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REPORT OF TECHNICAL GUIDANCE ON LUMPUNG AGRICULTURAL DEVELOPMENT PROJECT, INDONESIA

MAY 1976

JAPAN INTERNATIONAL COOPERATION AGENCY

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I . INTRODUCTION

1.1 Purpose of the Survey

In the last three and half years which have elapsed since Lampung Agricultural Development Project was started in November 1972, itinerant guidance and survey was conducted each year in the project area by a survey team sent from Japan.

The present survey was conducted, as in the previous surveys, with the view to examining the progress of the project during 1975 and providing advice and recommnedation on the project cooperation in 1976.

In view of the fact that the project has now reached the stage of diffusing improved farming techniques developed at Agricultural Extension Centre (hereafter called "Tegineneng Centre") into surrounding areas through establishment of demonstration farms and other means, special emphasis was placed on the reviewal of extension activities to provide practical advice on smooth and full-scale extension of advanced techniques.

1.2 Members of the Survey Team

Name	Assignment	Affiliation
Shinichi HASEGAWA	Leader	Technical advisor, Sugar Crop Development Fund (former Director of Vegetable and Ornamental Crops Research Station, Ministry of Agriculture and Forestry.)
Shigeyoshi NISHIWAKI	Cooperation Planning	International Cooperation Division, Economic Affairs Bureau, Ministry of Agriculture and Forestry.
Shin TANAKA	Extension Planning	Extension and Education Division, Agricultural Production Bureau, Ministry of Agriculture and Forestry.
Yoshiaki KANO	Liaison and Coordination	Technical Cooperation Division, Agricultural Development Cooperation Department, Japan International Cooperation Agency.

II. SURVEY RESULTS AND COMMENTS

1. Lowland Farming Development Sub-project

Under this sub-project, one large demo-farm (originally planned to cover an area of 100 ha, currently having an acreage of 40 ha) and 40 small demo-farms each covering an area of 5 ha are planned to be created in the lowland area embracing ten Kecamatans in Central Lampung of Lampung province. Operation of these demo-farms is intended to promote the extension of improved farming techniques through their demonstration and thereby elevate the farmers income level and livelihood.

By the implementation of the sub-project, the average yield of paddy in 1975 registered 3.9 tons per ha in the wet season and 4.1 tons per ha in the dry season in the project area. These values are higher by 20~30% than the average yield of the BIMAS participating farmers in the neighbouring areas. Further, the trial cultivation conducted in 1975 dry season for introduction of pulses recorded an average yield of 0.97 t/ha for soybeans and 0.66 t/ha for green gram, which suggests the possibility of their introduction in the paddy field area. However, the yield of paddy has been on the 4 t/ha level for some time, so that further effort will have to be made in the coming years to increase it to 5~6 tons per ha. To attain this objective, it is necessary to improve the plant protection and fertilization techniques and thus reduce the percentage of unripend grains which stands at as high a value as 40% at present.

As for the large demo-farm at Totokaton which was originally planned to have an acreage of 100 ha, farmland arrangement and consolidation work so far completed covers an area of only 40.3 ha. The team considers that it is incumbent upon the Joint Committee to make determination at an early date as to what measures should be taken for the remaining 60 ha area.

Outcomes of the experiments for lowland farming development below.

1-1 Experiments at Tegineneng Centre

(1) Three Element Experiment in Newly Created Paddy Fields (1974 ~ 1975)

Seedlings planted in the non-phosphate applied plots showed extremely poor growth after transplanting and eventually withered away. In the plots where phosphate fertilizer was applied at a dosage of 55 kg or 110 kg per ha, however, yield was as large as 3 t/ha, which clearly indicates that phoshpate application is essential in newly reclaimed paddy fields. The experiment also disclosed that in the plots where phosphate was heavily applied, quite a large yield was recorded in the initial year, but no yield increase effect was observed from the second and subsequent croppings.

As for the effect of nitrogen fertilizer, further experiments and studies must be made in the newly cleared paddy field area to arrive at any conclusive evaluation.

(2) Dosage Test of Nitrogen and Phosphate Fertilizers

Both nitrogen and phosphate fertilizers were applied at a dosage of 100~200 kg/ha, but this heavy application produced no clear effect upon the yield. Nor was any notable yield increase effect observed in the plot where fused phosphatic fertilizer was applied. In this plot, however, increase in the number of ears was observed and the grains/straw ratio improved.

(3) Growth Pattern Follow-up Experiment (1974/1975)

This experiment was conducted to grasp the pattern and period of growth and to clarify the relationship between the number of planted seedlings and the planting depth. The experiment revealed that shifting from one-seedling planting to five-seedling planting results in the increase

in the number of stems, accelerates the completion of the late productive tillering stage and the active tillering stage, and also increases the number of ears. In the experiment, seedlings were planted at three different depths, i.e., 1 cm, 5 cm and 9 cm. As a result, it was found that as the planting depth becomes larger, increase of tillers is decelerated and the active tillering stage is prolonged, whereas the heading and ripening are both accelerated.

(4) Experiment on the Combination of Planting Pattern and Nursery Days (1975)

This experiment disclosed that the increase of planting density results in the greater number of stems and ears per unit area, but no relationship could be observed between the planting density and the yield. Increase in the number of planted seedlings per hill resulted in the emergence of greater number of stems, but no change was detected in the number of ears or yield.

(5) Introduction of Mechanized Paddy Cultivation on a Trial Basis

Effort is being made for introduction of hand tractors. There is farmers' demand for hiring hand tractors, but since their demand presupposes that the fee for using them is not higher than being paid for hiring draught cattle, studies are being made to determine reasonable lease-out charges. Farmers' reaction to the introduction of threshers is also studied, but it is not likely that threshers will be introduced smoothly in the near future because of the poor road condition, additional labour for transporting harvested paddy, and necessity of mats and containers. Nevertheless, if farmers are inclined to cultivate short-statured varieties of panicle number type to increase production and find the advantages of thresher operation over the conventional use of Ani-Ani, they will eventually take of using threshers.

Compared with hand tractors and threshers, chemical sprayers enjoy an active demand and their introduction involves no particular problems. However, frequent development of failures and loss of nozzles and other parts were noted. Of all the introduced farming machines, weeders are most favourably accepted by farmers. Provincial Government embarked upon trial production of weeders on the recommendation of Japanese experts, and 200 sets manufactured in the province have already been sold. This is clear evidence to show that while the demonstration of Japanese farming machines of the newest type is important for the promotion of mechanized farming, it is equally or more important to introduce improved animal-driven or manual farming implements in the area (See the section dealing with the trial production of upland farming equipment). To promote the introduction of such improved farming implements, it is necessary to take supportive measures for the experts concerned.

1-2 Trial Paddy Production and Introduction of Upland Crops in Trial Plots

(1) Establishment of Demo-Farms and Technical Guidance

During 1974/1975, demo-farms were established in 27 places covering a total acreage of 136 ha. It is expected that the establishment of all the 40 demo-farms (186 ha) will be completed within 1976/1977 as originally planned. Japanese lowland farming experts stationed in the province provide technical guidance to their Indonesian counterparts who in turn offer advice and guidance to extension workers and farmers.

Since the sub-project was started in the total absence of experimental data, effort has been exerted to grasp the farmers' technical level by investigations in different areas, quadrant sampling surveys and analytical studies, and extension activities have been carried out on the strength of provisional cultivation standards which was worked out in accordance with the research data and cultural standards of other areas.

(2) Results of Surveys and Experiments

1) Yield Survey

The yield survey has been conducted since 1973 to evaluate the yield increase effect produced by the operation of demo-farms. It is known from this survey that the

average yield of dried and unhulled paddy in the three-year period from 1973 to 1975 was 3.95 t/ha in the wet season and 4.10 t/ha in the dry season. Compared with the five-year average yield (1969~1973) recorded in Central Lampung, these values are higher by 40% and 65%, respectively, which indicates that the operation of demo-farms achieved a notable yield increase. However, this achievement by heavy application of fertilizer seems to be diminiched to a substantial degree due to diseases and insect pests; frequent occurrence of disease and insect damages and the low percentage of ripened grains (approx. 58%) have been reported.

2) Dosage Test of Nitrogen and Phosphate Fertilizers (1974)

Ear length, number of ears, dry weight and yield in fertilized plots were all greater than in non-fertilized plots. The test also disclosed that additional application of urea in some fertilized plots resulted in the increase of culm length, dry weight and yield but produced no appreciable difference in the number of ears, ear length or grain - straw ratio. The dry weight and yield in the plot where triple superphosphater was applied at a dosage of 50 kg/ha were slightly smaller than in two other plots where the same fertilizer was applied at a dosage of 100 kg and 150 kg per ha, respectively. Between the latter two plots, however, virtually no difference was observed in the dry weight or yield.

It was also found that the effect of additional phosphate application becomes larger if nitrogen is used at a heavy dosage. Further, the effect of additional urea application was clearly observed up to a dosage of 200 kg/ha, which was divergent from the test data of Tegineneng Centre, and it was noted that mature fields were practically free from phosphate deficiency.

These test results made it clear that the currently adopted standard dosages of fertilizer application (200 kg/ha for urea and 100 kg/ha for T.S.P.) can be generally justified.

3) Planting Pattern Experiment (1974/1975)

The experiment disclosed that the yield per ha was 8.7 tons in 25 x 25 cm plot, 8.47 tons in 30 x 15 cm plot, and 7.7 tons in 20 x 20 cm plot, indicating that dense planting was not necessarily conductive to yield increase. It is possible that dense planting impeded the growth of the root and brought about other detrimental physiological effects. But the dominant reason for the poor yield in the dense planting plot is the development of diseases and insect pests including sheath blight.

4) Planting Depth Experiment (1975)

This experiment was conducted by planting seedlings at three different depths, i.e., 3 cm., 5 cm and 8 cm. The yield was 5.8 t/ha in 3 cm plot, 5.1 t/ha in 5 cm plot, and 4.7 t/ha in 8 cm plot, which made it clear that shallow planting was clearly contributory to yield increase. Since deep planting is firmly rooted among the farmers in the province, they should be enlightened on the yield increase effect of shallow planting. For this purpose, guidance should be given to promote the levelling of paddy field, shallow-water irrigation, and use of young seedlings.

5) Experiment on the Combination of Planting Pattern and Fertilization Dosage (1975)

This experiment was conducted by combining different planting patterns (15 x 25 cm, 15 x 30 cm, and 25 x 25 cm) with different dosages of fertilizer application (103 kg/ha, 83 kg/ha and 62 kg/ha for nitrogen, and 54 kg/ha and 36 kg/ha for phosphate). As a result, it was found that the culm length and ear length became larger by sparse planting and heavy fertilization, and that the number of ears tended to increase by dense planting and heavy nitrogen application. As to the yield, however, no comparative study could be made because of the outbreak of sheath blight which covered all the trial plots.

6) Experiment for Introduction of Second Crops

Paddy can be grown in the dry season so long as irrigation water is available. In the downstream areas embracing reclaimed paddy fields, however, irrigation water falls short of demand so that it is supplied in rotation to Desas or Kecamatans to enable the farmers in each area to cultivate paddy by turns.

In view of this absolute shortage of water, this experiment was started in 1975 for trial cultivation of soybeans and green-gram bean to study the possibility of introducing other crops than paddy for dry season.

The trial cultivation recorded a yield of 0.97 t/ha for soybeans and 0.66 t/ha for green-gram bean. Income from this trial production was just as high as can be obtained by paddy cultivation and justified the possibility of introducing second crops in future.

1-3 Outstanding Problems and Countermeasures

(1) Increase of Yield per Unit Area (Increase of Percentage of Ripened Grains)

1) As described already, the yield of paddy has increased to about 4 t/ha in all the demo-farms established under the sub-project. Although this yield level is higher than in any neighbouring areas, it can be said that there has not been any sign of further increase beyond this level.

In order to further raise this yield level, it is necessary to increase the percentage of ripened grains which stands at 58% at present, and this will call for the clarification of the causes of the prevailing high sterility ratio and for the control of diseases and insect pests, sheath blight in particular, which are considered the dominant cause.

2) As for the dosage and time of fertilization, it is considered justifiable to appy 200 kg/ha of urea (60 kg for basal dressing, 70 kg at time of transplanting, and 70 kg in 50~60 days after transplanting) and 100 kg/ha of T.S.P. (all for basal dressing). However, since it cannot be denied that there is a close relationship between this fertilization standard and the above-mentioned high sterility ratio, the team considers it necessary to conduct further studies and experiments on the time of fertilizer application.

3) The currently adopted cultivation standards, in which the nursery days are set at 20~25 days, planting depth at 3 cm, and planting pattern at 25 x 25 cm, 30 x 20 cm, and 30 x 15 cm, are regarded both reasonable and justifiable. However, since the standards have not yet taken deep root among the farmers, intensive extension and guidance services should be offered to induce them to follow the standards faithfully. The standards presuppose the use of seedlings younger than those planted by farmers following the traditional practice. In the extension and guidance services, therefore, it is particularly important to induce farmers to carry out puddling in a thoroughgoing manner and level paddy field, and to enlighten them on the yield increase effect of shallow planting.

4) Pelita I-1 which is recommended to the farmers in the province is resistant to blast and bacterial leaf blight but susceptible to sheath blight, stem borer and stem maggot, so that the farmers are inclined to introduce other improved varieties such as IR-26, IR-32 and IR-34. It is therefore incumbent upon Tegineneng Centre to conduct characteristic tests on these varieties as soon as possible to establish their cultural standards.

1-4 Large Demo-Farm

In the Technical Cooperation Agreement signed for Japan's cooperation in the sub-project, it is stipulated that the large demo-farm would have an acreage of about 100 ha. Farmland

arrangement and consolidation work so far conducted for the creation of this farm covered 5 ha in 1973, 27 ha in 1974 and 8.3 ha in 1975, so that the farm has an acreage of 40.3 ha at present. Improvement of the remaining 60 ha area of the farm is planned to be carried out in a simpler manner, and a design for such improvement has recently been completed.

A good lesson can be thus derived that surveys conducted before implementing any project are of great importance and that advanced techniques should be introduced by degrees in such a manner as will be compatible with each stage of development in the project area.

In 1975, the whole consolidation work of the 8.3 ha was undertaken by the Indonesian side from surveying to execution. It can therefore be said that the transfer of techniques has been a success.

At present, studies are being made by Japanese experts as to what improvement measures are to be taken for the area. Rice mill installation having been completed, the pressing need for the improvement of the area would be to formulate a collective farming plan covering the whole process from cultivation and harvesting to processing and distribution.

2. Upland Farming Development Sub-Project

As stated in the reports submitted by previous teams, Upland Farming Development Sub-project has been implemented with the view to increasing the yield per unit area of upland paddy, cassava and maize through improvement of their mixed cropping techniques. For this purpose, experiments have been conducted to improve the fertilization practices (specifically for adequate application of nitrogen and phosphate) compatible with the prevailing cropping system, and to introduce new varieties. Guidance has been offered in the operation of demo-farms on the strength of such experiments and has produced creditable achievements.

Specifically, the yield of paddy in the demo-farms ranged from 900 to 3,900 kg per ha in the 1974/75 wet season, with the mode registering 2,500~3,000 kg/ha. This is 5 to 6 times the average yield recorded in past years. The yield of maize, on the other hand, ranged from 1,341 to 2,359 kg per ha in grains, averaging 1,876 kg/ha. Although this average yield is not very high, it is 2 to 2.5 times the average of the whole province.

During its stay in Lampung province, the team had the opportunity to attend a field day meeting and an achievement rally. At the achievement rally, it was reported that the average yield of upland paddy in one Desa increased to 2.5 t/ha from the past level of 0.5 t/ha. The team was also informed that the yield of the farmer who won commendation on the day was as high as 3.6 t/ha.

To provide guidance and data required for the next stage of the province's agricultural development, experiments at Tegineneng Centre and Trial Plots are conducted with emphasis on the introduction of sorghum and pulses as well as on the single cropping of other various crops.

2-1 Experiments at Tegineneng Centre

(1) Results of Experiments in 1974/75

Major findings of the experiments conducted in 1974/75, subjects of which have already been introduced in the last year's report, are described below.

1) Planting Density and Fertilization Experiment of Cassava

A compound synthetic fertilizer (16 - 16 - 16) was applied in fertilized plots at a dosage of 300 kg/ha. It was not possible, however, to detect the fertilization effect in the Centre's trial plots alone, although the yield in fertilized plots was slightly higher than

in control plots.

As for the planting density, its increase tended to lead to greater yield, with the highest yield of 4.4 t/ha recorded in the most densely planted plot (100 x 60 cm). Among control plots, the highest yield was obtained in 100 x 80 cm plot.

2) Varietal Characteristics Test of Cassava

This test was conducted to study the characteristics of local varieties grown in the province. The test disclosed that SPP for industrial purpose (bitter variety) and Mentiga for food (sweet variety), which are widely grown in the province, are of the clone type, whereas Pahum and Nili are of the elongation type. For intercropping or mixed cropping, it seems that the latter two varieties are better suited. SPP is a variety of corm weight type. Corms of this variety are small in number but heavy. The dry matter ratio varies from 34 to 51% by variety, and SPP has the lowest ratio of 34%. The test disclosed, however, that the yield of corms of this variety is the highest of all varieties, and so is the yield of chips.

3) Upland Paddy Fertilization Experiment

This experiment was conducted to find out the optimal dosage of nitrogen and phosphate to be applied for cultivation of Bicol, an improved variety introduced from the Philippines. About 20% yield increase was attained by the application of these fertilizers, but the percentage of ripened grains was as low as 51~56% because of the damage caused by rice stink bugs. The dosage which can be considered reasonable from the results of the experiment was 30~60 kg/ha for nitrogen and 50~70 kg/ha for phosphate.

4) Breeding Experiment of Maize (DMR-5 and DMR-3)

Since the outbreak of downy mildew in 1973, resistant varieties, DMR-5 and DMR-3, have been introduced from the Philippines to replace Metro, the local variety which has been grown in the province. However, these two varieties showed considerable variability from the outset and about 50% of the plants were affected by the heavy outbreak of downy mildew. For this reason, breeding of the two varieties by ear-to-row selection and production and preservation of foundation seeds were conducted on commission from Central Research Institute for Agriculture at Bogor.

(2) Experiments in 1975 Dry Season

In 1975 dry season, variety tests of upland paddy were conducted using sprinkers provided by the Government of Japan.

One of the variety tests was intended to study the characteristics and yield of 18 promising varieties. Seeds of these varieties were sown on June 18, and the period required for maturity ranged from 103 to 140 days. The yield of these varieties is now under study, and it is expected that the test will be conducted continuously through the coming wet season.

The other variety test was conducted on 76 varieties, mostly of late maturing type (140~150 days), which were provided by Tamanbog Branch of Central Agricultural Research Institute. In the course of the test, many of these varieties developed blast and sheath blight and it was found that none were superior to those subjected to the first test. The test was therefore suspended.

(3) Progress of Experiments in 1975/76

1) Collection and Characteristics Test of Leguminous Crops

A characteristics test of leguminous crops is now in progress. The test covers a total of 74 varieties of 10 different crops including soybeans, green gram, groundnuts and those varieties whose scientific names are unknown.

2) Variety Test of Upland Paddy

The aforementioned variety test is conducted continuously on 20 varieties of upland paddy to study their characteristics and yield.

3) Upland Paddy Fertilization Test

This test is conducted on Seratus Malam, a local variety, and Bicol, an improved variety, in order to find out the optimal dosage of nitrogen and the optimal time of its top dressing.

4) Cassava Fertilization Test

Since the test conducted at Tegineneng Centre in the previous year produced no fertilization effect (Ref. Section 2-1 - (1) - 1)), another test is being conducted in lowlying fertile Bulusari area with special emphasis on the dosage of potassium application.

5) Variety Test of Maize

This test is conducted to study the resistance to downy mildew and yield of two varieties, Harapan-DMR-No. 6 and Harapan-DMR-No. 43, which were bred at Central Agricultural Research Institute. The susceptibility test conducted in mid-January revealed that the two varieties have approximately the same resistance as DMR-5 and are slightly more resistant than DMR-3.

6) Experiment on Cropping System

In this experiment, comparative study is made to find the difference in yield and profitability between the prevailing inter - and mixed cropping system and the single cropping system of upland paddy, cassava and maize. It is planned that a test will be conducted on the combination of rotation patterns for single cropping.

7) Trial Manufacture of Small Upland Farming Equipment

In the trial manufacture of farming equipment, stress is placed on hand or animal-driven small farming implements because their extension is most promising at the present stage of development. Hence, manufacture and experimental utilization of weeder, seeder, fertilizer spreader, and Sing Kong chopper for chopping cassava is in progress.

2-2 Experiments in Trial Plots

(1) Results of Experiments in 1974/75

1) Experiment on Cropping Pattern

This experiment was carried out in 13 places to study the difference in yield and profitability between two cropping patterns, i.e., the prevailing mixed cropping of upland paddy, cassava and maize (pattern A) and the mixed cropping of maize and cassava alone (pattern B). As a result of the analysis of reliable data collected from four places, the following fact were brought to light.

a) In pattern A, upland paddy exhibited a conspicuous fertilization effect but its growth was inhibited because maize had to be sowed again on account of heavy occurrence of downy mildew.

b) Maize grown by pattern B also exhibited a great fertilization effect.

c) Fertilization effect on cassava was not made clear.

d) Since the market price of cassava is extremely high this year (about 3 times the last year's level), no large difference in gross income was observed between the two patterns. Nevertheless, it can be concluded that pattern A, which includes upland paddy, is more stabilized from the point of view of yield, profitability, and self-sufficiency in food.

2) Trial Cultivation of Soybeans

This experiment was conducted on local varieties in the same 13 places in order to to study the possibility of introducing soybeans in the province. As a result, a considerably high yield (900~1,000 kg/ha in fertilized plots) was attained at Rengas and Tegineneng Centre where chemicals were sprayed. In other places, however, the yield was extremely low (80~220 kg/ha in fertilized plots), and damage of soybean stem miner, stink bug and pod borer was observed. Thus, the experiment furnished evidence to indicate that the success of soybean production in the province hinges on the control of insect pests.

3) Multiple Cropping Experiment

At the request of the Central Government, incomes and expenditures of the following three cropping patterns were studied through the year for comparison of net income.

A. Upland paddy, Maize → Maize, Kacang usu

Cassava → Cassava

B. Upland paddy → Sorghum, Groundnuts → Sorghum, Tobacco

C. Upland paddy, Cassava → Green gram, Cassava → Sorghum, Kacang panjang

As a result of this experiment, the following facts were made clear.

a) In pattenr C, green gram and sorghum recorded an extremely low yield because the former was afflicted with diseases and insect pests and the latter with bird injury.

b) Pattern B recorded the highest gross income of Rp 360 thousand which, however, was offset by the high production cost. As a consequence, the net income of this pattern turned out to be approximately the same as that of pattern A.

c) Pattern A, which is similar to the prevailing cropping pattern, produced a stabilized yield for all crops and registered an annual net income of about Rp 100 thousand .

d) Production cost distribution in the total capital input was as follows. This cost distribution was found to be subject to negligible variation in all the three patterns.

Ploughing 22 ~ 28% > Fertilizers 17 ~ 23% > Weeding 16 ~ 19% > Sowing & Fertilization 11 ~ 15% >

Seeds 6~12% > Harvesting & Processing 9% > Chemicals Spraying 1.5~3% > Chemicals 1~1.5% >

2-3 Outstanding Problems and Countermeasures

As stated in the reports submitted by previous survey teams, the current mixed cropping pattern of upland paddy, cassava and maize is both rational and reasonable in many aspects because of its compatibility with the technical level in the province. During its stay in the province,

the team noted with surprise that long-statured upland paddy having a plant height of more than 150 cm was grown in fields partitioned by levees having a width of only 40 cm, but no lodging could be observed except in few places including Tegineneng Centre. This may perhaps be ascribable to the fact that the province is absolved from the damage of typhoons or rainstorms. Although the team frequently encountered heavy showers accompanied by strong wind, lodging of upland paddy was observed only in few places.

Another notable fact was that the crops grown by mixed cropping seemed to be little shadowed by each other. This may be explained by the low latitude of the province where the sun streams directly from above throughout the year, especially in the wet season.

The existing technical level should be construed as being ideally adapted to such natural conditions, and positive effort should be made to take advantage of its validity and merits in charting the course of future technical improvement.

(1) Establishment of Plant Protection Method

Fertilizer application, initiated as the first step towards technical improvement, is producing excellent yield increase effect, but it has invited increased outbreaks of blast, sheath blight, and rice stink bug. Further yield increase is now impeded by these diseases and insect pests. Control of stem miner, stink bug, pod borer, etc. is a must for the introduction of pulses. Thus, disease and insect pest control is one of the pressing needs in the province.

In Lampung province, insect pests can readily find hosts because crops are grown throughout the year. It is therefore necessary to devise cropping systems which would facilitate the establishment of a comprehensive plant protection method, and necessary administrative measures should be enforced without any scruple whenever need arises.

(2) Problems in Introducing Single Cropping

When the yield per unit area of respective crops has been increased to a satisfactory level, further effort should be made to expand the planting area. Although the lack of manpower for reclamation is generally cited as being most impedimental to the expansion of farmland area, this problem can be solved, for instance, by giving reclamation works to contracts with large tractor owners. It is the question of management capacity rather than reclamation that must be tackled in planning farmland expansion work.

As described already, experiments of single cropping and rotation of different crops are being conducted at Tegineneng Centre and trial plots to provide for the next stage of development. In these experiments, effort should be exerted to establish cropping patterns promising efficient operation of various farming machines (cultivator, harvesters, etc.) which are expected to be introduced in the coming years, and comprehensive studies should be made for distribution of labour force, conservation of soil productivity, and control of diseases and insect pests. Needless to say, it is advisable that the extension of such cropping patterns be preceded by experimental operation by farmers in trial plots, etc. so that their validity and practicability may be assessed in advance from the viewpoint of farm management.

(3) Trial Plots

As will be clear from the cassava fertilization experiment described in the foregoing pages, fertilizer application in Tegineneng Centre's fields has been carried out in a manner quite divergent from that followed by general farmers. Accordingly, any new technique developed at the Centre has had to be checked at trial plots to find the ways and means of its extension among general farmers. For this reason, trial plots have been doubled each year since 1973.

The team is of the opinion, however, that the increase of trial plots does not necessarily lead to higher accuracy and reliability of the experiments conducted there. On the contrary, it could result in the degradation of both accuracy and reliability if the management and operation of the trial plots is left to a limited number of personnel.

To give an instance of such accuracy drop, reliable experimental data that could be put to a further analysis were produced only at 4 out of the 13 trial plots where the cropping pattern experiment was conducted in 1974/75. In the case of the trial soybean cultivation conducted in the same 13 trial plots in 1974/75, only 10 plots produced data that could be considered reliable.

In the coming years, therefore, it is necessary to determine the location and number of trial plots after a rigid and thoroughgoing examination.

(4) Accelerated Utilization of Draught Animals

At present, trial manufacture of various farming implements is being pushed forward to improve labour productivity by making maximum use of animal power in order to provide for the next stage of development.

Use of such farming implements is closely interrelated with various factors such as the levee width, planting pattern, fertilizer types, etc. and also produces an immense influence ensued from the ground cultivation by animal-driven implements. Hence, closer mutual cooperation than ever is required of the experts in different specialized fields in promoting the trial manufacture of these implements.

(5) Maize Seed Production

Introduction of DMR-5 and DMR-3 proved to be quite effective for the control of downy mildew of maize, and this was followed by an experiment for introducing two other resistant varieties, Harapan-DMR-No. 6 and No. 43.

Since all these varieties were newly bred by hybridization, establishment of an efficient seed production system is urgently required.

3. Training Programme

3-1 Past Achievements

For the smooth implementation of Lampung Agricultural Development Project, Tegineneng Centre has been conducting training of extension workers, key farmers and operators over the past years.

Integration of all training activities is contemplated by the Indonesian government. However, since this is still in the planning stage, training is conducted with the necessary funds appropriated by the relevant government offices.

Training at Tegineneng Centre is conducted by Dinas Pertanian, the Centre's supervising organ, and by Dinas Perkebunan which provides guidance in the perenial crop production (clove-tree) by making use of the Centre's facilities.

Dinas Pertanian provides training in the production of food crops, and this is closely related with Tani Makmur project and BISMAS programme. Training associated with Tani Makmur project is offered by Indonesian counterparts, with the cooperation of Japanese experts who formulate training plans, prepare training curriculums, and provide guidance in the preparation of textbooks and teaching materials.

As stated in the report of the survey team dispatched to the province in 1975, systematization of training curriculums and consolidation of textbooks are in progress. Lack of uniformity of training curriculums is assignable to the fact that training in the past years had been conducted without resorting to any curriculums. By the completion of trainingmaster-curriculums in 1975/76, it is expected that the operation of the training programme will be made far more efficient and smoother in the coming years.

In 1975/76, training was offered to 17 extension workers (totalling 152 man-days), 120 key farmers (240 man-days) and 35 operators (270 man-days). Table 1 shows the breakdown of trainees by course.

Table 1 - Training Conducted in 1975/76

Classification	Lowland Sub-project	Upland Sub-project	Total
Extension Worker	81 man-days (9 trainees x 9 days)	72 man-days (8 trainees x 9 days)	153 man-days
Key Farmer	94 man-days (47 trainees x 2 days)	146 man-days (73 trainees x 2 days)	240 man-days
Operator	150 man-days (15 trainees x 10 days)	120 man-days (20 trainees x 6 days)	270 man-days

Training comprises classroom lectures and practical field training which are offered in a ratio of 6 : 4 to extension workers, 5 : 5 to key farmers, and 4 : 6 to operators. These ratios are considered generally justifiable.

Extension workers of upland sub-project are given training in six subjects, i.e., fertilization techniques, plant protection, farm machinery, cultivation techniques, agricultural management, and agricultural extension. Water management is added to these six subjects for those extension works of lowland sub-project.

The training curriculums prepared in 1975/76 are shown in Tables 2, 3, and 4.

Table 2 - Training Curriculum for Extension Workers Associated with Tani Makmur Project (1975/76)

Subject	Objective	Item	Guidance Matter	Method	Lecture	Practical Training
Agricultural Extension	1 Deepening of the trainees' understanding of the demo-farm operation plan to awaken their interest in the plan	1) Planning of demo-farm establishment and operation	1) Purpose of demo-farms 2) How to select demo-farms 3) How to operate demo-farms	Classroom lecture Case study	3	1
		2) Project study	1) How to evaluate the operation of demo-farms		1	
			2) How to analyze the success or failure of demo-farm operation		2	
	2 Fostering the farmers' groups for creation of agricultural cooperatives in parallel with the operation of demo-farms	1) Grouping of farmers	1) How to recruit farmers' leaders 2) How to organize farmers' groups 3) How to manage farmers' groups	Classroom lecture	6	
			4) Method of group discussion	Discussion		6
		2) Rearing of agricultural cooperatives	1) Activities of farmers' groups and their associations	Classroom lecture	3	
			2) Functions and organization of agricultural cooperatives		3	
	3 Improvement of the administrative abilities and general knowledges required of extension workers	1) Preparation of operational reports	1) How to prepare operational reports 2) How to prepare official documents		4	
		2) Film show	1) Indonesian agriculture 2) Japanese agriculture	Film		6
		3) Family planning	1) How to work out family planning 2) Practical questions involved in family planning	Classroom lecture	3	
	Sub-Total (1 + 2 + 3)				25	13

Subject	Objective	Item	Guidance Matter	Method	Lecture	Practical Training
Agricultural Management	1 Improvement of trainees' understanding of the fundamental knowledges of agricultural management	1) Recording of data of agricultural management	1) Book-keeping by single and double entry 2) How to calculate the production cost 3) Agricultural credit system	Classroom lecture	3	
	2 Improvement of the trainees' capabilities for providing guidance in agricultural management and for making simple management diagnosis and design	2) Method of management diagnosis	1) How to conduct personal interviews with farmers for management survey 2) Method of management diagnosis 3) Method of land, labour, and fund planning 4) Method of group accounting	Seminar	2	1
	Sub-total (1 + 2)				5	
Paddy Cultivation Techniques	1 Provision of fundamental knowledges and techniques related to varieties, growth and cultivation of paddy	1) Variety	1) Varietal characteristics 2) Seed sorting	Classroom lecture	1	
		2) Germination of paddy, and care and management of paddy field	1) Rearing of rice seedlings 2) Transplanting 3) Care and management of paddy field (weeding), and harvesting	Field training		2
	2 Improvement of the trainees' understanding of the physiological factors of yield components, and their capability for making growth diagnosis	1) Yield components	1) Yield components 2) Growth diagnosis 3) Method of quadrant sampling survey	Classroom lecture Field training	1	1
	Sub-total (1 + 2)				2	3

Subject	Objective	Item	Guidance Matter	Method	Lecture	Practical Training
Upland Crops Cultivation Techniques	1 Provision of fundamental knowledges and techniques relevant to varieties, growth and cultivation of main upland crops	1) Upland paddy 2) Maize 3) Pulses 4) Cassava	1) Variety 2) Seed disinfection 3) Planting method (planting density) 4) Determination of weeding time 5) Determination of harvesting time	Classroom lecture Field training	1	 4
	2 Improvement of the trainees' Understanding of cropping patterns, and their capability for providing joint farming groups with guidance in the preparation of a cropping plan	1) Cropping pattern 2) Cropping plan	1) Prevailing cropping pattern and its defects 2) Cropping pattern and cultural method 1) Preparation of a cropping plan for joint farming groups 2) Care and management of fields of joint farming groups	Classroom lecture	1	
	Sub-total (1 + 2)				2	4
Plant Protection	1 Improvement of the trainees' knowledges about the names, damages and occurrence period of diseases and insect pests of main crops to enable them to judge the degree of damage and determine when to take control measures	1) Paddy 2) Maize 3) Pulses	1) Paddy borer 2) Stink bug 3) Blast 4) Sheath blight 1) Downy mildew 2) Corn borer 3) Seedling blight 1) Agromysa 2) Bean bug	Classroom lecture	2	
	2 Enabling the trainees to acquire techniques required for handling, storage and spraying of chemicals	1) Disease and insect pest control method	1) Hanging type sprayer 2) Powered sprayer 3) Mist blower	Field training		5
	Sub-total (1 + 2)				2	5

Subject	Objective	Item	Guidance Matter	Method	Lecture	Practical Training
Fertilization Techniques	1 Deepening of the trainees' understanding of fertilization effect to enable them to determine a suitable fertilization method at the right time	1) Fertilization of paddy	1) Time of fertilizer application 2) Dosage of fertilizer application 3) Method of fertilization	Classroom lecture Field training	1	2
		2) Fertilization of upland crops	1) Determination of the need for fertilization 2) Time, dosage and method of fertilization for mixed cropping	Classroom lecture Field training	1	2
	Sub-total (1)				2	4
Agricultural Machinery	1 Deepening of the trainees' fundamental knowledges about agricultural machinery, and awakening their interest in machines	1) Utilization of agricultural machinery	1) Different kinds of agricultural machinery and farming implements 2) Utilization system of agricultural machinery 3) Cost and its payment	Classroom lecture	1	
		2) Engine	1) Types and structure of engine 2) Maintenance	Classroom lecture	1	
	2 Enabling the trainees to Acquire skill in the operation of agricultural machinery	1) Hand tractor	1) Operation 2) Maintenance	Field training		2
		2) Sprayer	1) Operation 2) Repair	Field training		2
	Sub-total (1 + 2)				2	4

Subject	Objective	Item	Guidance Matter	Method	Lecture	Practical Training
Water Management	1 Enabling the trainees to acquire the techniques of paddy field water management	1) Water management	1) Importance of irrigation water 2) Water requirement for puddling 3) Water management of paddy field	Classroom lecture	1	
	2 Enabling the trainees to acquire the construction and management techniques of simple branch canals	2) Branch canal	1) Construction of branch canals 2) Construction cost 3) Management of canals	Classroom lecture	1	
	Sub-total (1 + 2)				2	0
Total					42	34

Notes: 1. 45 minutes is appropriated to each unit in all curriculums shown in Tables 2, 3 and 4.
2. The curriculum shown in this table is adopted for training in paddy cultivation techniques, and "water management" is excluded for training in upland crops cultivation course.

Table 3 - Training Curriculum for Key Farmers Associated with Tani Makmur Project (1975/76)

Subject	Objective	Item	Guidance Matter	Method	Lecture	Practical Training
Agricultural Extension	Training in practical knowledges and techniques required for the management and activities of farmers' groups so that the trainees will be able to act as capable leaders of group members	1) Management and operation of demo-farms	1) Purpose of demo-farms 2) How to operate demo-farms 3) How to organize and manage demo-farm groups	Classroom lecture	2	
		2) Roles and responsibilities of key farmers	1) Roles and responsibilities of key farmers 2) How to keep communication with Tegineneng Centre 3) How to organize and moderate group meetings	Classroom lecture Group discussion	6 ( )	3 ( )
Agricultural Management	Acquainting the trainees with the sound accounts of farmers' groups and cultivating their book-keeping capacity	1) Agricultural book-keeping	1) How to raise the group's fund 2) How to keep the group's accounts	Classroom lecture Seminar	2 (2)	1 ( )
Cultivation Techniques	Training in improved practical techniques to enable the trainees to lead the farmers' groups	1) Essential points of cultivation techniques	Paddy: 1) Rearing of seedlings 2) Transplanting 3) Care and management of paddy field 4) Harvesting	Classroom lecture	1	
			Upland crops: 1) Cropping pattern 2) Sowing 3) Weeding 4) Harvesting	Classroom lecture		
		2) Practical training	Paddy: 1) Sowing 2) Transplanting 3) Weeding	Field training		2
			Upland crops: 1) Sowing	Field training	(1)	( )

Subject	Objective	Item	Guidance Matter	Method	Lecture	Practical Training
Fertilization Techniques	Training in practical fertilization techniques to enable the trainees to provide guidance to the group members	1) Fertilization method	1) Time of fertilization 2) Dosage of fertilizer application 3) Fertilization method	Classroom lecture	1	
		2) Practical training	1) Fertilizer application	Field training		1
Plant Protection	Acquainting the trainees with main diseases and insect pests and their damages, and training them in the control method	1) Diseases and insect pests, and their damage	1) Borer 2) Stink bug 3) Downy mildew 4) Blast 5) Agromysa	Classroom lecture	1	
		2) Practical control training	1) Full-automatic sprayer 2) Powered sprayer	Field training		1
Agricultural Machinery	Training in the operation of tractors for satisfactory management of demo-farms	1) Method of utilization	1) Ploughing cost incurred by the use of 4-wheeled tractors 2) Cost of hand tractor operation 3) Maintenance	Classroom lecture	1	
		2) Practical training	1) Hand tractor	Field training		1
Total					14	9

Table 4 - Training Curriculum for Operators Associated with Tani Makmur Project (1975/76)

Subject	Objective	Item	Guidance Matter	Method	Lecture	Practical Training
Engine	Acquainting the trainees with the mechanism of engines to deepen their interest in machines	1) Engines of different types	1) Different kinds of engine 2) Diesel engine 3) Gasoline engine	Classroom lecture	3	
				Field training		1
		2) Mechanism of engine	1) Structure 2) Fuel system 3) Electric system 4) Oil 5) Cooling system	Classroom lecture	2	
				Field training		1
Hand Tractor	Training in the structure, operation and maintenance of hand tractors	1) Structure and operation of hand tractors	1) Structure 2) Starting 3) Handling of attachments	Classroom lecture	1	
				Field training		2
		2) Maintenance and repair	1) Oiling 2) Oil replacement	Classroom lecture	1	1
			3) Maintenance and repair		2	
		3) Operation	1) Ploughing (rotary type).	Field training		7
Sprayer and Powered Sprayer	Training in the operation of powered sprayers and in the repair of hand sprayers	1) Sprayer	1) Structure of sprayer 2) Repair of sprayers 3) Maintenance	Classroom lecture	1	
				Field training		1
		2) Powered sprayer	1) Structure of powered sprayer 2) Fuel 3) Maintenance and storage	Classroom lecture	1	
		3) Operation	1) Sprayer 2) Powered sprayer	Field training		6

Subject	Objective	Item	Guidance Matter	Method	Lecture	Practical Training
Full-automatic thresher	Training in the structure, operation repair of threshers	1) Structure of thresher	1) Straw supply port 2) Threshing drum 3) Sorting 4) Walker 5) Adjustment of rotation	Classroom lecture	2	
				Field training		2
		2) Maintenance and storage	1) Oiling 2) Cleaning	Field training	1	1
		3) Threshing work	1) Distribution of workers 2) Threshing work	Field training		3
Test	Testing of the trainees' pre-training technical level and its improvement after training	1) Pre-training test	Fundamental knowledges about machinery	Written test	1	
		2) Post-training test	Absorption of knowledges and techniques imparted in the training course	Written test	1	
				Test of technical competence		1
Total					16	26

3-2 Outstanding Problems and Countermeasures

(1) Training of Extension Workers

Since the agricultural extension activities in Indonesia were initiated not many years ago, many of the extension workers now in service are not well experienced. The repetitive training in the same subjects, which is offered under the present training programme, is therefore quite useful in improving their quality and making up for the lack of their experience.

When considered from a long-term point of view, however, it leaves no doubt that the training of extension workers should be repleted in a substantial degree. To meet this purpose, it will be necessary to conduct training with higher frequency, to extend the training period, and to establish meet-career courses ranging up to advanced classes. Further, for newly appointed extension workers, it will be necessary to give training in fundamental knowledges required for the discharge of their duties besides the usual technical training.

(2) Consolidation of Teaching Materials and Textbooks

With the cooperation of Japanese experts, consolidation of teaching materials and text-books to be used for training is in smooth progress. However, the teaching materials, textbooks, and reference books available at Tegineneng Centre are far from being sufficient. All possible means including budgetary measures should be taken to prompt their repletion and consolidation.

(3) Repletion of Extracurricular Training

Solidification of the training programme is both useful and indispensable for the qualitative improvement of extension workers. Considering, however, that no phenomenal and rapid improvement of their quality and capacity can be expected of the training programme, it will be necessary to conduct extracurricular in-service training while making positive efforts for the repletion of regular training courses. The two-hour special lecture which is delivered at each regular monthly meeting of extension workers is a commendable in-service training particularly because of the favourable reactions of the audience. In the coming years, effort should be exerted to seize every opportunity to conduct such extracurricular training.

(4) Training Not Associated with Tani Makmur Project

Since Tegineneng Centre covers the whole of Lampung province, the teaching materials and training plots of the Centre should be utilized widely and made available for training not directly associated with Tani Makmur project. At present, five training courses (125 man-days in 1965/76) are conducted by Provincial Agricultural Extension Department besides the training provided under Tani Makmur project. The team considers that Japanese experts and their counterparts should positively cooperate in the training in these courses.

There is a plan to set up a "training committee" at the Centre for integrated operation of training programmes. Since Japanese experts are expected to take part in the activities of the committee in the capacity of advisor, they should offer all expert services and advices when the plan is materialized.

4. Agricultural Extension Activities

4-1 Past Achievements

Agricultural extension activities are conducted for diffusion and extension of improved farming techniques chiefly by the operation of demo-farms. Extension services are not limited to the technical guidance (farming guidance) and management guidance (farm management guidance) offered to demo-farm participating farmers, but are also provided to Kelompoks as farmers' study groups and to Himpunans which are organized by a number of Kelompoks to pave the way for creation of KUD.

Major extension achievements are introduced below in Items (1) and (2).

(1) Establishment of Demo-Farms

New and improved farming techniques developed at Tegineneng Centre are experimented at demo-farms, and then diffused and propagated among the neighbouring farmers. Thus, the demo-farms play the central role in the extension of agricultural techniques.

Demo-farms have been created according to the annual construction plan for completion of 97 farms including 1 large farm in five years. Of these, 41 farms (inclusive of the large

demo-farm) are intended for experiments and demonstration of paddy cultivation techniques, and the remaining 57 are intended for demonstration of upland crops cultivation techniques.

Locations of small demo-farms are selected in accordance with the established procedure. Specifically, Tegineneng Centre' request for recommendation of suitable sites is transmitted to all localities concerned through Kabupaten and Kecamatan Extension Offices and municipalities. When recommendations are recieved from respective localities, they are screened by the accompanying data. The selected sites are then surveyed twice by Japanese experts and their counterparts (preliminary survey and detailed survey). The results of the survey are examined at the meeting of Japanese experts where the selection of the most suitable site is made and transmitted to the conference of assistants to Director of Dinas Pertanian and Indonesian counterpart experts. The final determination of the location of a new demonstration farm is made by the project director.

Tables 5 and 6 show the demonstration farms established in the past years, and Tables 7 and 8 show their extension achievements.

Table 5 - Establishment of Small Demo-Farms for Extension of Paddy Cultivation Techniques
- Planned and Completed -

Kecamatan	1973/74	1974/75	1975/76	1976/77	Total
Trimurjo	4( )				4(4)
Punggur	3( )				3(3)
Metro		5( )			5(5)
Pekalongan		2(2)			2(3)
Batanghari			5( )		5(5)
Sekampung			4( )		4(4)
Sukadana			4( )		4(4)
Suptihraman				- (-)	- (4)
Purbolinggo				- (-)	- (4)
Raman Utara				- (-)	- (4)
Cumulative Total	7(7)	7(8)	13(13)	- (12)	27(40)

Notes: Figures in parentheses indicate the initially planned numbers of farms

Table 6 - Establishment of Small Demo-Farms for Extension of Upland Farming Techniques
- Planned and Completed -

Kecamatan	1973/74	1974/75	1975/76	1976/77	Total
Natar	3(3)		1	-	4
Gedontatan		1		- (28)	1
Gunungsugih	3(3)		6	-	9
Terbanggibesar		2( )	5	-	7
Sukadana		1( )	3	-	4
Cumulative Total	6(6)	4(9)	15(13)	- (28)	25

Notes: Figures in parentheses indicate the initially planned numbers of farms

Table 7 - Extension of Lowland Farming Techniques by Small Demo-Farms

ITEMS	Number of Farms			Acreage			Number of Participating Farm Households			Number of Kelompoks		
	SDF	Quasi-SDF	Total	SDF	Quasi-SDF	Total	SDF	Quasi-SDF	Total	SDF	Quasi-SDF	Total
Trimurjo	4	10	14	20.7	58.9	79.6	44	109	153	4	10	14
Punggur	3	9	12	15.2	50.1	65.3	28	79	107	3	9	12
Metro	5	13	18	24.9	75.6	100.5	48	146	194	5	13	18
Pekalongan	2	4	6	10.0	23.0	33.0	27	50	77	2	4	6
Batanghari	5	5	10	25.0	25.0	50.0	49	51	100	5	5	10
Sekampung	4	3	7	20.0	15.0	35.0	41	34	75	4	3	7
Sukadana	4	4	8	20.0	20.0	40.0	38	40	78	4	4	8
Total	27	48	75	135.8	267.6	403.4	275	509	784	27	48	75

Notes: 1. All figures based on 1974/75 achievements
2. Quasi-SDFs are the farms located in the neighbourhood of small demo-farms and improved by their spill-out effect.

Table 8 - Annual Extension Achievements of Upland Farming Techniques by Small Demo-Farms

Year	Number of SDF	Extension Area	Number of Farm Households	Number of Kelompoks	Number of Himpunans
1973/74	6 (6)	61.8 (100)	108	6	-
1974/75	10(15)	323.7 (700)	588	41	-
1975/76	25(28)	1140.7(1400)	2003	126	5
1976/77	(56)	(2800)			
1977/78	(56)	(5600)			

Notes: Figures in parentheses indicate the initially planned number and acreage

In 1975/76, 13 small demo-farms were newly established, so that 27 farms covering an acreage of 135.8 ha are now in operation for the lowland sub-project. It was originally planned to establish one more farm in 1975/76 to put a total of 28 farms in operation. It can be said that the construction work has been implemented smoothly over the past years. In parallel with the creation of these farms, a total 48 semi-demo-farms have been established up to the end of 1975/76 to cover an area of 267.6 ha. At present, therefore, an area of 403.4 ha is covered by these two types of demo-farms.

A for in the Upland sub-project, 15 small demo-farms were newly estabished in 1975/76, and a total of 25 farms covering an area of 1,140.7 ha are now in operation. It was originally planned to complete 28 farms by the end of 1975/76, but this delay was caused by the deficient supply of the necessary equipment and materials in 1974/75. The number of farms newly established in 1975/76 (15 farms) is larger by two than was originally planned according to the annual construction schedule. It can therefore be said that the construction of these farms has also been in smooth progress.

If the construction of demo-farms proceeds smoothly as in the past, it will be possible to accomplish the original plan in both number and acreage.

Demo-farms are serving as the bases for extending improved farming techniques among neighbouring farmers. Demonstration of improved techniques produces a convincing effect upon the farmers because they can see for themselves the outcome of such techniques at each growth stage of crops, so that many of them have expressed the hope to participate in the operation of demo-farms. These facts indicate that the operation of demo-farms are instrumental not only in extending new techniques but also in rearing farmers' groups and organizations.

Operation of demo-farms was started in time with the commencement of trials and experiments at Tegineneng Centre and trial plots. At the outset, therefore, some apprehension was entertained about the validity of trials conducted at the farms, but it was dispelled later as it became clear that the trials proved the applicability of many new techniques.

The yield recorded in demo-farms is higher than in the surrounding areas. The yield of upland crops, in particular, is high enough to strike not only the neighbouring farmers but also the participating farmers with great surprise. A key farmer interviewed by the team stated, "I just cannot estimate how large the crop will be." This remark would suffice to tell the high yield level enjoyed by SDF participating farmers.

(2) Training of Farmers

Training of farmers can be considered in two broad categories, the coaching which is offered in respective Desas and clusters, and the training courses conducted at the training institute for the recruited trainees. Since the latter type of training has already been introduced in Section 3 (Training Programme), the following description deals only with coaching.

Coaching conducted at present can be classified as followed by the source of fund.

1) Desa coaching, 2) Roundtrip guidance, and 3) Field Day, which are all conducted with the budgetary appropriation under Tani Makmur project, and 4) Coaching conducted for Tani Makmur project or its participant farmers with the fund from other sources than Tani Makmur project.

A brief explanation is given below on each of these different types of coaching.

1) Desa Coaching

This coaching is usually conducted in the fields in respective Desas and clusters before planting, and it is quite effective in providing the participating farmers with direct and detailed technical guidance. The participant farmers include those living in the neighbourhood of demo-farms, which is commendable for future extension of techniques.

2) Roundtrip Guidance

This guidance is given in demo-farms or trial plots during the growth period of crops. As it provides the arena for exchanging views and advices between farmers, it is quite effective in convincing the participants of the effects and merits of advanced farming techniques. Farmers in the neighbourhood of demo-farms and trial plots are encouraged to participate in the guidance meeting, and this is commendable for the extension of techniques and expansion of demo-farms.

3) Field Day

Field Day is held in one or two demo-farms during the harvesting period of each cropping season with the participation of general farmers. A sort of achievements rally is held on the day to announce the yield of different crops, give commendation to individual farmers and their groups who have attained an excellent yield, and demonstrate the operation of various farming machines. Hence, it is effective in stimulating the farmers' volition for production increase and in diffusing knowledges about improved techniques and Tani Makmur project among the neighbouring farmers.

4) Other Coaching

Apart from the coaching described in Items 1) ~ 3) above which is financed by Tani Makmur project, a) monthly meeting, b) film show, and c) study tour are organized for Tani Makmur project and its participating farmers with the necessary fund appropriated from other sources than Tani Makmur project. The team found that the film show study tour are excellent means of training because they are accepted favourably by farmers as a study-cum-amusement programmme.

4-2 Outstanding Problems and Countermeasures

(1) Establishment of Demo-Farms

1) Strengthening of Disease and Insect Pest Control

Introduction of improved techniques has invited intensified damage of diseases and insect pests (specially sheath blight and stink bug) and rodent damage. It is therefore necessary to exert greater plant protection effort and improve the damage diagnostic techniques of extension workers and farmers.

2) Coordination of Tani Makmur Project and BIMAS Programme

As a matter of principle, operation of demo-farms is intended to be promoted under Tani Makmur project separately from BIMAS programme. However, Lowland Farming Development Sub-project is being pushed forward without clear distinction between its trial area and BIMAS area. The two areas overlap each other in many places. In Upland Farming Development Sub-project, too, it is apparent that the expansion of extension areas will lead to the fostering of Himpunans and creation of KUD. Since complete separation of the two programmes is thus impracticable, it is necessary to take suitable measures for their coordinated implementation.

The recent commodity price escalation brought about a difference between the two programmes in terms of the cost of fertilizers offered to farmers. Since this could be impedimental to the smooth progress of Tani Makmur project, suitable measures should be devised to assure that Tani Makmur project will be implemented in no less beneficial manner than BIMAS programme.

(2) Training of Farmers

1) Extension Method and Materials

The extension methods employed at present are all effective. As for the materials used in the extension services, however, the team felt that it would be necessary to take account of the technical and educational level of farmers in order to attain higher extension effect. To be more specific, the team considered it necessary to use the pictorial agricultural calendar and textbooks now being prepared by Japanese experts and to post up illustrated signboards at demo-farms for easier understanding.

The film show is an excellent means of training. Since there are few recreational facilities in rural communities, farmers enjoy the show as a sort of entertainment, and each show attracts an audience of as many as 300 ~ 1,000. As most films are foreign-produced, however, the training effect of the show is inevitably made lower than could be attained by Indonesian films. Production of Indonesian films should therefore prompted in the coming years.

2) Training and Employment of Key Farmers

The present availability of extension workers apprarently falls short of demand and their number should be greatly increased for satisfactory extension service. Although the increase of extension workers is planned by the competent Indonesian authorities, it is not probable that a sufficient number of extension workers can be secured in the immediate future. In the face of the prevailing shortage, it is necessary to make concentrated effort in the training of key farmers so that they will be appointed assistants to extension workers and play the role of leader or manager in the process of developing farmers' groups from Kelompoks to Himpunans and further to KUD.

3) Establishment of Information Transmission System

It is possible that the development from extensive farming to improved farming will invite a situation that calls for such an emergency measure to cope with sudden outbreaks of of diseases and insect pests. An information transmission system should therefore be established under which the key farmers in respective areas should maintain communication with Tegineneng Centre with extension workers in between. For efficient operation of this system, it is necessary that cards or picture books of diseases and insects be made available to the key farmers's level and that training be conducted from time to time so that suitable measures will be taken immediately when any abnormal occurrence of diseases or insect pests is detected.

4) Preparation of Group Guidance Cards

In the agricultural development scheme of Indonesia, great importance is attached to the rearing of farmers' groups because it is planned to improve the technical level of individual farmers and promote regional development by fostering the activities of such groups. In order for these groups to pursue a sound and smooth course of development, it is very important to grasp them accurately as the object of extension service. In this connection, it deserves to be evaluated as being appropriate that Japanese experts are now engaged in the preparation of the format of the group guidance card to be used for collecting basic data for rearing Kelompoks and Himpunans. The format of the card should be made as simple as possible because extension activities cannot be conducted in a satisfactory manner if excessive labour is required for the entry of the card.

5) Grasping of Activities of Extension Workers

Extension service is a cycle of three activities, i.e., selection of problem, its solution, and evaluation. Unless this cycle is repeated continuously in a planned and systematic manner, the objective of extension activities cannot be attained. The team learned that some Japanese experts were planning to survey and grasp the extension achievements to

enable subject-matter specialist to provide closer and more efficient guidance of extension workers. While this attempt is undoubtedly contributory towards the qualitative improvement of extension workers, it is to be noted that the survey should be carried out with careful account taken of the possibility of impeding the activities of extension workers. The greater part of the extension service in the province is intended to provide the same guidance repetitively for solving common problems confronting many farmers. For the purpose of the said survey, therefore, it is avdisable to interview extension workers or give them suitable guidance without resorting to a self-completion questionnaires so that extension workers themselves will become cognizant of the need of the systematic repetition of the above-mentioned cycle in their daily service.

6) Publication of Handbook for Extension Workers

For the smooth operation of the extension programme, Japanese experts are planning the publication of "Handbook of Extension Workers" containing knowledges and information required for their daily activities. While this attempt is truly praiseworthy, it would be difficult for both technical and financial reasons to publish and distribute to all extension workers a handbook which is a collection of all knowledges and techniques of extension activities. It is therefore recommended that the complilation work be started with the techniques and knowledges which subject-matter specialists consider indispensable for extension activities at present and in the immediate future, and that a series of handbooks compiled by subject be published over some period of time. This method was employed in Japan at the outset of agricultural extension activities to publish a series of books entitled "Kairyo Fukyu Sosho (Library of Handbooks for Agricultural Extension)" which enjoyed favourable comment of all quarters concerned.

7) Japanese Experts and Indonesian Counterparts

Japanese expert in Extension, for instance, covers a very broad expanse of activities. A single expert could be engaged in diversified activities such as the survey of the activities of extension workers, preparation of teaching materials and textbooks, arrangement and preparation of demonstration halls, consolidation of data room, compilation of publications, organization of lecture meetings and seminars, operation and management of training plots, translation of the script of slide films, production of slide films, and formulation of extension plans. In addition, he is required to conduct such routine works as the organization of study meetings, collection of data, and guidance of extension workers and farmers.

On account of the language barrier, Japanese experts do not usually provide direct guidance service by delivering lectures in classrooms or at study meetings, but they offer indirect guidance service through their Indonesian counterparts. Although this indirect guidance method is not totally absolved from any criticiam, it produces higher efficiency than any other conceivable methods because counterparts are given intensive guidance by Japanese experts and digest the imparted knowledges and techniques for the improvement of their own technical level and that of farmers, and this helps them stand on their own feet in the long run. Another fact that justifies the validity of this method is that Japanese experts are extremely busy and their number is limited, and yet they are expected to achieve successful cooperation results within a limited period of their assignement so that the outcomes of Japan's cooperation will gain deep root in the project area even after the expiration of the cooperation period.

The problem involved in this indirect guidance method is that counterparts who are to work with Japanese experts cannot be recruited on certain occasions and that quite a few tained counterparts are inclined to leave their post because of the instability of their status and treatment. It is therefore hoped that further effort will be made to secure sufficient numbers of counterparts and improve their treatment.

8) Integration of Training Activities

At present, training activities are handled by many central and local government offices. Since training activities are impeded in many aspects under the current system, their early integration is hoped for. Fortunately, such integration is envisaged under R.E.C. Plan(Rural Extension Centre Plan). But implementation of this plan must be preceded by suitable arrangements and coordination with Tegineneng Centre to avoid unnecessary confusion, so that it is advisable to establish the aforementioned "Training Committee" at the Centre for systematic promotion of the training to be conducted by Provincial Agricultural Extension Department until the materialization of R.E.C. Plan.

9) Evaluation of Tani Makmur Project

One of the impending problems facing Japanese extension experts who are stationed in the province for cooperation in Tani Makmur project is how to make a comprehensive evaluation of the activities carried out under the project.

In order to assess the effect of the project implementation, these extension specialists have so far conducted various surveys of demo-farm participating farmers such as surveys of yield, income and home diet before and after participation, yield comparison with the neighbouring farmers, survey of participating farmers' desires and reactions to the project, and measurement of the project effect by the cost-benefit method. However, they are still searching for the optimal method applicable to overall and comprehensive evaluation of the project. It is therefore hoped that Japanese government will give them support by arranging for the dispatch of experts well versed in the evaluation of projects of this type.

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