility as compared with the case of using normal cultivation field soil.

The soil that can be used for nursing bed soil in Nile Delta is limited to Tameiya and the soil from normal cultivation field. In view of the trial in the preceding item 2 and this trial, it is considered important to use normal cultivation field soil as bed soil for seedling box and to decrease sowing quantity to 160 g, nursing a heavy dry matter weight seedling in Nile Delta, because Tameiya's soil fertility is very low and unsuitable for nursing seedling and Nile Delta soil is saline soil with high pH value.

4. Effect of Zinc Application for Seedling Growth

Object

Nile Delta soil has high pH value and contains an extremely low percentage of zinc. For this reason, studies were made on the effect of zinc application to bed soil on seedling growth.

Method

1) Zinc sulfide (ZNS):
   Dry bed soil is mixed with zinc sulfide equivalent to 10, 25, 50 and 100 ppm and soaked bed soil with water from the lower part of seedling box using osmotic method.
2) Zinc sulfate (ZSO4)
   Seedling box is filled with dry bed soil. Make a water solution of zinc sulfate of 25, 50, 100 ppm, and soak bed box with the solution of 1 liter per box from the lower part of the box by osmotic method.
3) Variety: Giza - 172
4) Date of sowing: May 9, 1984
5) Method of raising of seedling: It was the same as 1

Result

Table 3 shows plant height on the 20 days after sowing (June 1). According to it, a remarkable effect is recognized in both zinc sulfide treatment plot and zinc sulfate treatment plot as compared with no treatment plot.

Table 3. Effect of zinc application on rice seedling growth

Unit cm.

Zinc / Rep, No.	Zns 10ppm	Zns 25ppm	Zns 50ppm	Zns 100ppm	ZSO_4 25ppm	ZSO_4 50ppm	ZSO_4 100ppm	Control
Rep, 1	14.2	13.1	13.4	13.0	11.0	11.0	10.7	8.6
Rep, 2	14.8	13.0	12.8	13.2	11.1	11.2	11.6	8.6
Rep, 3	14.6	13.8	10.0	11.0	11.4	11.0	11.3	7.6
Rep, 4	16.0	15.0	13.0	12.0	12.0	10.8	12.6	8.2
Total	59.6	54.9	49.2	49.2	45.4	44.0	46.2	33.0
x	14.9	13.7	12.3	12.3	11.4	11.0	11.6	8.3
SD	0.670	0.798	1.345	0.877	0.389	0.141	0.687	0.409

Zns and ZSO_4, no significance.
Zns, SZO_4 and control, CV=3.29** Significance at the 1% level. LSD 1.712

Sowing date, 9th May
Checking date, 1st June.

Namely, as against the plant height of 8.3 cm of no treatment plot, the plant height in zinc sulfide treatment plot is in the following order according to the treatment concentration; 10 PPM > 25 PPM > 50 PPM = 100 PPM, showing the highest effect of 14.9 cm for 10 PPM. On the other hand, no difference in effect is recognized according to concentration in zinc sulfate treatment plot, indicating the plant height of 11.0 - 11.5 cm for all concentration treatments.

In both treatment plots, leaf color is darker and culm diameter is larger as compared with no treatment plot. Nile Delta soil generally has a high pH value and zinc deficiency, and seedling nursing and initial growth are often obstructed. Both zinc sulfide and zinc sulfade, if applied in the quantity of 10 - 25 PPM, remarkably promote seedling growth as a result of studies on the effect of these agents on seedling growth.

So, it is planned to add the above results as one of the basic items of the method for raising young seedling.

II. Cropping Seasonal Change

1. Effect of Cropping Seasonal Change for Growth and Yield on Paddy Field

<u>Object</u>

The rice cultivation in Nile Delta is incorporated in the 3-year rotation system of rice, cotton and maize (winter crops are wheat, Egyptian clover, etc.), and the cropping season is regulated by harvesting and sowing of preceding and succeeding crops, irrigation condition and other factors.

In mechanized rice cultivation, it is very important to clarify the conditions for expanding suitable cropping season, improve machinery's working efficiency per year, establishing yield increase techniques.

From above viewpoints, studies were made on the effect of cropping seasonal change on the growth and yield of paddy rice.

<u>Method</u>

1) Variety: Akihikari, Giza - 173, Giza - 172
2) Cropping season (date of transplanting):
   May 15, May 20, May 25, May 30, June 5, June 10, June 15, June 20, June 25, June 30, July 5, July 10, July 15, July 20 of 1984.
3) Size of trial plot: Area of 1 plot is 420 m^2, 3 repetition system
4) Leaf age: 3.0 (by seedling box)
5) Cultivation practice: Plowing, chisel plow, manual puddling with leveling board, number of plant per hill - 6,

transplanting by manual, planting density per m^2 - 24 (30 x 14 cm)

6) Fertilizer application:

Basal application per feddan - Ammonium sulfate 102 kg, superphosphate 150 kg, potassium 25 kg to be applied just before puddling.

Top dressing per feddan - Urea 25 kg to be applied on the 10 day after transplanting and on the 23rd day before heading.

7) Investigation:

Growth survey is conducted at an interval of 10 days on 20 hills after transplanting for each cropping season up to the 70th day after transplanting regarding plant height and number of tillers. Yield survey for 1 plot is conducted by the yield survey method of selected representative hill from 140 numbers hill.

Result

1) Variation of vegetation period:

Variation of vegetation period according to cropping seasonal change is shown in Tables 4 - 6 and Fig. 5. According to them, all the varieties have different heading time and maturity time as cropping season changes, and vegetation period tends to become shorter, and the extent varies considerable depending on varieties character for early or late heading.

Table 4. The effect of cropping seasonal change for growth period

Variety ; Akihikari

Transplanting date	Duration (From transplanting date up to heading time)	Heading time	Duration (From heading time up to time of maturity)	Time of maturity	Total days from transplanting date up to time of maturity
15/May	70 days	24/July	30 days	23/Aug	100 days
20/May	71 "	30/July	30 "	29/Aug	101 "
25/May	74 "	7/Aug	28 "	4/Sep	102 "
30/May	71 "	9/Aug	30 "	8/Sep	101 "
5/June	71 "	15/Aug	30 "	14/Sep	101 "
10/June	70 "	19/Aug	30 "	18/Sep	100 "
15/June	68 "	22/Aug	30 "	21/Sep	98 "
20/June	67 "	26/Aug	30 "	25/Sep	97 "
25/June	69 "	2/Sep	30 "	2/Oct	99 "
30/June	70 "	8/Sep	28 "	6/Oct	98 "
5/July	67 "	12/Sep	28 "	10/Oct	95 "
10/July	69 "	17/Sep	30 "	17/Oct	99 "
15/July	69 "	22/Sep	28 "	20/Oct	97 "
20/July	67 "	25/Sep	27 "	22/Oct	94 "

Table 5. The effect of cropping seasonal change for growth period

Variety ; Giza 173

Transplanting date	Duration (From transplanting date up to heading time)	Heading time	Duration (From heading time up to time of maturity)	Time of maturity	Total days from transplanting date up to time of maturity
15/May	95 days	18/Aug	37 days	24/Sep	132 days
20/May	96 "	24/Aug	37 "	30/Sep	133 "
25/May	94 "	27/Aug	38 "	4/Oct	132 "
30/May	94 "	1/Sep	37 "	8/Oct	131 "
5/June	96 "	9/Sep	35 "	14/Oct	131 "
10/June	96 "	14/Sep	35 "	19/Oct	131 "
15/June	94 "	17/Sep	36 "	23/Oct	130 "
20/June	95 "	23/Sep	34 "	27/Oct	129 "
25/June	93 "	26/Sep	37 "	2/Nov	130 "
30/June	94 "	2/Oct	34 "	5/Nov	128 "
5/July	93 "	6/Oct	34 "	9/Nov	127 "
10/July	91 "	9/Oct	34 "	12/Nov	125 "
15/July	90 "	13/Oct	38 "	20/Nov	128 "
20/July	88 "	16/Oct	37 "	22/Nov	125 "

Table 6. The effect of cropping seasonal change for growth period

Variety ; Giza 172

Transplanting date	Duration (From transplanting date up to heading time)	Heading time	Duration (From heading time up to time of maturity)	Time of maturity	Total days from transplanting date up to time of maturity
15/May	103 days	26/Aug	41 days	6/Oct	144 days
20/May	102 "	30/Aug	44 "	13/Oct	146 "
25/May	104 "	6/Sep	41 "	17/Oct	145 "
30/May	102 "	9/Sep	39 "	18/Oct	141 "
5/June	102 "	15/Sep	37 "	22/Oct	139 "
10/June	103 "	21/Sep	34 "	25/Oct	137 "
15/June	101 "	24/Aep	39 "	2/Nov	140 "
20/June	100 "	28/Sep	38 "	5/Nov	138 "
25/June	98 "	1/Oct	39 "	9/Nov	137 "
30/June	96 "	4/Oct	40 "	13/Nov	136 "
5/July	94 "	7/Oct	42 "	18/Nov	136 "
10/July	94 "	13/Oct	38 "	20/Nov	132 "
15/July	95 "	18/Oct	36 "	23/Nov	131 "
20/July	93 "	21/Oct	35 "	25/Nov	128 "

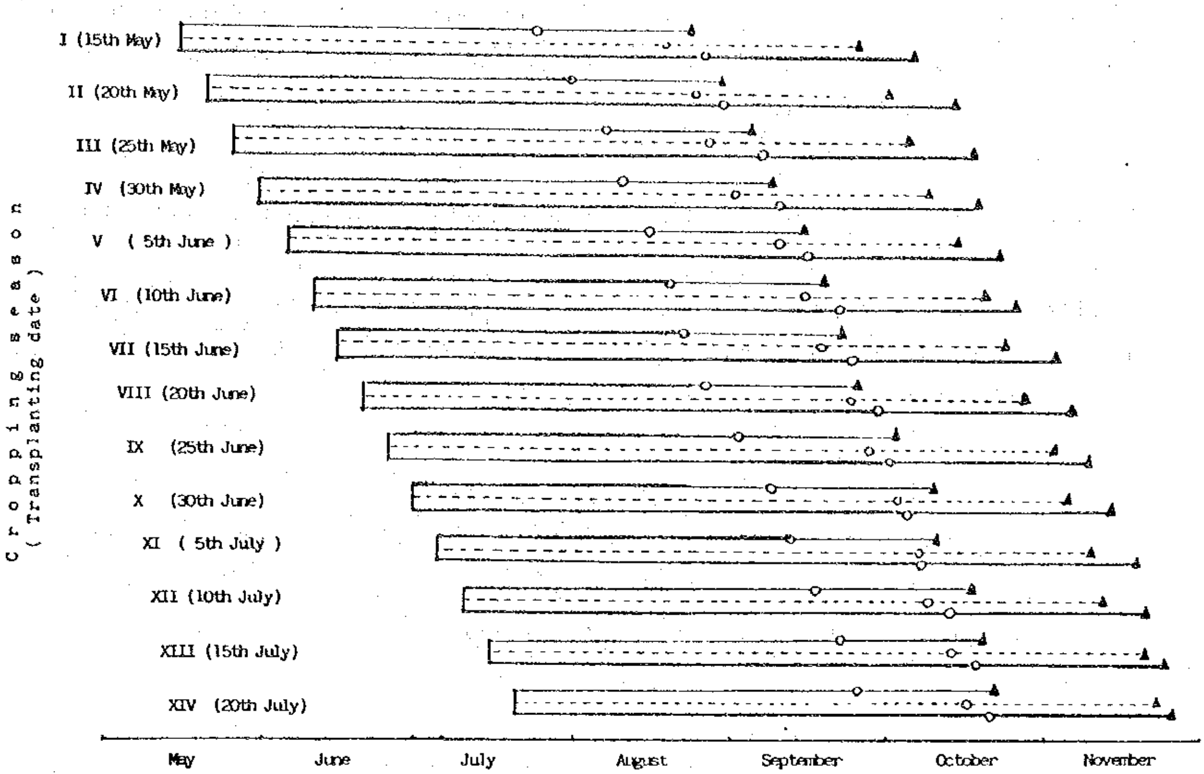


Fig. 5. Transplanting date, heading time and time of maturity relationships Note ; —— Akihikari ----- Giza 173, —— Giza 172. ○ Heading time ▲ Time of maturity

Heading days of Akihikari, an early maturing variety are almost stable in any cropping season, approximately 70 days. But, the heading days of a middle maturing variety Giza-173, are 95 days for cropping season I (transplanting, May 15) and are 88 days for cropping season XIV (transplanting, July 20). Thus, heading days become shorter as cropping season is delayed.

In the case of Giza-172, a late maturing variety, 103 days in cropping season I become less as transplanting season is delayed, and become 93 days in cropping season XIV, showing a remarkable reduction in heading time.

As for ripening period, from heading to the time of maturity, it is regulated by ripening temperature and tends to be short for the early maturing variety and long for the late maturing variety, and respective varieties show a tendency toward shorter ripening period in line with the later cropping season.

A decrease in the number of spiletets per panicle due to delay in cropping season supposedly shortens ripening period as stated later.

In conclusion, variation in total growing period due to cropping seasonal change has shown the number of shortened days of 6 days for Akihikari, 7 days for Giza - 173 and 16 days for Giza - 172, being controled by 2 elements - heading period and ripening period.

2) Variation of plant height and number of tiller by cropping seasonal change:

Variation of plant height by seasonal change is shown in Fig. 6 through Fig. 8, and variation of the number of tillers is Fig. 9 through Fig. 11.

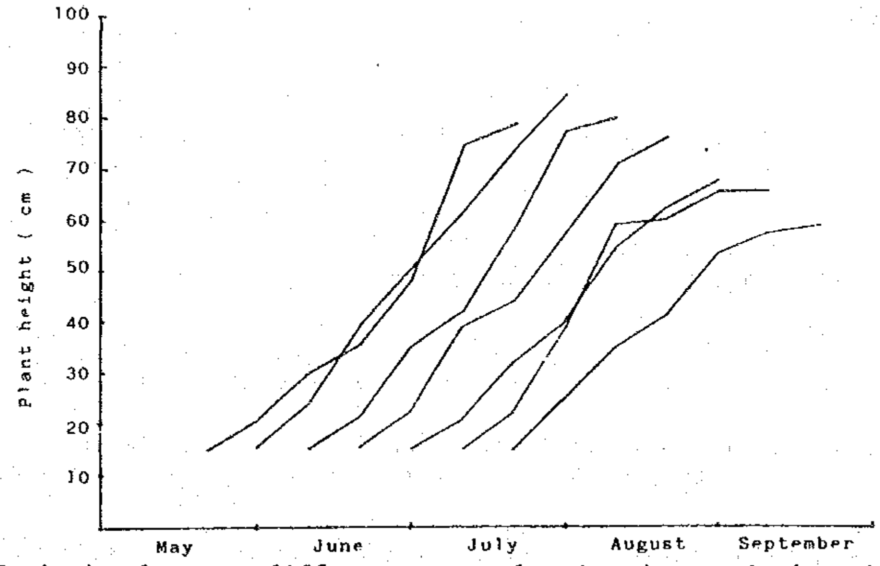


Fig. 6. Variation between different transplanting date and plant height

Note ; Variety, Akihikari

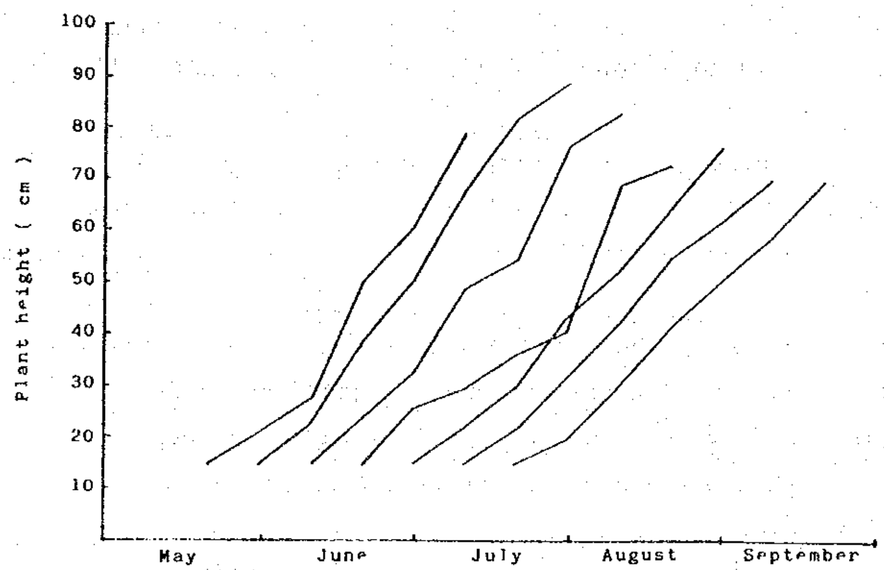


Fig. 7. Va;riation between different transplanting date and plant height

Note ; Variety, Giza - 173

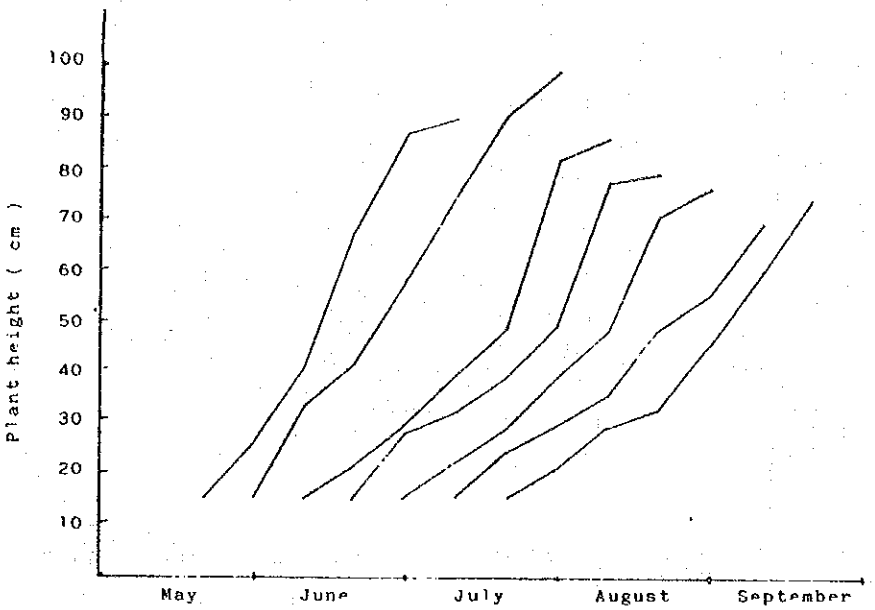


Fig. 8. Variation between different transplanting date and plant height

Note ; Variety, Giza 172

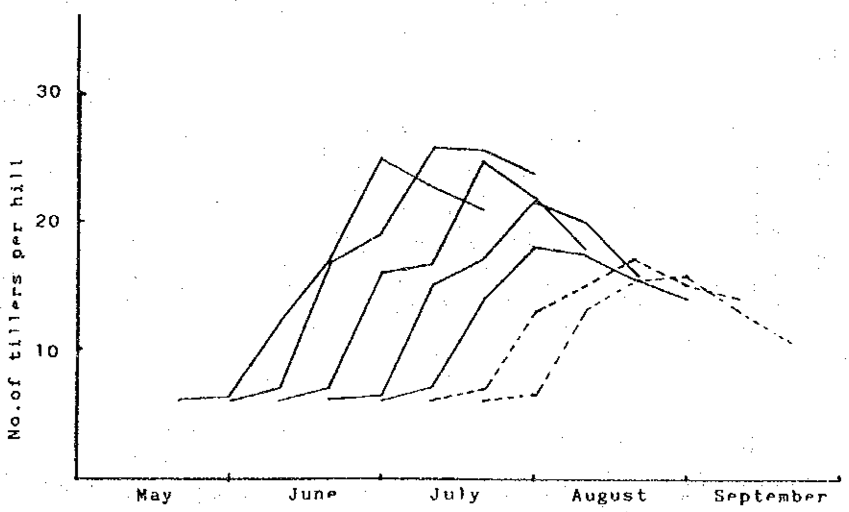


Fig. 9. Variation between different transplanting date and No. of tillers per hill

Note ; Variety, Akihikari

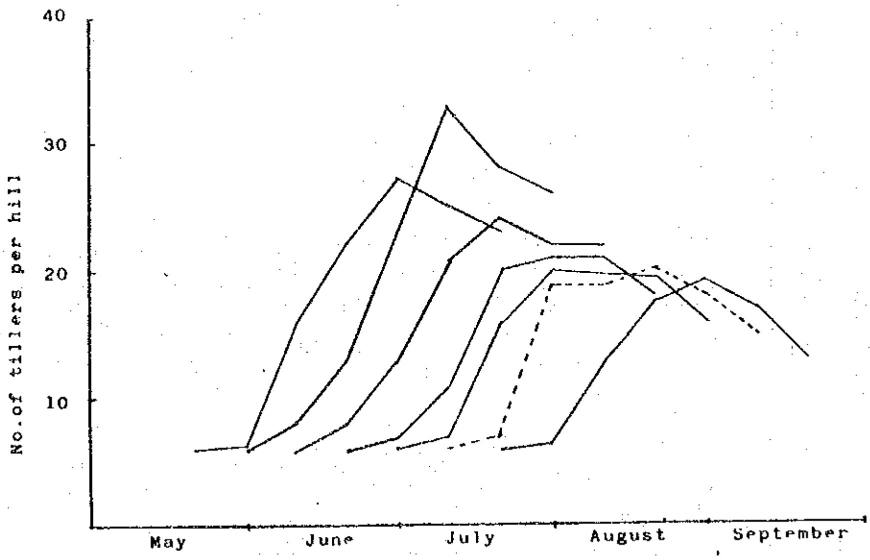


Fig. 10. Variation between different transplanting date and No. of tillers per hill

Note ; Variety, Giza - 173

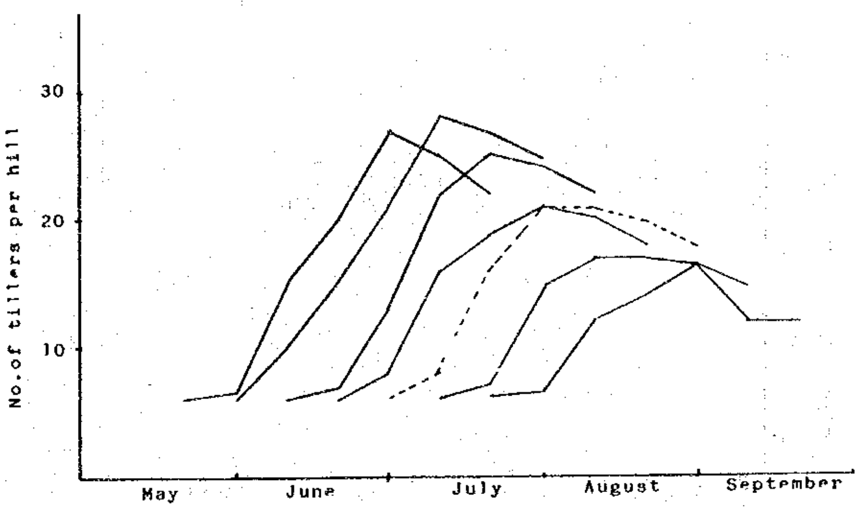


Fig. 11. Variation between different transplanting date and No. of tillers per hill

Note ; Variety, Giza - 172

According to the former Figures, any of the varieties shows similar characteristics in the relation between cropping season and plant height growth, namely, the growth speed of cropping season IV (transplanting, May 30) is the fastest, taking almost lineal growth progress until the 70th day after transplanting and reaching the tallest plant height. There is a tendency that seedlings become slow in growth as the disparity of cropping season is greater, centering around cropping season IV, indicating shorter final plant height.
As for the variation in the number of tillers in Fig. 9-11, it is characterized by the greatest increase in the number of tillers in cropping season IV, and each variety shows the maximum number of tillers in cropping season IV as in the case of plant height, showing a tendency to decrease in the number of tillers in the earlier and later cropping seasons centering around cropping earlier and later cropping seasons centering around cropping season IV. The increase in the number of tillers on the 30th day after transplanting is most marked, and this tendency is the same as the number of heading.
In conclusion, the effect of cropping seasonal change on plant height and the number of tillers shows the fastest growth speed for cropping season IV, and the growth progress becomes slow as cropping season is away from the season IV, decreasing in both plant height and the number of tillers.

3) Variation of yield and yield components:
Tables 7-9 and Fig. 12 indicate the above subject. According to them, 3 experimental varieties all showed maximum yield for cropping season IV; 11.27 t/ha for Giza-172, 10.29 t/ha for Giza-173 and 9.71 t/ha Akihikari.

Table 7. Relationship between transplanting date and yield components

Variety, Akihikari

Transplanting date	Nos. of panicles		Nos. of spikelets		Percentage of ripened grain	1000 grain weight(gr)	Yield (ton/Ha)	Percentage of yield decrease
	Per hill	Per M^2	Per panicle	Per M^2				
15th May	20	480	71	34080	85	25.4	7.35	24.3
20th May	21	504	73	36792	85	25.5	7.97	18.1
25th May	22	528	73	38544	87	25.6	8.58	11.6
30th May	24	576	74	42624	88	25.9	9.71	0
5th June	22	528	72	38016	85	25.7	8.30	14.5
10th June	20	480	71	34080	84	25.5	7.30	24.8
15th June	19	456	70	31920	82	25.3	6.62	31.8
20th June	16	384	70	26880	82	25.3	5.58	42.5
25th June	15	360	67	24120	81	25.2	4.92	49.3
30th June	14	336	63	21168	81	25.0	4.29	55.8
5th July	15	360	60	21600	80	25.1	4.33	55.4
10th July	14	336	61	20496	81	24.5	4.07	58.1
15th July	14	336	60	20160	79	25.0	3.98	59.0
20th July	12	288	55	15840	80	24.8	3.14	67.7

Notes: Leaf age, 3 leaves
No. of hill, $24/M^2$
No. of plant, 6/hill

Table 8. Relationship between transplanting date and yield components

Variety, Giza 173

Transplanting date	Nos. of panicles		Nos. of spikelets		Percentage of ripened grain	1000 grain weight(gr)	Yield (ton/Ha)	Percentage of yield decrease
	Per hill	Per M^2	Per panicle	Per M^2				
15th May	23	552	62	34224	85	24.5	7.13	30.7
20th May	24	576	65	37440	87	25.0	8.14	20.9
25th May	26	624	67	41808	87	24.9	9.06	12.0
30th May	28	672	68	45696	88	25.6	10.29	0
5th June	25	600	67	40200	85	25.4	8.68	15.6
10th June	22	528	67	35376	82	25.4	7.37	28.4
15th June	20	480	63	30240	82	25.2	6.70	34.9
20th June	20	480	63	30240	81	24.4	5.98	49.1
25th June	19	456	60	27360	57	24.0	4.92	52.2
30th June	16	384	58	22272	75	23.0	3.84	62.7
5th July	15	360	56	20160	72	22.3	3.23	68.6
10th July	15	360	55	19800	70	22.0	3.05	70.4
15th July	15	360	55	19800	68	22.0	2.96	71.2
20th July	13	312	53	16536	65	21.0	2.26	78.0

Notes: Leaf age, 3 leaves
No. of hill, $24/m^2$
No. of plant, 6/hill

Table 9. Relationship between transplanting date and yield components

Variety, Giza 172

Transplanting date	Nos. of panicles		Nos. of spikelets		Percentage of ripened grain	1000 grain weight(gr)	Yield (ton/Ha)	Percentage of yield decrease
	Per hill	Per M^2	Per panicle	Per M^2				
15th May	22	528	78	41184	84	25.4	8.79	22.0
20th May	22	528	82	43296	86	25.6	9.53	15.4
25th May	24	576	83	47808	85	25.9	10.52	6.7
30th May	25	600	84	50400	86	26.0	11.27	0
5th June	25	600	83	49800	86	26.0	11.14	1.2
10th June	22	528	82	42396	86	25.5	9.49	15.8
15th June	21	504	81	40824	85	25.7	8.94	20.9
20th June	20	480	78	37440	86	25.0	8.05	28.6
25th June	20	480	76	36480	85	25.3	7.85	30.3
30th June	18	432	73	31536	83	25.1	6.57	41.7
5th July	17	408	70	28560	83	25.5	6.04	46.4
10th July	17	408	67	27336	82	24.9	5.58	50.5
15th July	12	288	65	18720	80	25.0	3.74	66.8
20th July	11	264	65	17160	80	24.7	3.39	69.9

Notes: Leaf age, 3 leaves
No. of hill, $24/M^2$
No. of plant, 6/hill

As their cropping seasons move away from cropping season IV, an yield decrease is clearly noticed. In this trial, Giza-172 excelled Akihikari and Giza-173 for all cropping seasosn, always showing the highest yield (except cropping season XIII). Regarding the yield decreasing rate of each cropping season against cropping season IV summarized in Tables 7-9, the yield decreasing rates for cropping seasonal change of Giza-173 and Akihikari are much higher than the rate of Giza-172.

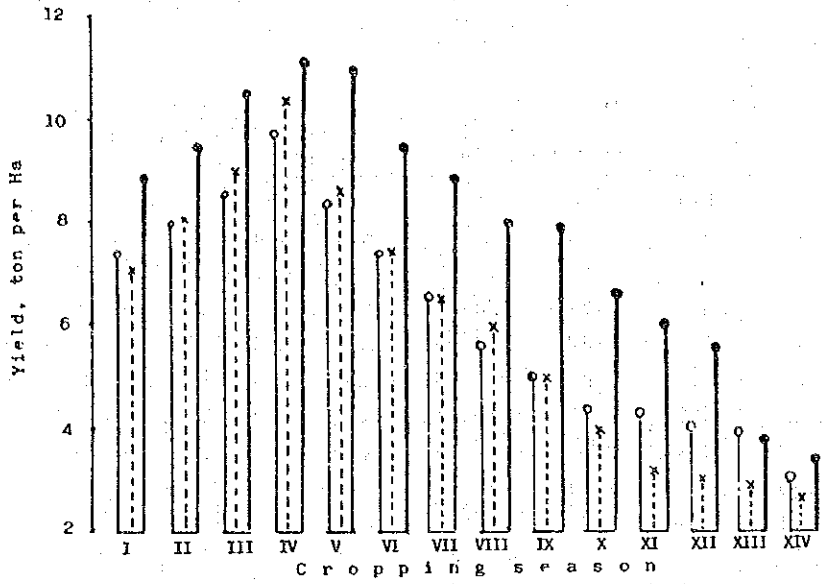


Fig. 12. The effect of cropping seasonal change for yield

Note ; Relation between cropping season and transplanting date.
I (15th May), II (20th May), III (25th May), IV (30th May),
V (5th June), VI (10th June), VII (15th June),
VIII (20th June), IX (25th June), X (30th June),
XI (5th July), XII (10th July), XIII (15th July) XI (5th July)
; Varieties, ○ Akihikari, × Giza 173, ● Giza 172

The next Fig. 13-17 and tables 7-9 explain the effect of cropping seasonal change on each yield component.

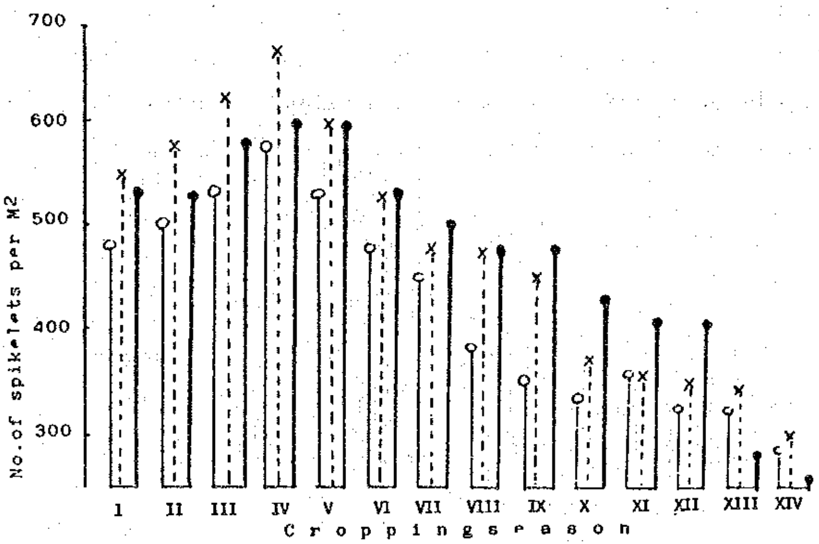


Fig. 13. The effect of cropping seasonal change for panicle per M^2

Note ; Varieties and cropping season are the same as Fig. 12

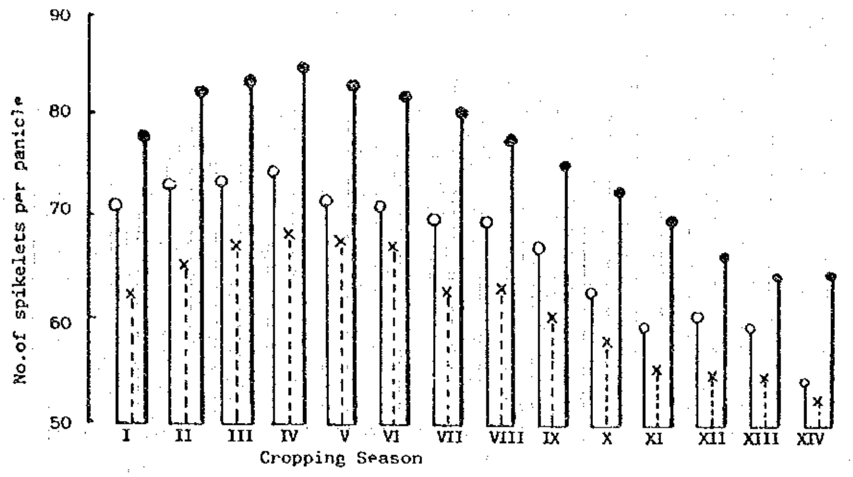


Fig. 14. The effect of cropping seasonal change for spikelets per panicle

Note ; The varieties and cropping season are thesame as Fig. 12.

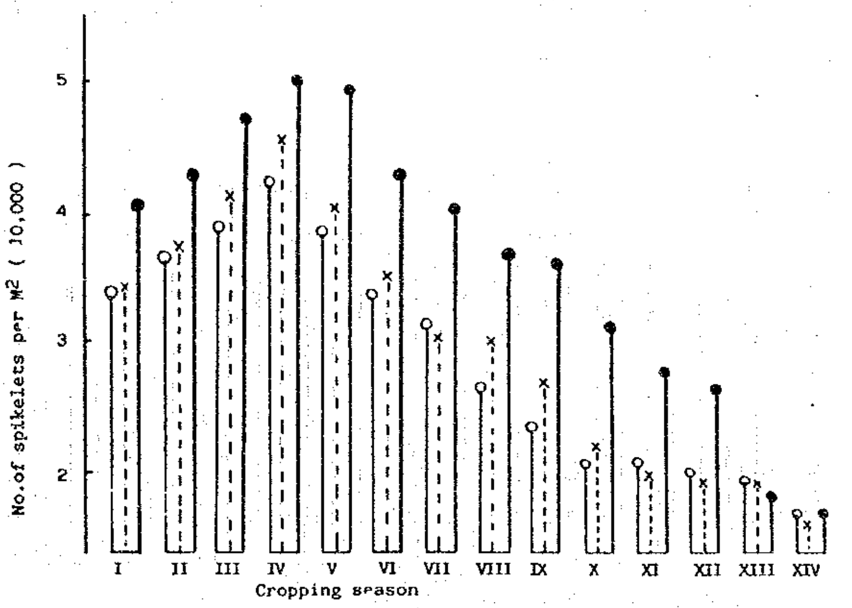


Fig. 15. The effect of cropping seasonal change for spikelets per M^2

Note ; The varieties and cropping season are the same as Fig. 12.

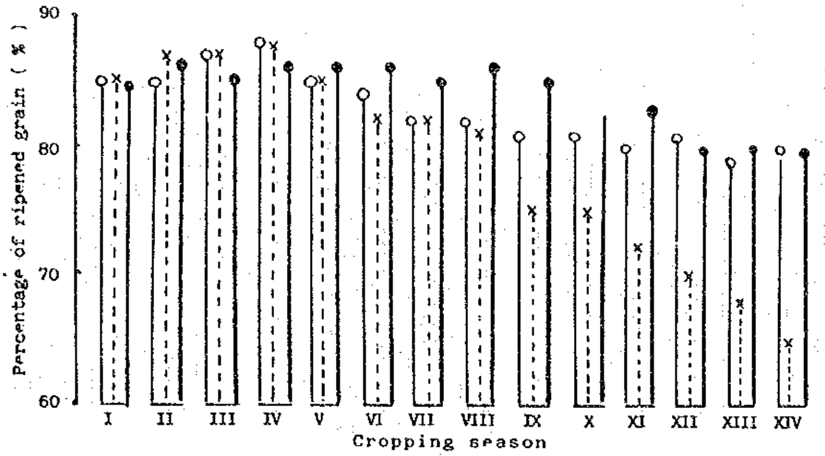


Fig. 16. The effect of cropping seasonal change for percentage of ripened grain

Note ; The varieties and cropping season are the same as Fig. 12.

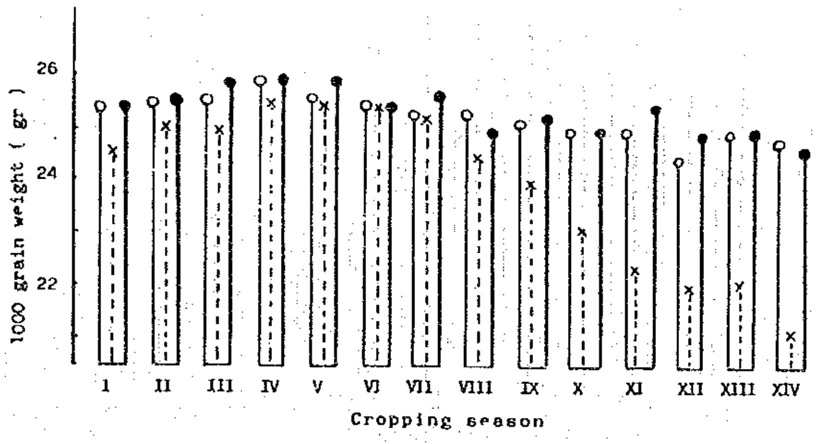


Fig. 17. The effect of cropping seasonal change for 1000 grain weight

Note ; The varieties and cropping season are the same as Fig. 12.

Firstly, the number of panicles shows very characteristic reaction as indicated on Fig. 13 and tables 7-9. Namely, each variety's panicle number keeps increasing as cropping season develop up to IV, and reaches the maximum number in cropping season IV, declining thereafter in the number as transplanting period is away from the season IV. As specific reactions of varieties, Giza-173 always show yield increase superior to others in the early cropping season from I to IV, but shows sharp yield decrease after the season IV together with Akihikari in proportion to late transplanting.

So, in the late transplanting after the season IV excepting for VIII and IX, Giza-172 always shows the greatest value. The increase curve of the number of tillers in preceding item is perfectly reflected in these reactions. The number of spikelets per panicle increases in later cropping seasons up to the season IV for all varieties in the same way as the number of panicles as shown in Fig. 14 and table 7-9, but the number conversely decreases after the season IV with seasonal disparity.

In respective cropping seasons, special features of varieties are clearly demonstrated - the number of spikelets per panicle of panicle weight type variety, Giza - 172, is always the largest, and that of panicle number type variety, Giza-173, is the smallest. Intermediate variety, Akihikari. Shows the medium number of spikelets per panicle in every season.

The number of spikelets per m^2, the product of panicle number per m^2 and the number of spikelets per panicle, is mentioned in Fig. 15 and tables 7-9. The number of spikelets per m^2 indicates yield capacity, or the character that signifies the upper limit of yield and shows compound reaction of panicle number and the number of spikelets per panicle.

Ripening ratio and 1000 grain weight are referred to in Fig. 16-17 and tables 7-9. According to them, the percentage of ripened grains and 1000 grain weight bear a close relationary resemblance each other, entirely different from other yield components.

Ripening ratio and 1000 grain weight are not affected by the variation of cropping season, but maintain high value throughout the cropping seasons. However, blast disease occurred to Giza-173 after cropping season VIII (transplanting, June 20), and later transplanting had higher percentage of damage of blast disease, lowering ripening ratio and 1000 grain weight.

Taking a general view of effect of cropping seasonal change on yield components, both the panicle number and the number of spikelets per panicle keep increasing up to cropping season IV, when they register maximum value, then, turn into decrease as cropping season progresses. As for ripening ratio and 1000 grain weight, no significant change is caused by cropping seasonal change except Giza-173 after the season VIII when the damage of blast disease started.

The relation of panicle number per m^2 with yield and the relation of the number of spikelets per panicle and yield are respectively shown in Fig.18 and Fig. 19.

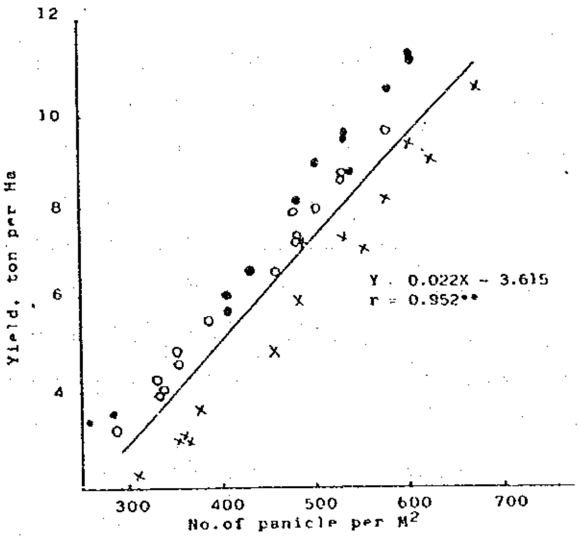


Fig. 18. Relation between No. of panicle per M^2 and yield per Ha under the condition of cropping seasonal change.

Note ; ○ Akihikari, ╳ Giza-173, ● Giza-172

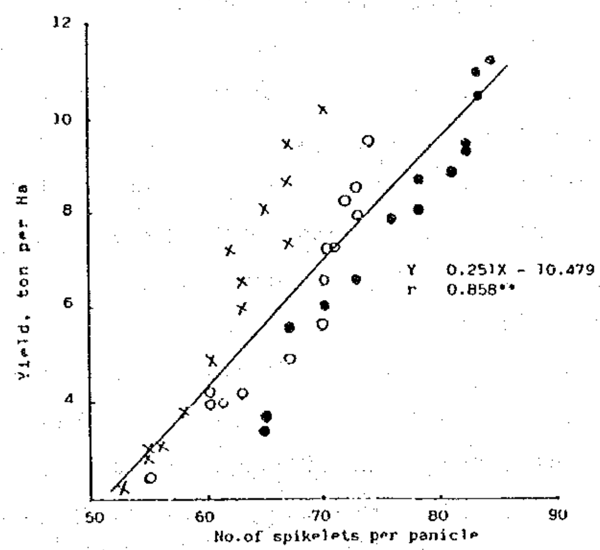


Fig. 19. Relation between No. of spikelets per panicle and yield per Ha under the condition of cropping seasonal change

Note ; ○ Akihikari, ╳ Giza-173, ● Giza-172

These figures indicate unquestionably that both the panicle number and the number of spikelets per panicle are closely related with respective yields. Both the panicle number and the number of spikelets per panicle have positive correlation for each variety trail, but the degree of the correlation considerably declines when there varieties are considered mixed for study purpose. Fig. 20 shows the relation between the number of spikelets per m^2, the product of panicle number per m^2 and the number of spikelets per panicle, and yield.

Composite observation of varieties and cropping seasons recognizes very close correlation between the number of spikelets per m^2 and hield, which is considered to be under complete control of the spilets number per m^2. In this case, the values of cropping seasons VIII and IX of Giza-173, when ripening ratio and 1000 grain weight abnormally declined due to damage of blast disease, are included.

If these value are excluded, the correlation coefficient would be higher. Namely, varience of yield by cropping seasonal change is unitarily determined by the number of spikelets per m^2, and it is especially worth notice that linearl relation exists up to 50,000 grains of spikelets number per m^2.

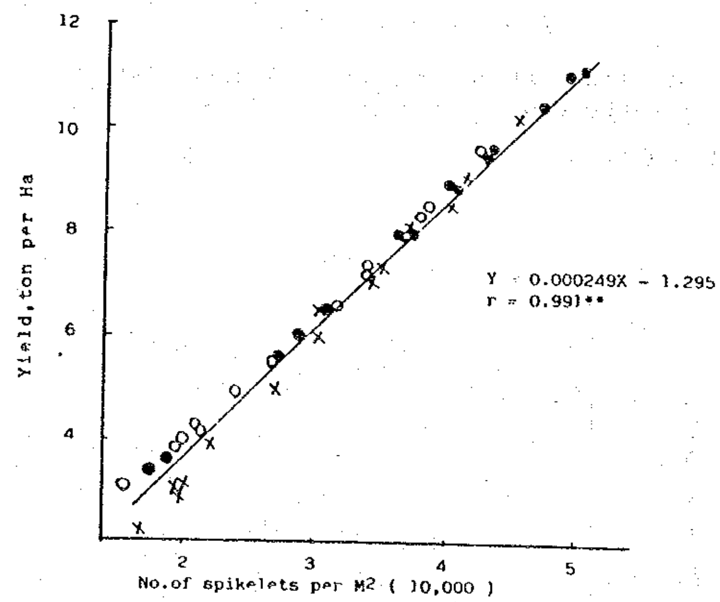


Fig. 20. Relation between No. of spikelets per M^2 and yield under the condition of cropping seasonal change.

Note ; ○ Akihikari, × Giza-173, ● Giza-172

In Japan, the spikelets number per m^2 and ripening ratio and 1000 grain weight generally have negative correlation, and the yield reaches the peak at 35,000 grains. If the spikelets number continuous increasing, yield tends to decrease in many cases due to decline in ripening ratio and 1000 grain weight. This fact shows that the average solar radiation of 300 $cl/cm^2/day$ for ripening period in Japan regulates the amount of dry matter production.

While, in Nile Delta of Egypt, there is a straight line relation between yield and spikelets number, probably because greatly abundant solar radiation (600 $cal/cm^2/day$) supports ripening.

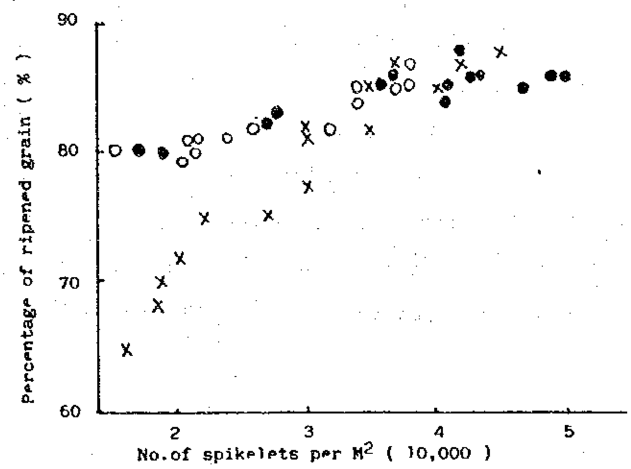


Fig. 21. Relation between No. of spikelets per M^2 and percentage of ripened grain under the condition of cropping seasonalchange.

Note ; ○ Akihikari, × Giza-173, ● Giza-172

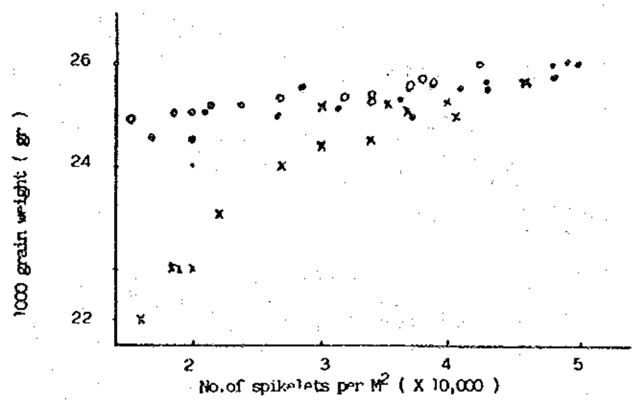


Fig. 22. Relation between No. of spikelets per M^2 and 1,000 grain weight under the condition of cropping seasonal change.

Note ; ○ Akihikari, × Giza-173, ● Giza 172

Fig. 21 indicates the relation between the spikelets number per m^2 and ripening ratio, and Fig. 22, the relation between the spikelets number and 1000 grain weight.

According to them, both the ripening ratio and 1000 grain weight have no negative relation with the spikelets number per m^2, except Giza-173 plot suffered from damage of blast disease, but, conversely, show a little increase as the number of spikelets increases. Namely, an increase in the number of spikelets per unit area does not give any influence on ripening ratio and 1000 grain weight, in other words, yield variation by cropping seasonal change is controlled only by yield capacity change because of remarkably high amount of dry matter production in ripening period.

The effect of cropping seasonal change on yield and yield components has been clarified as stated above.

Based on the cultivation method through this experiments in Fig.12 and Tables 7-9, suitable cropping seasonal span has been formulated.

Assuming the yield over 6 t/ha, the suitable cropping seasonal span is from cropping season I (transplanting, May 15) to the season VII (transplanting, June 15) for early and medium maturing varieties, Akihikari and Giza-173, and from the season I (May 15) to the season XI (July 5) for late maturing variety Giza-172.

Furthermore, it became clear that transplantable period may be extended to 50 days by combination of early, medium and late maturing varieties.

The harvesting period for these cropping seasons according to Fig. 5 and table 4, for Akihikari, from cropping season I (August 23) to the season VII (Sept. 21), for Giza-173: from the season I (Sept. 24) to the season VII (Oct. 23), for Giza-172: from the season I (Oct. 6) to the season XI (Nov. 15). Thus, the possible harvesting period can be extended to 82 days.

It is considered possible to eliminate the working peak of rice transplanter and harvesting machinery, to improve thier working efficiency per year and to utilize these machines economically through systematic combination of early, medium and late maturing varieties in view of the time of harvesting of preceding crop and the time of planting of succeeding crop.

As already made clear, yield variation by cropping seasonal change is regulated by the spikelets number per m^2, so, increasing the number of panicles and spikelets in late transplanting leads to yield increase.

This makes utilization of transplanter which is suitable for dense planting more economical. For this purpose, the following measures are particularly required to increase the number of spikelets per m^2 in the future.

1) Selection of short stem panicle weight type variety
2) Establishment of raising of seedling for healthy seedling
3) Improvement of transplanter for dense planting
4) Establishment of the method to promote initial stage growth
5) Establishment of the rational fertilizer application system for this region

III. Rice Transplanter Trials

1. Comparison Study for Effective Field Efficiency of Different Type Rice Transplanter

Object

In the Nile Delta, Japanese-made transplanters of 4 row walking type, 6 row riding type and 8 row riding type are introduce at present. Effective field efficiency trails for these transplanters under local conditions were conducted.

Method

1) Machinery used:

4 row walking type transplanter, 6 row riding type transplanter, 8 row riding type transplanter, 6 row and 8 row riding type transplanters are front transplanting type.

2) Cultivation practice:

Plowing : Lengthwise and sideways 1 plow respectively, by chisel plow.
Puddling : 2 plows by puddling rotary mounted on wheel tractor.
Transplanting : 3 days after puddling.
Raising of seedling : Dry seed weight 200 g per box.
Leaf age : 3.0
Plant age : 3.0
Plant height : 15 cm.

Result

The effective field efficiency trial results of 4 row walking type, 6 row and 8 row transplanters are indicated on table 10.

According to it, actual transplanting time for the machine with more transplanting rows is shorter, sowing the same tendency as theoretical field efficiency. As for effective field efficiency, assuming the efficiency of 4 row walking type to be 1, 6 row riding type showed 1.01, 8 row riding type showed 1.28. Regarding seedling feeding time in total working hours, 4 row walking type accounted for 21.3%, 6 row riding type, 32.3% and 8 row riding type accounted for 45.5%. Seedling feeding time occupies more percentage as the number of transplanting row increases. This means that an increase in the number of transplanting row of transplanter is not linked with effective field efficiency in multiple proportion.

Table 10. Performance test for rice transplanter

Survey items \ Type of machinery	4 row walking type	6 row riding type	8 row riding type	Remarks
No. of operation	(*31+**4)	(21+4)	(16+4)	*No. of working line for lengthwise **No. of working line for sideways
Actual transplanting time	$1^h28^m22^s$	$1^h15^m23^s$	40^m03^s	
Seedling feeding time by labor	26^m04^s	29^m05^s	40^m31^s	h = Hour m = Minute s = Second
Seedling feeding time by operator	05^m03^s	09^m46^s	07^m22^s	
Turning time	11^m38^s	08^m42^s	07^m57^s	Working speed (20m distance) 4 row = 34 sec, 6 row = 35 sec, 8 row = 31 sec,
Adjusting time at the field	12^m41^s	04^m37^s	06^m17^s	
Trouble adjusting time at field	02^m17^s	05^m26^s	03^m00^s	
Fueling time at the field	0	0	0	
No. of seedling box comsumed	(89)	(99)	(95)	
Total working hours	$2^h26^m15^s$	$2^h12^m59^s$	$1^h45^m11^s$	
Size of field width x length (m)	40 x 100	39 x 99	39 x 99	
Working field efficiency (%)	64.6	47.2	39.6	Actual working area/h / Theoretical working area/h
Planting finger adjustment	70,10 x 14	70,10 x 14	70,10 x 14	70, No. of hill /3.3 M^2 10,10mm horizontaly 14,14mm vartical
Fuel comsumption (liter)	2.6	3.4	2.9	
Field depth (cm)	27	27	20	

These figures will not change greatly in normal operation. The effective field efficiency of 4 row walking type transplanter dose not differ so much as compared with 6 row and 8 row riding type transplanters, and its advantage over 2 other machines is evident in view of the price of machinery and machinery cost per transplanting area. However, 4 row walking type posed a problem of excessive fatigue for operators under local condition of soil stickness. This waits for further studies in the future, including field depth and transplanting time after puddling.

2. Rice Transplanter's Planting Accuracy

Experimental machinery and method are the same as 1, Table 11-(1) indicates planting finger adjustment for each machine, transplanting seedling number per hill and vacant hill rate.

Table 11.(1). Relation between planting accuracy and adjustment of transplanting finger (No. of hill checked, 100)

(Sowing Q'ty, 200gr per box)

Type of transplanter	Transplanting finger adjustment (mm)		No. of plant/hill	S.D.	Ratio of vacant hill (%)
	Horizontally	Vartical			
6 row riding	10	10	3.80	1.94	6.6
"	10	14	4.20	2.84	3.3
"	10	14	4.22	2.61	5.0
"	14	14	6.27	3.45	5.0
8 row riding	14	14	6.74	3.14	2.5
4 row walking	10	14	4.48	2.67	7.5

Table 11.(2). Planting accuracy and its details

(sowing Q'ty, 350 gr per box, planting adjustment, 14 x 14)

Plant No, grand total/50 Nos, hill	No, of planted seedling	No, of sharply seedling	No, of cutted seedling	No, of floated seedling	Ratio of vanact hill (%)
568	510	35	17	6	0
Ratio (%) 100	90	6	3	1	0

According to it, enlargement of adjustment of planting finger and the number of planting per hill is closely related for the same standard seedling box, and an increase in the number of planting and a decline in vacant hill rate are noticed.

Occurence of vacant hill is supposedly caused by sowing accuracy, but the rate is on a 2.5% - 5% level, which offers no problem. Fig. 23 shows distribution of planting number per hill.

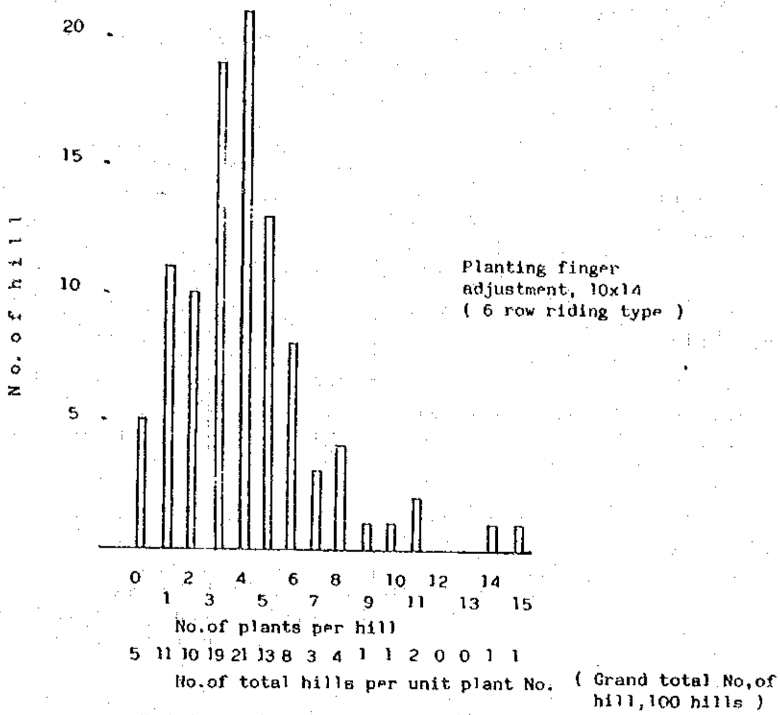


Fig. 23. Distribution of No. of plant per hill

According to it, the planting number per hill of 2-8 seedling within alloable limits accounts for 60% with the vacant hill rate of 5%. The figure includes two cases of the planting number of 14 and 15 per hill, and ununiform showing is considered from these cases. Over densed sowing, frequently results in broken or cut seedlings. To prevent such defective sowing, planting accuracy was investigated in the sowing quantity of 350 g per box, and the results are mentioned in table 11.

According to the table, broken or cut seedlings account for 10% of total number of planting, through there are few broken or cut seedlings in the case of the normal sowing quantity of about 200 g. The investigation results include many cases of broken seedlings because of spindly growth seedling, accounting for 6% of the above 10% value.

Though, there is no vacant hill in view of over densed sowing, occurrence of broken or cut seedling phenomenon is presumably caused by spindly growth of seedling resulting from over densed sowing. In planting by transplanters, planting finger's capacity is mechanically adjusted and is considered stable, so, planting accuracy largely depends on the condition of seedling box such as sowing quantity. For this reason, it is important to carry out planting work under the conditions of suitable sowing quantity and uniform sowing.

Table 12. Relation between seedling density per nursery tray and the transplanter performance of Japanese transplanter, Model ; YP-6000 & YP-8000.

Adjustment index of transplanter	Size of seedling block per finger adjustment	Transplanting density (hills/M²)	Needed Number of nursery tray/Feddah	Seedling density per nursery tray (280x580x30mm)							
				*175gr(**335cc)		200gr(390cc)		250gr(493cc)		300gr(572cc)	
				Population		Population		Population		Population	
				/hill	/M²	/hill	/M²	/hill	/M²	/hill	/M²
"60"	10 x 10		64	2.9	68.2	3.3	77.6	4.2	98.7	5.0	117.5
Interhillar	10 x 14	23.5	89	4.1	96.4	4.7	110.5	5.8	136.3	7.0	164.5
distance; 18cm	14 x 14		124	5.7	134.0	6.5	152.8	8.2	195.7	9.8	230.3
"70"	10 x 10		71	2.9	75.4	3.3	85.8	4.2	109.2	5.0	130.0
Interhillar	10 x 14	26.0	100	4.1	106.6	4.7	122.2	5.8	150.8	7.0	182.0
distance; 16cm	14 x 14		136	5.7	145.6	6.5	169.0	8.2	213.2	9.8	254.8
"80"	10 x 10		82	2.9	87.0	3.3	99.0	4.2	126.0	5.0	150.0
Interhillar	10 x 14	30.0	114	4.1	123.0	4.7	141.0	5.8	174.0	7.0	210.0
distance; 14cm	14 x 14		159	5.7	168.0	6.5	195.0	8.2	246.0	9.8	294.0

(1983, RMP Kallin Center
By; S, Sugawara, Nour Saleh, Essam Ghazy, Mahmou Hamad & Mohamad Yusef)

Note

Note; (1) Variety: Giza 172,1000 grain weight = 25.86 gr at 14% moisture content.
(2) Germination ratio = 70%
(3) * in dry wieght
(4) ** Volume of pregerminated seeds
(5) Depth of mechanically transplanted field: 30 cm, three days after puddling
(6) Slip ratio of transplanter: 20%
(7) Nursery loss ratio: 05%

Adequate adjustment of planting finger is necessary based on the relation between sowing quantity and finger adjustment mentioned in table 12.

IV. Training

1. Training results : The results of training from the beginning of the Project to the end of March, 1985 are as follows:

1) October - December, 1982 : 101 persons (Rice mechanization basic course)
2) February - April, 1983 : 151 persons (Same as above)
3) December 1983 - March 1984 : 164 persons (Same as above)
4) March - End of March 1984 : 13 persons (Advanced mechanization course, chief mechanical officer of all districts, Kafr El Sheikh Governorate)

5) December 1983 - March 1984 : 12 persons (Advanced rice cultivation course, chief agronomist of all districts, Kafr El Sheikh governorate

6) September 1984 - February 1985 : 43 persons (Rice mechanization Basic course)

Total 484 Persons

Out of the above training course, those conducted before March, 1984 covered the staff of Kafr El Sheikh governorate and Agricultural Cooperative Association, because Kallin Center had no accommodation facilities. After completion of Meet El Dyba Rice Mechanization Center and accommodation facilities for trainees in April 1984, trainees gathered from the governorates of all mechanized rice cultivation district. Details of governorates from which the 484 trainees came from are as follows:

1) Kafr El Sheikh : 441 persons
2) Bihira : 13 persons
3) Shakia : 10 persons
4) Gharbia : 9 persons
5) Kalubia : 8 persons
6) El Menia : 1 person
7) Cairo : 1 person
8) Beniswif : 1 person

Total 484 persons

2. Teaching Materials and its Detail for Training

Details of training and teaching materials are summarized in table 13. Training curriculum is mentioned in table 14. Training lecture (for rice mechanization basic course) and practices are in the ratio of 1:1. Raising of seedling by seedling box takes much part of curriculum in view of local conditions. Textbooks, pamphlets and other training materials are revised, supplemented and up-to-dated from time to time incorporating verification trial results, advice on mechanization problems in guidance activities.

Table 13. Training content and its materials

Days, month and year	Training content	Training materials	Remarks
Oct, 1982 to Apr, 1963	Paising of seedling for mechanized transplanting and rice transplanter	* Raising of seedling by seedling box * Rice transplanter	Training duration, one week.
Dec, 1983 to Mar, 1984	Raising of seedling for mechanized transplanting and rice transplanter	#Raising of seedling and mechanized rice transplanting	Training duration, 12 days. Slide and film has been used for training from Dec, 1983.
	Paddy cultivation practice	#Paddy culture physiology and fertilizer application techniques	
	Working performance and cost for mechanized rice transplanting	* Disease and insect pest control for raising of seedling by seedling box.	
		#Performance of rice transplanter	
Sep, 1984 to Feb, 1985	Mechanized rice cultivation (From raising of seedling up to mechanized harvesting)	#Raising of seedling for mechanized transplanting (Reversed edition) #Paddy culture physiology and fertilizer techniques (Revised edition)	Training duration, 12 days and 16 days.

Note ; * Pamphlet. Written by Arabic
Text book.

Table 14. Training schedule for rice mechanization basic course

Rice Mechanization Center, (R,M,C.)

Date	Item & Item No.	Contents	Time schedule	Name of instructor	Remarks
1st day		Opening celemony & orientation	9.00–9.30	All instructor	Auditorium
		Preliminary evaluation test	9.30–11.00	All instructor	Lecture room
		Agri-mechanization in Egypt	11.00–12.00	Mohmud Hamad	Lecture room
	Nursery (1)	Seed selection, seed disinfection, soaking & sprouting.	13.00–14.00	Fituh Husein	Lecture room
	" (2)	Selection nursery place & collection soil for nursery box. Crushing, sieving soil & putting soil to nursery box.	14.00–15.00	Mohamad Itman	Lecture room
	" (3)	PH, EC, Techigaren & soaking tray	15.00–16.00	Alaa Eid	Lecture room
		* Showing film (Rice mechanization)	20.00–21.00	Mohmad hamad	Auditorium
2nd day	Nursery (4)	Fertilizer application to nursery box	9.00–10.00	Alaa Eid Shawky Maklad	Lecture room
	" (5)	Sowing Q'ty & covering soil. Pilling seedling tray (Covered by vinyl film) & preparation greening bed.			
		Relation between transplanting time & it's yield.	10.00–12.00	Mohamad Yusef	Lecture room
	Greening bed (6)	Irrigation to nursery (greening bed) & Nursery diseases.	13.00–16.00	Fatih Nemura	Lecture room
3rd day		** 1st day's contents practice at the field. (1), (2), (3) **(4)	9.00–16.00	Fituh Husein, Mohamad Itman. Alaa Eid.	R,M,C field.
4th day		**2nd day's contents practice at the field. (5), (6).	9.00–16.00	Mohamad Yusef. Fatih Nemura	R,M,C field
5th day	Rice field (7)	Field preparation	9.00–10.30	Abd Baset	Lecture room
	Rice transplanter (8)	Structure & function of each parts of Rice transplanter	10.30–16.00	Asar Mohamad Ibrahim Yusef	R.M.C work shop
6th day	Rice transplanter (9)	Adjustment of hill & plant No, & operation method. Requirement of nursery box per feddan	9.00–12.00	Essam Gazy Asar Mahamad	
	(11)	Rice transplanter operation training	13.00–16.00	Asar Mohamad Ibrahim Yusef	R,M,C field
7th day	Rice transplanter (12)	Rice transplanter operation training	9.00–16.00	Asar Mohamad Ibrahim Yusef	R,M,C field
8th day	Rice transplanter (13)	Maintenance & storing of Rice transplanter	9.00–16.00	Asar Mohamad Ibrahim Yusef	R,M,C work shop
9th day	Planning (14)	Area coverage of Rice transplanter & planning. Calculation of Rice tranceplanter utilization expence	9.00–12.00	Fituh Husein Essam Gazy Abd Baly	Lecture room
	Weed control (15)	Kinds & life circle of weed on paddy field	13.00–16.00	Fatih Nemura Mohamad Itman Abd Rahman	Lecture room
10th day	Weed control (16)	Herbicides, kinds, characteristics & usage.	9.00–12.00	Fatih Nemura Mohamad Itman Abd Rahman	Lecture room
	Harvesting (17)	The kinds of machine and it's operation training.	13.00–16.00	Iburahim Nour Magid Romeih Iburahim Usef	R,M,C Workshop
11th day	Rice cultivation technique (18)	Rice cultivation technique	9.00–16.00	Samir Hadre Mustafa Essa	Lecture room
12th day		**Final evaration test, discussion & closing celemony	9.00–14.00	All instructor	Auditorium

Films and slides are also used aiming at audiovisual training. It is important that there is a definite difference in the level of technique and knowledge between the staff of the Rice Mechanization Center as lecturers and trainees for smooth operation of training. Therefore, lecturers are limited to the counterparts who are in charge of verification trial connected with the contents of lecture or who previously received expert training concerning lecture in Japan.

3. Consideration, Requests from Trainees and others

Training was started in October, 1982 based on a strong request of Egyptian authorities for training field foremen of the mechanized rice transplanting demonstration, which was scheduled for implementation in April 1983. Because of these circumstances, contents of training in the beginning were mainly seedling box and transplanters. However, the contents were changed to detailed training adapted to local situation including seedling box and transplanters in view of the subsequent verification trial results, advice on demonstration and guidance activities.

The training course in and after 1984 covers overall rice mechanization from nursing seedling to mechanized harvesting including mechanization practices, manuring weed control and expenses. Training period was a 7 - day course at first, then was extended to a 12-day course and finally to a 16-day course to meet traineers' request in 1984.

According to the discussions after evaluation test for trainees (rice mechanization basic course) and training, there is a demand for further extension of training period to improve understanding of seedling box and transplanters, which are still new techniques in this district (Bed soil pH, EC, sowing quantity, planting number and adjustment of planting finger, greening bed management, etc.)

As mechanized rice transplanting was put to practice in 1984, it is said that said technique has not taken root satisfactorily in local districts other than Kafr El Sheikh Governorate. Considering circumstances and absolute necessity of seedling technical settlement for mechanized rice transplanting, nursing seedling will be the main subject of taining. Besides, many trainees desire that training period and the time for which should be studied in the future. Other requests include complete arrangement of heating equipment in winter and sports supplies.

Trainees are satisfied with meals and accommodation. Sports supplies and facilities are being arranged gradually, but measures for heating equipment in winter should be studied. Air conditionor is strongly desired because of severe cold in winter, when power breakdown frequently occurs.

There is no problem of discipline in connection with training life. Training results can be recognized clearly through observation of the demonstration site for mechanized rice transplanting in Kafr El Sheikh, taken charge of by those who have finished training of the Center. For further technical settlement of mechanized rice cultivation, improvement of training business and re-training for previously finished trainees are necessary, taking subsequent verification trial results at the Center into consideration.

V. Advice and Guidance Activity for Mechanized Rice Cultivation Area in Kafr El Sheikh Governorate

The Egyptian Government formulated a 5-year food production increase plant as one of the measures of improve its agricultural and social situation, and gave priority to mechanized rice cultivation as an important political measure. In response to this government policy, the Agriculture Ministry inaugurated this project to establish mechanized rice cultivation technology for suitable local agricultural condition in Egypt in 1982. However, the Agriculture Ministry and major rice cultivation governorates in the Nile Delta area expressed their strong intention that they could not wait for completion of mechanized rice cultivation technical system as the Project aims at and that they wished to spread even partial technology tentatively in 1983.

Under these circumstances, the Agricultural Ministry and Dhkaria governorate and Kafr El Sheikh governorate purchased Japanese-made transplanters and started demonstration to farmers, strongly requesting the Project to give advice and guidance. This project considered it premature to spread techniques, because the Project's activities was just started. Nevertheless, the Project could not neglect demonstration promoted by Egyptian side independently, and was compelled to start giving advice and guidance to the demonstration of Kafr El Sheikh governorate in April 1983.

In 1984, the field guidance system which had been employed in the previous year was not adopted, partly because re-training for persons in charge of demonstration site had been given at the Center after demonstration.

Instead, field guidance was given only on problems occurred in the period from nursing seedling to mechanized transplanting. Table 15 shows the demonstration of mechanized transplanting conducted for the organization under the Central Agricultural Cooperative Association of Kafr El Sheikh governorate (KFS hereinafter), size of plot and a schedule from nursing seedling to mechanized transplanting.

Table 15(1). Demonstration area for rice transplanter : April up to July 1984.

(KAFR El Sheikh governorate)

Name of district	Name of working site	Area (Feddan)	Type of the transplanter & numbers			Working duration for nursery		Working duration for transplanting		Name of engineer incharge		Remarks (Machinery & nursery troubles etc.)
			4 row	6 row	8 row	Date of start	Date of completion	Date of start	Date of completion	Agronomist	Mechanical	
Kafr El Sheikh	Kafr El Taifa	53			2	6, May	29, May	3, June	27, June	Shawkat Mustafa	Mahdy Sheben	Over irrigation
	El Akola	200		4		4, May	12, June	1, June	7, July	Talat Aisa El Said El-Nagar	Mohemed Moltar Ahemed All Mohamed Salama	Over irrigation, Over doses fertilizer.
	El Shamarka	75		2		4, May	25, May	28, May	23, June	Hassan Abden Yusef Saida	Ali Abdminein Negi Abshosha	Over irrigation, Over doses fertilizer.
	Nosra	100		2		4, May	23, May	26, May	21, June	Osman Metwari	Said Mohamad Adli Rabib Basir El said	Fertilizer application method
	Sandela	120		3		8, May	26, May	23, May	25, June	El Said Ahamed	Ebrahim Zakl Ebrehim Dusuki	Steering gear box broken, P.T.O. shaft broken.
	El Hamura	91		3		6, May	26, May	1, June	27, June	Samir Saleh	Ald Hassan-Hatiya, Ali El Said, Ebrahim Elsaid	Hyd, oil seal, pin, Transplanting finger trouble.
	** Ariamun Hayatim	8 16			1	1, June	4, June	7, July	15, July	** Ebrahim-Nour,	Ebrahim nour Hatiya Shalan Beshuni El-Ekutiyar, Ali El Meshir	Steering gear box broken, P.T.O. shaft broken, Storanaer broken, Hyd, oil seal broken,
	Sub total	663		14	3							

Table 15(2). Demonstration area for rice transplanter : April up to July 1984.

(KAFR El Sheikh governorate)

Name of district	Name of working site	Area (Feddan)	Type of the transplanter & numbers			Working duration for nursery		Working duration for transplanting		Name of engineer incharge		Remarks (Machinery & nursery troubles etc.)
			4 row	6 row	8 row	Date of start	Date of completion	Date of start	Date of completion	Agronomist	Mechanical	
Side Salem	Handasa	110		3		5, May	5, June	1, June	25, June	Mohamed hata,	Ahamed Atiya Fatih Abd El-Hady,	Pythium, Working schedule.
	El Mofty	70		2		8, May	7, June	4, June	29, June	Abd El Halim-El Sewy. Ali Abd El-Rahman.	Fatih Saleh Haram Ramadan Ali Ahmad	Start work without training staff therefore all kinds trouble of seedling were occured.
	Sub total	180		5								
Kallin	El Manshela El Kobla	28		1		5, June	6, June	19, June	27, June	Foahd Kalifa	Mohassen Abd-Shakor,	
	Kallin	14		1		1, June	15, June	20, June	29, June	"	Malak Matta	Pythium.
	Abo Naim	41		1		8, June	16, June	5, July	18, July	Ahmad Abokadr	Ebrahim Gencim	Working schedule no good, irrigation troubles, secound gear trouble.
	Nashart	12			1	5, June	12, June	25, June	29, June	Ahmed Haras	(Above members covered all Kallin area)	Pythium, working schedule no good (too late).
	*Uncmi	13			1	2, June	12, June	12, June	9. July	**Mohamad-Yusef	"	
	**Kallin El Balat	40			1	2, June	15, June	28, June	2, July	Abd El Salam-Kassam.	Shafi Osmen	
	Sub total	148		3	3							**From Rice Mechanization Center.

Table 15.(3) Demonstration area for rice transplanter: April up to July 1984.

(KAFR El Sheikh governorate)

Name of district	Name of working site	Area (Feddan)	Type of the transplanter & numbers			Working duration for nursery		Working duration for transplanting		Name of engineer incharge		Remarks (Machinery & nursery troubles etc.)
			4 row	6 row	8 row	Date of start	Date of completion	Date of start	Date of completion	Agronomist	Mechanical	
Dusuck	Mohalet Dial	204		4	1	4, May	28, May	24, May	22, June	Mohamed A Makssod	Ali Amer Ashraf El Defrewy, Hareth Kotb Tharwat abo-Yusef.	Pythium, steering gear box broken.
	Sanhor	81		2		7, May	29, May	2, June	22, June	Mohamad Serhan	Kamel Mustafa Abdel Bagory	Sreering gear box broken.
	Demenka	81		2		8, May	7, June	7, June	22, June	Fatih Hamed	Ahmed El Kady Tawfic Solh	
	Sub total	366		8	1							
Fuwa	Kabrit	40		1		12, May	5, June	4, June	25, June	Faisal El Zaafarany,	Mohamad El-Shelif.	Over irrigation, pythium.
	Elolwy	90		2		10, May	2, June	2, June	23, June	Hassan El-Shakawy	Abdel Salam El Kadry Ali Assar	C, miyabeenus, over irrigation.
	Sendion	60		1		17, May	7, June	10, June	8, July	Nasr Ahemed	Pashed Salam	
	Sub total	190		4								
Motobis	Menyet El Morshet	100		2		1, May	22, May	27, May	29, June	Mohamed Ali, Abdel R El-Kharoooby.	Semir Hassan Duosuki A El-Nasr	C, miyabeenus, over irrigation
	Motobis	42		1		3, May	25, May	28, May	10, July	Mohamed Hassan Hamdy El Ashery	Kamar Kamel El Said-Shazly.	
	Sub total	142		3								

Table 15.(4) Demonstration area for rice transplanter: April up to July 1984.

(KAFR El Sheikh governorate)

Name of district	Name of working site	Area (Feddan)	Type of the transplanter & numbers			Working duration for nursery		Working duration for transplanting		Name of engineer incharge		Remarks (Machinery & nursery troubles etc.)
			4 row	6 row	8 row	Date of start	Date of completion	Date of start	Date of completion	Agronomist	Mechanical	
Hamool	Zidan	25		1		20, May	15, June	20, June	7, July	Khabil Shalrawy.	Ebrahim El Zahi.	
	El Sahayet El Khemsin	16 60		2		25, May	20, June	25, June	10, July	Abd A L Razek Abdel Fatah-Orabi		
	**El Kharigeen	200			6	21, May	1, June	11, June	7, July	Ebrahim Nour Alaa Eid	Ebrahim Nour Asaa Mohemed	Work start by non trained staff therefore all seedling were damaged at first stage. **From Rice Mechanization Center.
	Sub total	301		3	6							
Biala	Elsae	308	1	4		20, April	31, May	14, May	25, June	Shehala Mohamed, Abdalla Mohamed, Mohamed Talbe	Gebir Gibali Elbialy Gerbi Hassan El-Sidani.	Over irrigation.
	Ebshan	255	2	2		22, April	31, May	20, May	29, June	Fatin Mohamed Adel Elsaid	Mohamed Elmosi Gemir Elhedidl Ali Mohamed	Steering gear box broken.
	Sub total	563	3	6								
	All total	2553	3	46	13							

The size of implemented plot is less than that in previous of 4,401 feddan (1 feddan = 0.42 ha), but the same demonstration was conducted by other organizations (the persons in charge were the same as in previous year, who had completed the Center's training), and the area of implementation was on the same level as previous year for KFS governorate in general.

1. Transplanting Time

It is said that the optimum transplanting time here for high yield is around May 15 - June 15. According to table 15, no location completed mechanized transplanting before June 15 in the demonstration in KFS governorate this year. The paddy field of this country is all winter crop plots such as wheat and clover under the alteration of land usage between dry and flooded condition system generally performed in Nile Delta. A delay in reaping and harvesting of these crops presumably caused a delay in mechanized transplanting time.

It is considered necessary to study preceding variety which can be harvested earlier and selection of mechanized transplanting implementation field (method to convert the field of early harvesting crops such as flax into paddy field).

2. Nursing Seedling

Problem in the initial stage of nursing seedling occurred at a demonstration site respectively in Hamol and Sidisalem district, caused by the persons in charge of these sites, who had received no training yet. Many places suffered from Damping off disease probably by Pythium spp. and Helmintosporium leaf spot, but the number of such cases was less than previous year according to survey. This is considered to be due to the improved technology which has taken root among the persons in charge to a certain extent through the re-training for the persons in charge of demonstration site in all district and their experience in field with the area of about 100 feddan. For the future safe nursing seedling, seed disinfection and Damping-off disease preventive chemical control which have not been introduced, are essential so that an urgent measure should be taken.

3. Utilization and Condition of Transplanter

An improvement is notice in the arrangement of field and adjustment of machinery in connection with mechanized transplanting as compared with previous year. Table 16 indicates the effective field efficiency of respective demonstration sites utilizing 6 row riding type transplanter.

These values are generally higher than those for the same type machine which was shown in table 17 in last year, including an excellent demonstration site with the efficiency of 292 feddan/day/machine, probably because of improved operation management and operation technique.

Table 16. Actual working capacity of rice transplanter (KAFR El Sheikh governorate April to July, 1984)

Name of cooperative	Area (Feddan)	Duration of trans-planting days	**Nos, of trans-planter	Actual working capacity of rice transplanter (6 row)					Remarks
				Per day	Per trans-planter	Per finger per day	Per hour	Working efficiency of transplanter %	
1. El Akola	200	37	4	5.40	1.35	0.225	0.168	16.62	
2. El Shamarka	75	27	2	2.77	1.38	0.231	0.172	17.01	
3. Nosra	100	27	2	3.70	1.85	0.308	0.228	22.56	
4. Sandela	120	34	3	3.52	1.17	0.196	0.146	14.44	
5. El Hamura	91	27	3	3.37	1.12	0.187	0.140	13.85	
6. Handasa	110	25	3	4.40	1.46	0.244	0.182	18.00	
7. El Mofty	70	26	2	2.79	1.34	0.224	0.167	16.52	
8. Kallin	14	9	1	1.56	1.56	0.258	0.194	19.19	
9. Abo Naim	41	14	1	2.92	2.92	0.486	0.365	36.11	
10. Sanhor	81	21	2	3.85	1.92	0.321	0.240	23.74	
11. Demenka	81	16	2	5.06	2.53	0.421	0.316	31.26	
12. Kabrit	40	22	1	1.80	1.80	0.303	0.226	22.36	
13. Elolwy	90	22	2	4.09	2.04	0.340	0.225	22.26	
14. Sendion	60	29	1	2.06	2.06	0.344	0.257	25.43	
15. Menyet El Moshet	100	34	2	2.94	1.47	0.245	0.183	18.10	
16. Motobis	42	44	1	0.95	0.95	0.159	0.118	11.67	
17. Ziden	25	18	1	1.38	1.38	0.23	0.172	17.01	
18. El Sheyet & Khemsin	76	16	2	4.75	2.37	0.395	0.296	29.28	
Total	1416	448	35	56.56	28.72	4.794	3.543	375.41	
Average	78.66	25.5	1.9	3.14	1.59	0.266	0.196	20.85	

** Type of rice transplanter Riding type 6 row. Rice Mechanization Center 1984.

On the other hand, there are some sites of considerably low efficiency and the cause should be investigated for improvement. The utilization rate of transplanters introduced by the Central Agricultural Cooperative Association, KFS governorate is reported below:

1) 4 row walking type introduced 25 machines, utilization rate is 12%
2) 6 row riding type introduced 75 machines, utilization rate is 61%
3) 8 row walking type introduced 5 machines, utilization rate is 80%

It is noticed that the utilization rate of 4 row walking type transplanter is very low. Only two demonstration sites in Beala district utilized 4 row walking type this year, and other districts keep said machine looking brand-new in their warehouse just as in previous year.

The advantage of 4 row walking type is evident as compared with 6 row and 8 row riding types in its working efficiency, price of machinery and machinery cost per area, but operators at demonstration sites suffer from excessive fatigue, sometimes being unable to pull out their feet from field under severe stickness field condition.

Table 17. Actual working capacity for rice transplanter

From KFS activity, July 1983.
R.M.P. kallin center
Nour SALEH, S. SUGAWARA
Essam GAZY, Mohamud HAMAD

Slip ratio 20%, Working speed 30.5 sec/20 m.

Name of coop	Area feddan	Duration of transplanting	Nos, of machine	Actual working capacity of rice transplanter Feddan				
				Per day	Per machine per day	Per finger per day	Per hour (8h/day)	Actual working efficiency %
1. Zidan	60	28	1	2.14	2.14	0.356	0.268	26.4
2. El sal	120	56	2	2.14	1.07	0.178	0.134	13.2
3. Ibshen	107	25	2	4.28	2.14	0.356	0.268	26.4
4. Bil shasha	90	39	2	2.31	1.16	0.192	0.145	14.3
5. Sandirah	150	40	3	3.75	1.25	0.208	0.156	15.4
6. El hamrah	70	39	2	1.75	0.90	0.149	0.113	11.1
7. Mohaletkhasab	125	43	3	2.91	0.97	0.161	0.121	11.9
8. El morabin	57	35	1	1.63	1.63	0.271	0.204	20.1
9. Ariamun	133	26	3	5.12	1.71	0.284	0.214	21.1
10. Mohalet Diay	85	21	2	4.05	2.03	0.337	0.254	25.1
11. Demenka	48	20	1	2.40	2.40	0.400	0.300	29.6
12. Shabas No. 2	58	26	2	2.23	1.12	0.185	0.140	13.8
13. Gamaila	157	27	3	5.81	1.94	0.322	0.243	23.9
14. Sidi Ghazy	42	28	1	1.50	1.50	0.250	0.188	18.5
Total	1302	453	28	42.06	21.96	3.649	2.745	270.80
Average	93	32.36	2	3.04	1.56	0.260	0.200	19.34

They do not want to use said machine and this is the cause for the low utilization rate. Furthermore, smooth operation of riding type machines with simplicity just by their side accelerates their keeping away from said machine. This may be a big reason for riding type-oriented utilization rate. To effectively operate 4 row walking type in the future, detailed studies should be made covering field depth, irrigation and transplanting time, degree of fatigue of operators and yield.

As for the utilization rate of 6 row and 8 row riding type machines, 15 machines were not used due to break-down except unused ones owned by the Central Agricultural Cooperative (4 row walking type-7, 6 row riding type-7).

4. Break-Down

The damage and wear of second gear (drive, planting gear) as happened last year as big break-down occurred only once this year versus 16 in previous year because of additional furnishing to all related machines with wanning system for food clutch certify operation and gear slip-off prevention unit by the manufacturing company of these transplanters. Damage to steering gear occurred 5 cases versus 4 cases last year, showing a tendency to continuous and increasing failure. Minor failure can be coped with locally and the operation of machines can be maintained, but these big troubles do not occur in Japan and necessary parts can not be obtained here.

Thus, the operation of machines is forced to be suspended. These break-downs are considered to result from operator's rough handling and field depth. It is necessary to reinforce machinery strength to meet local conditions.

In addition to big failure, small and medium scale troubles happened on many occasions. These troubles are expected to increase in view of the operation hours as many as 200 hours per season and the laspe of utilization years. Especially, the transplanters introduced by the Central Agricultural Cooperative Association of KFS governorate have a tendency toward low utilization rate due to break-downs waiting for repair. The Project suggested that the said Association give satisfactory consideration to and take prompt measures for the introduction of parts and proper arrangement for repair tools for demonstration sites based on log book and break-down data.

VI. Paddy Weeds in the Experimental Field of Meet El Dyba, Rice Mechanization Center

1. Kinds of paddy weeds in Egypt

Echinochloa crus-galli (Inubie)*

Echinochloa colonum (No Japanese)*

Cyperus difformis (Tamagayatsuri)**

Eclipta alba (a variety of Takasaburoh)

Ammania spp (a variety of Himemisohagi)

In addition to the above, the following weeds, which do not grow on Japanese field, grew:

Syperus rotundus (Hamasuge)**

Cynodon dactylon (Gyoogishiba)*

Panicum repens (Haikibi)*

Paspalum paspaloides (no Japanese name)*
Dinebra refroflexa (no Japanese name)

* Gramineae family   ** Cyperaceae family

The cause for growth of perennial weeds in the farm was previously under the alteration of land usage between dry and flooded condition system in addition to the water shortage this year (1984). Considering the above weed growth condition, sufficient water supply is essential for weed control, such as prevention of weeds by flooding and effective use of herbicide.

2. Damage by strongly injurious weeds

Studies were made on the effect of the above main weeds, Echinochiloa crus-galli and Cyperus rotundus, which are strongly injurious on paddy rice growth and yield by changing planting density. Trial materials are as follows:

A) Paddy rice : Seedling box
B) Echinochloa crus-galli : Seedling box
C) Cyperus rotundus : Natuaral Growth

Assuming that the seeds of Echinochloa crus-galli and tuber of Cyperus rotundus are mixed in the soil for seedling box, 24 hills per m^2 were transplanted on July 15 with the following ratio:

A) Paddy rice : 4 seedlings/hill
B) Echinochloa crus-galli : 4 seedlings and 2 seedlings/hill
C) Cyperus rotundus : 2 seedlings and 1 seedling

The growth investigation results for paddy rice and weeds on the 50th day after transplanting are shown in table 1. As for the growth of weeds, Echinochlea crus-galli reached 90 - 101 cm and Cyperus rotundus reached 111 - 135 cm on the 50th day after transplanting, a remarkable growth in height as compared with that of paddy rice.

Table 1. Growth of paddy rice and weeds

Trial plot	Paddy rice		Weeds	
	Plant H.	No. of Till.	Plant H.	No. of Till.
	cm	no/hill	cm	no/hill
+ Echinochlea crus galli (2)	65	12	90	15
+ Echinochlea crus galli (4)	65	6	101	22
+ Cyperus rotundus (1)	60	14	135	8
+ Cyperus rotundus (2)	56	11	111	6
+ 0	65	18	-	0

As a result, the number of tillers of paddy rice was 1/3 of reference plot in the Echinochloa crus-galli 4-seedling plot, and about 2/3 in 3 other plots.

The yield of paddy rice is indicated on table 2. The yield decreasing rate of each plot as against the reference plot (net) is: Cyperus rotundus 1 and 2 plots - 70% and 84%, Echinochloa crus-galli 2 plot - 91%, Echinochloa crus-galli 4 plot - 99%. The duration of sunshine in Egypt is much longer than Japan, and the damage to paddy rice by both varieties of weeds, C4 plant, is very large.

Table 2. Paddy rice yield

Trial plot	Panicle number	Small panicle number	Ripening ratio	1000 grain weight	Yield /a	Yield decreasing rate
	No./hill	No./hill	%	g	Kg	%
+ Echinochlea crus galli (2)	10	41	50	15	7.4	91
+ Echinochlea crus galli (4)	4	33	27	8	0.7	99
+ Cyperus rotundus (1)	14	51	68	21	24.5	70
+ Cyperus rotundus (2)	10	48	65	18	13.5	84
+ 0 Natural condition	19	40	95.5	23.5	40.9	51
+ Hand weeding	30	51	94	24	82.8	0

3. Relation of Germination of Cyperus Rotundus with Planting Depth/Water Depth

Studies were made on the effect of planting depth and water depth on the germination of Cyperus rotundus. Natural gorwth Cyperus rotundus (small seedling: below 2 cm, large seedling: above 10 cm, 10 seedlings each) was transplanted in the 1/2000 a. Wagnel pot with the planting depth and water depth mentioned in table 3 on August 5, and its number of germination was investigated on the 15th days after transplanting.

No germination was noticed for small seedlings under the condition of planting depth 5, 10 cm, and germination of large seedlings was respectively one. In the case of planting on the ground, most of them servivied even under the condition of water depth 5, 10 cm.

As a result, it became clear that burying of tubers of the plants in soil is effective for weed control of Cyperus rotundus.

Table 3. Relation of germination of Cyperus rotundus with planting depth and water depth

Planting Depth	Water Depth	Number of Germination	
		Small Seedling (below 2 cm)	Large Seedling (above 10 cm)
10 cm	5 cm	0	1
5 cm	5 cm	0	1
0 cm	5 cm	8	9
0 cm	10 cm	6	9
0 cm	0 cm	8	8

4. Weed Control Experiment by Herbicide

1) Experiment on herbicide treatment at the time of young seedling transplanting

Studies were made regarding the effect of difference in treatment time of 5 kinds of herbicides on the growth of paddy rice.

Experimental herbicide and quantity (per a.)

A) Liquied Pentazon	37.5 cc
B) Oxadiazon (Emulsion) 12%	50 cc
C) Granulated Butachlor 5%	300 g
D) Granulated Benthiocarb Symetrin	400 g
E) Granulated Pyradolate	300 g

Cultivation practice

A) Rough puddling : July 3

B) Fertilization : July 4

C) Ploting : July 5

D) Transplanting : July 8.9.10

Used 20 seedlings from seedling box, 6 seedlings per hill, 26 hills per m^2, manual transplanting, 1 plot 40 m^2, 2-plot system.

Herbicide treatment

A) 1st : July 7 (the following day of puddling)

B) 2nd : July 10 (4 days after puddling)

D) 3rd : July 13 (7 days after puddling)

D) 4th : July 16 (10 days after puddling)

E) 5th : July 21 (15 days after puddling)

2) Experiment on 1 time treatment of herbicide in young seedling transplanting cultivation

Studies were made on the applicability of 1 time treatment of mixed herbicide having wide weed control spectrum.

Trial herbicide and quantity (per a)

A) Granulated Naploanilede Butiachlor 7%, 35%	300 g
B) Granulated Pyrazolate Butachlor 6%, 2.5%	300 g
C) Granulated Benthiocarb 7%	300 g

Cultivation practice

A) Puddling : July 18

B) Transplanting : July 24

C) Fertilization : July 25

Weeding effect is shown on table 4. For Cyperus defformis, all of the 3 kinds of herbicide showed excellent effect, but, for Ammania spp, Granulated Pyrazolate Butachlor herbicide showed high effect, with the remaining 2 kinds showing inferior effect.

Table 4. Effect of weed control

Trial Plot	Cyperus Difformis		Ammania spp		Total	
	No. Weed,	Ratio	No. Weed,	Ratio	No. Weed,	Ratio
Naploanilede Butiachlor 7%, 35%	0	0	80	86	80	60
Pyrazolate Butachlor 6%, 2.5%	0	0	11	12	11	8
Pyrazolate Benthi-ocard 7%	0	0	52	56	52	39
No treatment	41	100	93	100	134	100

The growth of paddy rice was inferior in the Naploanilide Butachlor tablet herbicide plot. Yield was the lowest in No-treatment plot due to weed damage, and the second from the lowest was Napleanilide Butachlor plot due to partly to weed damage besides herbicide damage.

Table 5. Growth and yield of paddy rice

Trial Plot	Growth Survey		Harvest Servey				
	Plant H.	No. Tiller	No.of Panicle	No.of Small	Ripening P.ratio	1000 Weight	Yield /a
	cm	No.	No.	No.	%	g	Kg
Naploaniled Butiachlor 7, 35%	35.5	11	31	31	81	21	58.2
Pyrasolate Butachlor 6, 2.5%	41.0	14	32	53	80	20	65.1
Pyrasolate Benthiocarb 7%. 7%	45.7	16	34	50	80	22	71.8
No treatment	41.4	18	21	57	80	22	50.6

As a result, Pyrazolate Butachlor herbicide had the highest weeding effect. The effect herbicide including Butachlor on the growth of paddy rice was noticed. Judging from the above results, Pyrzolate Benthiocarb tablet herbicide is safest for application in high temperature.

3) Experiment on systematization of herbicide in direct seeding cultivation under flooded condition

Though Pylazolate tablet herbicide has a highly safe properly in direct seeding cultivation under flooded condition, its weed controling period is feared. Therefore, its systematization with other kinds of herbicide was studied (per a) :

A) Granulated Pyrazolate	10%	300 g
B) Granulated Butachlor	5%	300 g
C) Granulated CNP Butachlor	5%, 3%	300 g
D) Liquid Bentazone	37.5% cc	
E) Granulated Enthiocarb Symetrin	7%, 1.5%	300 g

Cultivation practice

A) Rough puddling : July 10

B) Puddling : July 14

C) Sowing : July 15

Herbicide treatment

A) Pyrazolate tablet herbicide : July 16

B) Granulated Pyrasolate and Granulated Butachlor : July 26

C) Granulated CNP Butachlor and Liquid Bentazone : August 9

5. Discussion

The paddy field herbicides on the market in Egypt are 6 kinds; i.e. Exadiazon, Benthiocarb, Bentazone, Butachlor, Molinate and DCPA.

All of which are either liquid of emulsion herbicides and on tablet type is on the market. According to counterparts, the area of paddy field herbicide application is 210,000 ha.

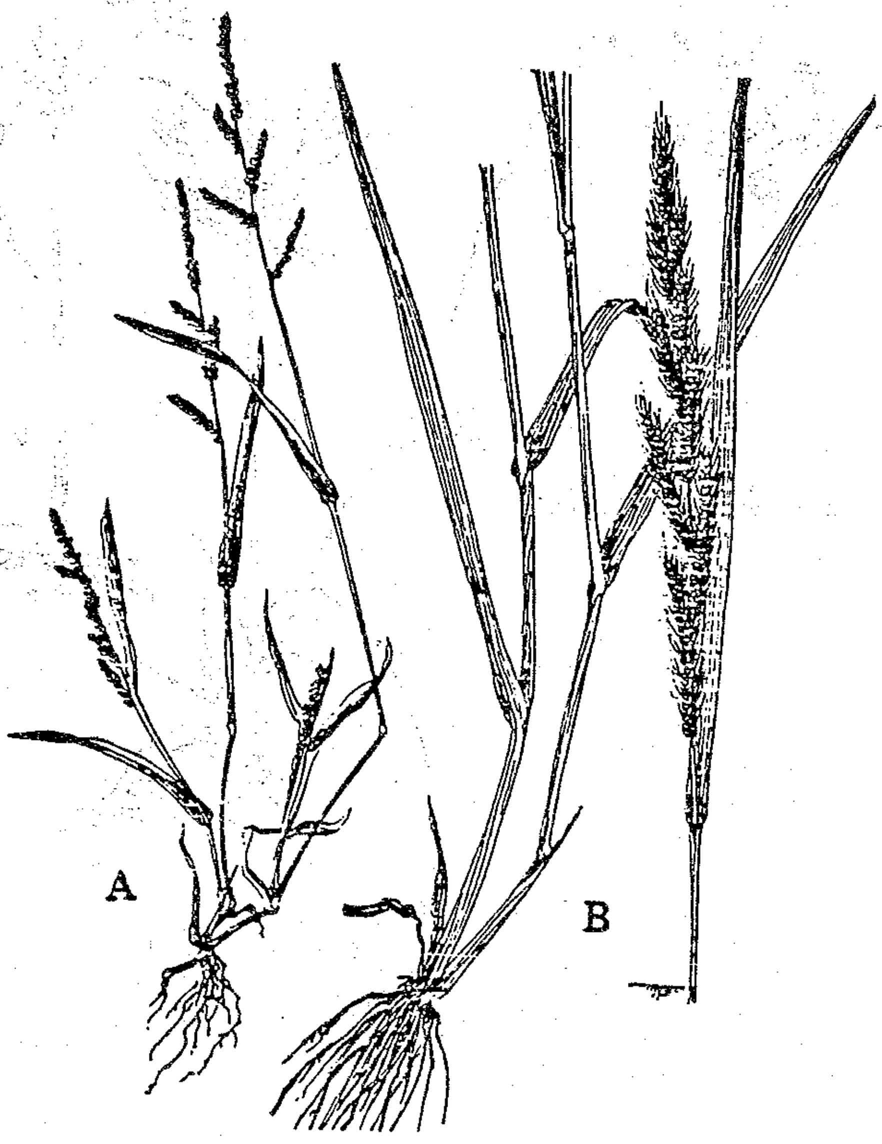
Oxadiazon and Benthiocarb are used for 84.000 ha respectively and Bentazon and other herbicides are used for the remaining area of 42.000 ha. Considering treatment based on the above herbicides on the market, scattering of Oxadiazon emulsion and Benthiocarb emulsion in undulated solution before or after puddling in young seedling transplanting cultivation, and scattering of Benthiocarb + DCPA emulsion in mixed solution after drainage in 1-2 leaf of rice in direct seedling cultivation under flooded condition will be the basic treatment. However, sprayers are not spread so much due to unfamiliarity of spraying of agricultural chemicals. In the latter treatment case, therefore, owning of sprayers is a precondition.

In view of the above circumstances, tablet herbicide - oriented treatment is desired. In young seedling transplanting cultivation, one time treatment using CNP Butachlor tablet, already locally transformed into tablets in Formosa and Tahi, is considered promissing. In direct seedling cultivation under flooded condition, systematized treatment of Pyrazolate and medium/latter period herbicides just after seedling is considered promissing.

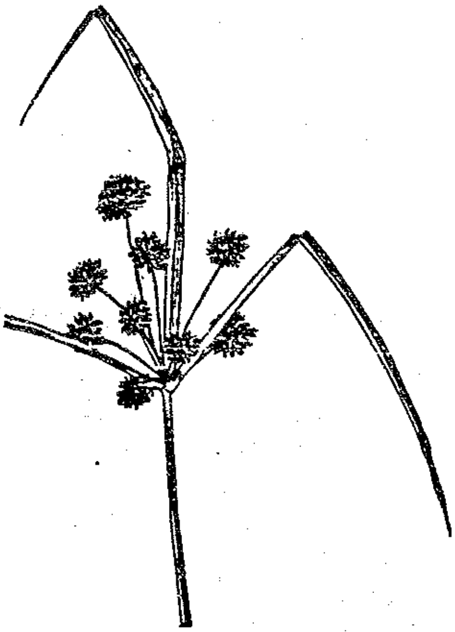
For the more development studies, prior settlement of problems peculiar to Egypt is essential, for example, relation between weed growth and alteration of land usage and water depth of paddy field (including ground exposure). In spreading herbicide, studies on its toxic character to men and fish are necessary. Because fish are an important source of protain. The spread of herbicides should be carried out carefully so that no problems such as PCP in Japan may occur.

GRAMINEAE

ANNUAL WEEDS

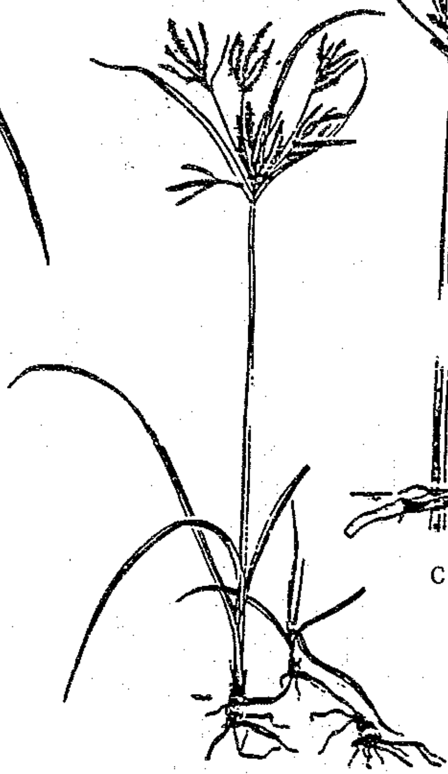


A. Echinochloa colonum   B. Echinochloa crus-galli



A - Cyperus difformis

C - Cyperus longus



B - Cypprus rotundus