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# ***PALAWIJA***

# ***NEWS***



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## **Arrowroot Production in the Marshall Islands - Past, Present and Future**

by Dirk H.R. Spennemann\*

The traditional agroforestry and horticulture of the Marshall Islands (Central Equatorial Pacific Ocean) relied on a number of plants. The main food plant was, and still is, without doubt, breadfruit (*Artocarpus altilis* & *A. mariannensis*), followed by Pandanus (*P. tectorius*). Polynesian arrowroot (*Tacca leontopetaloides* Kuntze), usually consumed in the form of extracted starch, played a more important role in the drier northern atolls of the archipelago than in the south, where taro (*Cyrtosperma chamissionis*) was the most important root crop. While historically its availability made human life sustainable for some atolls, its importance today has dwindled dramatically.

At present there is a notion in the Marshall Islands that arrowroot (local term: *makmok*) no longer grows as large as it used to in the past and that this is somehow related to nuclear testing which took place on the northern atolls of Bikini and Enewetok in the 1950s. Since recording and assessment of traditional food production is part of the work of the Marshall Islands' Historic Preservation Office, a field trip to Mile Atoll was used to investigate, among other Historic Preservation issues, the abundance and utilization of arrowroot in the present context.

Arrowroot plants were found to be abundant on those islands where human impact on the

that arrowroot flour (starch) was produced every year, but in small quantities. It was immediately used in several food dishes relished by the Mile people.

The Marshallese distinguish between a male and a female arrowroot plant. The female arrowroot is known to bear more, and much larger tubers, with the effect that these plants are preferred for harvesting to their male counterparts. My own observations on Mile Atoll have shown that there are four varieties or sub-varieties. Three varieties have green stems and stalks, while one has violet/purple leafstalks. The tubers of this purple-stemmed variety have brownish skin and a yellow to white interior when cut. According to an informant, the purple variety was introduced by the Japanese from Pohnpei sometime in the 1930s. The three green-stalked varieties consist of one group which produces a single large tuber and two which produce more than one tuber. Among the latter varieties is one which has a purplish/reddish flesh when cut, and one which has a yellowish-whitish flesh.

### ***IN THIS ISSUE***

<i>Arrowroot Production in the Marshall Island-Past, Present and Future</i> .....	1
Dirk H.R. Spennemann	
<i>Soybean Productivity in Indonesia: what Comparative Advantage?</i> .....	2
Pierre Rondot and Frederic Lancon	
<i>Editorial</i> .....	3
Seiji Shindo	
<i>Regional Workshop on Priorities for Soybean Development in Asia, December 3-6, 1991, Bogor, Indonesia</i> .....	10
<i>CGPRT Centre News and Activities</i> .....	11

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\* Dr. Dirk H.R. Spennemann is the staff archaeologist of the Marshalls Historic Preservation Office and has worked on a variety of topics on atoll subsistence from the historic and archaeological perspective.

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Plants growing in a number of different conditions and soils were dug up and a correlation between the degree of crowding by competitor plants (mainly *Wedelia biflora*, *Vigna Marina*) and the size of the tubers was found. Today, as arrowroot is no longer a prime starch source, the plant is left to fend for itself, while in the past some tending, mainly weeding, took place. Crowding by competitors and neglect, then, are seen as the main reasons for the reduction in plant size and tuber yield, rather than radiation.

Arrowroot, however, is a very desirable food plant. Unprocessed tubers contain from 10% to 25% extractable starch, which, from a nutritional point of view, is the richest (unenriched) natural starch on earth. The fine crystal structure of arrowroot starch makes it easily digestible and therefore a favourite food for the weak and sick as well as for small children.

As was documented in the 1950s, arrowroot may be the ideal crop to be grown under *Cocos* in copra plantations. Given the large area covered by *Cocos* plantations in the Marshall Islands, large quantities of this starch could be produced with comparatively little effort. A revitalization of arrowroot would allow the Marshallese to use existing knowledge and skills, while at the same time producing a starch at a fraction of the cost (25-40%) of comparable imported flour or starch. The economic viability calculations for arrowroot flour already take into account the income loss caused by the time spent on gardening rather than copra making. Given the popularity of the small amount of arrowroot starch that is produced, the reintroduction of arrowroot under *Cocos* is seen as a viable option for sustainable development on the non-urban atolls of the Republic of the Marshall Islands.

A detailed report on past and present occurrence, importance, starch extraction techniques and plant utilization is in preparation. For further information, write to Dr. Dirk. H.R. Spennemann, Historic Preservation Office, P.O. Box 629, Majuro, Marshall Islands 96960.

## Soybean Productivity in Indonesia: what Comparative Advantage?<sup>1</sup>

Pierre Rondot<sup>2</sup> and Frederic Lançon<sup>3</sup>

### Introduction

At a time when developed countries are arguing within the GATT for free international trade and for the removal of trade barriers the question arises whether there is any advantage in putting soy farmers of the world into direct competition.

Soybean, which originated in China, is at present grown in many areas of the world; in tropical and temperate climates, in developed and developing countries, under large, capital-intensive farming systems as in the United States of America and Brazil and small, labour intensive farming systems as in Asia, including Indonesia. Javanese farmers, who grow soybean on farms of about 0.3 ha, have little in common with American and Brazilian farmers whose farms often exceed 500ha in size.

The labour productivity of American or Brazilian farmers is far higher than the labour productivities of the Javanese farmers. Does this mean that soybean should not be planted in Indonesia?

The above question is somewhat rhetoric because national competitiveness does not exist. Some of Java's farmers achieve competitive yield levels, and others do not.

### Field activities

In the framework of the Soybean Yield Gap Analysis Project (SYGAP), researchers, in cooperation with extension personnel and farmers, tested location-specific technology packages based on the findings of national research, for two years.

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<sup>1</sup> Presented at Regional Workshop on Priorities for Soybean Development in Asia. Bogor, Indonesia, 3-6 December, 1991.

<sup>2</sup> Agri Agricultural Economist CGPRT Centre - CIRAD/DSA and Regional Co-ordinator of Soybean Yield Gap Analysis Project (SYGAP).

<sup>3</sup> Agricultural Economist and Associate Expert of SYGAP (Soybean Yield Gap Analysis Project) in Indonesia. ESCAP CGPRT Centre.

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## Editorial

### Patterns of Consumption

Seiji Shindo,  
Director  
CGPRT Centre

It is generally recognized that as the disposable income of people increases, their food consumption pattern changes. At first more calorific foods, such as cereals and oil, are consumed, then "quality foods" such as meat, dairy products and further sophisticated pro-cessed foods are increasingly included in the diet. At the same time, the proportional expenditure for food in the total household expenditure diminishes, which means more is spent on clothes, education, health, leisure, and housing, but not necessarily in that order.

This general sequence of events is believed to take place in every country, in every race and every segment of society. There is ample evidence to prove this. However, the pattern and speed of the changes vary greatly by country. Since diet pattern is the reflection and culmination of history, religion, tradition, culture and climate, its pattern of change can never be the

same. Why is it that in South Asia, particularly India, milk is preferred to meat? Why is it that Italians directly consume nearly one and a half times the amount of cereals than do neighbouring countries? We can only partially explain these trends.

The limitations of mathematical analysis of demand, though it may be the most effective way for projecting the future, rests here. The results based on statistical data need to be interpreted, analyzed and supplemented by the knowledge of people's preferences, and historic and cultural circumstances, and above all what shifts are actually taking place. I feel this interpretation can only be made by the people born and reared in the respective countries, although of course there may be a risk of bias through their own preferences and background.

Another limitation of statistical analysis is a lack of proper interpretation of the results. In Japan, until recently, or probably even today, the income elasticity of rice has been positive, yet the per capita consumption, after reaching a

peak in 1962, has been declining. It can only be explained by the fact that the tendency away from rice has been stronger in younger generations whose income is statistically low while older people tend to maintain their long-accustomed habit - rice in every meal. Results of a similar nature may happen anywhere. Mechanical application of statistical analysis may lead to drawing an incorrect picture. Proper interpretation is required, which can only be done by a person having a good deal of insight into the actual situation.

It is recognized that demand for many CGPRT crops have been increasing, not as direct food in the way that maize, cassava or sweet potato is traditionally used, but as livestock feed and processed food. These increases will be vastly different from country to country. This is why we are interested in knowing and analyzing the pattern, course and speed of the changes. It is not limited to an academic interest, but is rather the prerequisite before identifying actions and programmes relating to CGPRT crops development.

Data were collected in three project locations in Java in each of which 30 farmer-co-operators tested the recommended package. Findings were compared with those of 30 farmers who used their own technology.

The recommended technology was specific to each location. Applications differed from farmer to farmer according to individual choice and specific constraints.

#### *Project locations*

The project selected three locations in different agro-ecological systems, in irrigated and upland farming areas.

At *Jombang*, soybean is cultivated as a monocrop after rice, in irrigated paddy fields. The dominant cropping systems are rice/rice/soybean or rice/soybean/soybean. The farmers's choice of one or the other cropping system is dictated by the availability of water and labour.

At *Wonogiri*, soybean is grown in rainfed conditions and planted before rice. The dominant

cropping system is soybean/ *ricerpalawija*<sup>\*.</sup> Soybean is always intercropped with maize, sorghum or cassava.

*Karawang*, the third project location, is representative of a non-traditional soybean growing area. The usual cropping pattern is rice/rice/fallow. Soybean is being introduced as a third crop in a recently irrigated area which covers 200,000 ha.

#### *Data collected*

The data and the observations made in each location were collected by six agricultural engineers who lived in pairs in the selected villages for two years. They were visited every two weeks during the soybean growing season by the project staff from Bogor.

The information collected includes a very complete and detailed dataset on labour and

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\* Palawija: Indonesian name for non-rice food crops.

other input uses and costs and on cultural practices.

### 1. Yield distribution and planting date

Many factors influence soybean yield including pest control, fertilization, variety, water stress and labour application. According to the location and climate, each factor will affect the yield differently.

According to farmers, national researchers and extension staff, the time of planting has a significant effect on soybean yield. We have therefore ranked the results according to the date of planting in the three locations.

At *Jombang* the yield varies considerably, more with farmer-cooperators, between 0 to 1,700 kg/ha (cv: 0.45), than with non-cooperators, between 200 to 1,285 Kg/Ha (cv:0.42) (Figure 1 and 2). The recommended package had no significant impact on yield variability but offered an opportunity to the farmers to increase their total output per hectare, although at a higher cost.

At *Jombang* the yield is related to the date of planting (Figure 3).

When soybean is planted after rice, the planting period of soybean depends on the time of the rice harvest, which varies according to the irrigation calendar. Farmers who planted their soybean early could benefit from additional rainfall before having to irrigate their fields (Figure 3). During the soybean growing season, the water supply to the plant is regulated at different periods depending on the irrigation group. Farmers who planted earlier benefited from an irrigation calendar more in accordance with plant requirements.

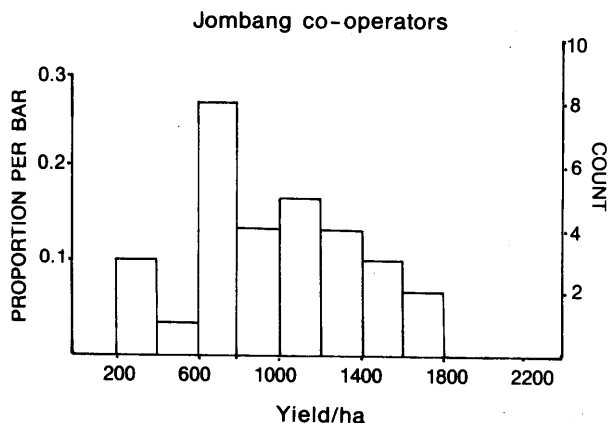


Figure 1 Yield distribution for farmers; co-operator, Jombang 1991.

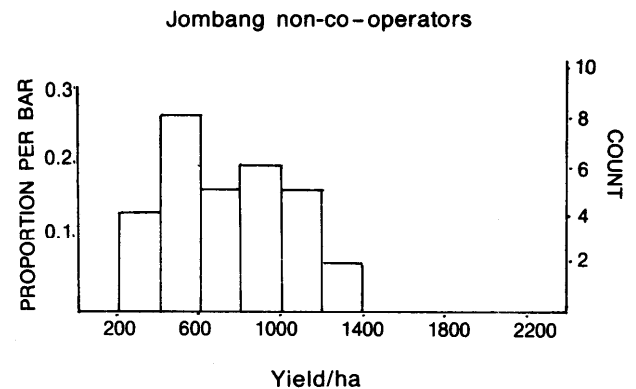


Figure 2 Yield distribution for farmers; non-co-operator, Jombang 1991.

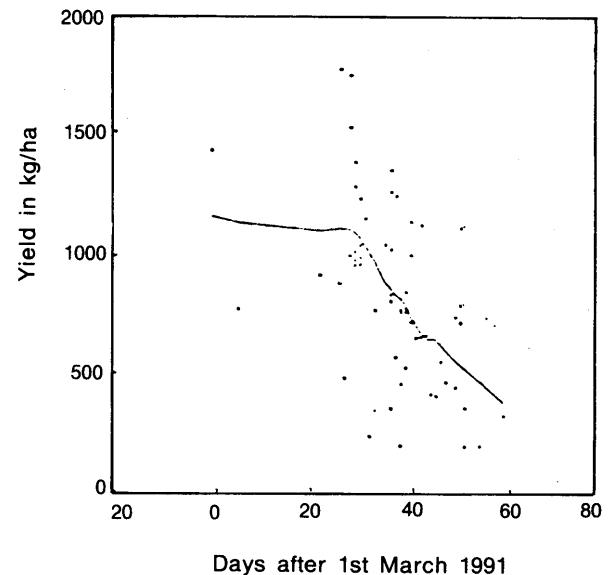


Figure 3 Date of planting and yield variation. SYGAP/Jombang 1991.

This shows that soybean cultivation has to be considered in the framework of the whole cropping pattern, with careful attention to the switch from paddy to soybean cultivation.

Yield variability is also important in Wonogiri. The recommended package reduces the farmer's risk, the yield variability being smaller (yield c.v.: 0.421, Table 1) for the co-operators than for the non co-operators (Yield c.v.: 0.607) as shown by Figure 4 and 5.

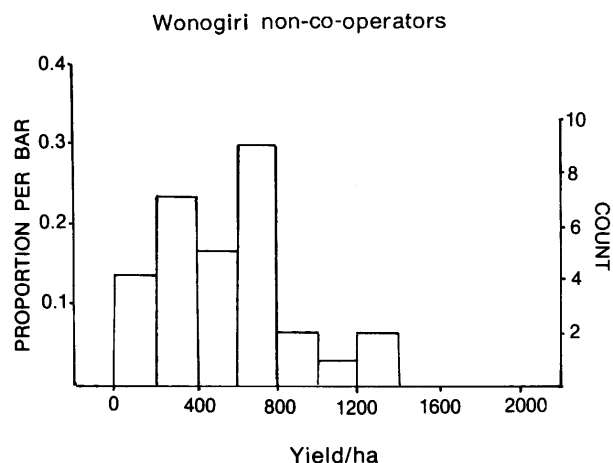


Figure 5 Yield distribution for farmers; non-co-operator, Wonogiri 1991.

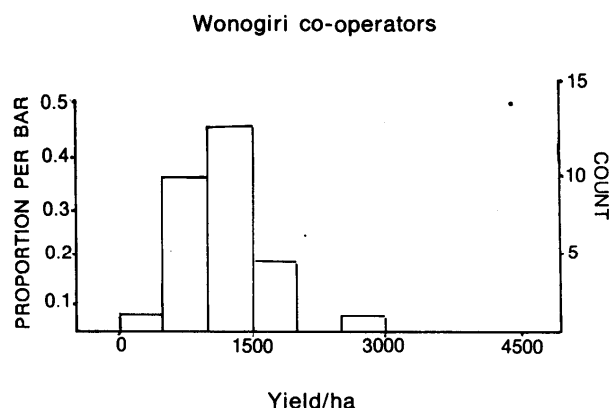


Figure 4 Yield distribution for farmers; co-operator, Wonogiri 1991.

Figure 6 shows that for Wonogiri there was no correlation between planting time and yield. The planting period was decided by the rainfall distribution. Here soybean is planted before rice. As farmers want to avoid delay in their rice, which should be planted before the end of March, soybean must be planted before mid December.

In this case yields are related to another facet, that of water management.

The recommended package includes a better drainage system than that of the traditional farmer. Wonogiri enjoyed heavy rainfall during the monitored agricultural season and fields with appropriate drainage systems achieved better yields.

Because the recommended package reduced the risk, farmers were very willing to experiment

with it in their own fields with or without project assistance. It was difficult to find reference farmers for the purpose of data collection and comparison, since most of the farmers in the selected villages were influenced by the project findings.

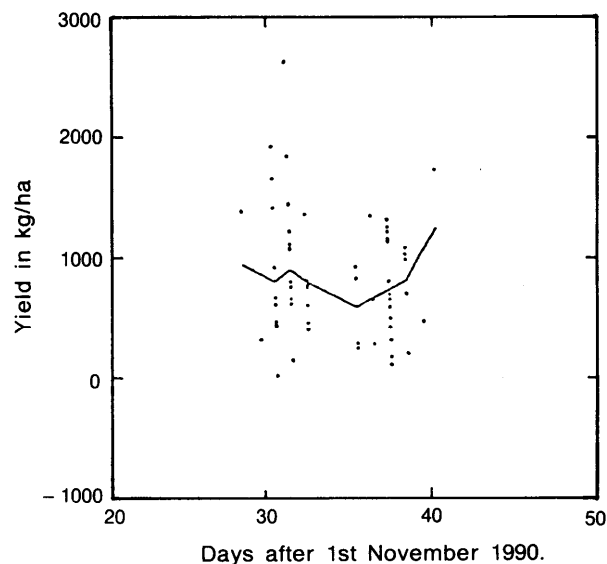


Figure 6 Date of planting and yield variation. SYGAP/Wonogiri 1990/1991

The highest yield in Wonogiri (2,600 kg/ha) was achieved by a farmer who had an excellent drainage system. During most of the soybean growing period, the drainage canals were full of water, without, however, flooding the field. This farmer demonstrated that soybean can be successfully cultivated in water-saturated soil when appropriate soil preparation is done prior to planting.

The lowest yields (60 to 500 kg/ha) were from a group of farmers whose fields were flooded most of the time, because of the lie of the land and inadequate drainage.

In Karawang, Figure 7 and 8, shows that soybean yield distribution is not homogeneous, varying from nothing to the almost 3 t/ha, achieved by a small group of farmers.

No correlation could be noted between time of planting and yield (Figure 9). Farmers who planted soybean later, however, seem to have a slightly higher yield than those who planted earlier, confirming farmers views. Soybean is planted in irrigation blocks, immediately after rice harvesting, in the residual moisture of the paddy fields.

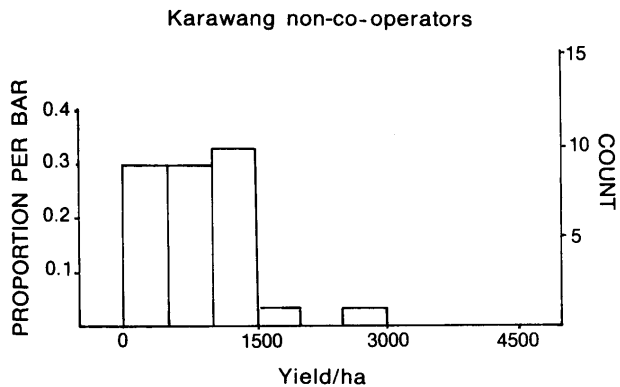


Figure 7 Yield distribution for farmers; co-operator, Karawang 1991.

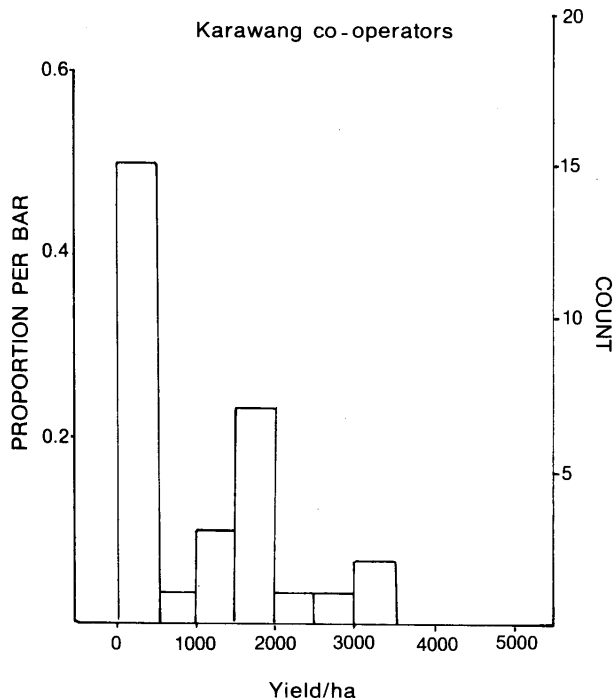


Figure 8 Yield distribution for farmers; non-co-operator, Karawang 1991.

An unexpected attack by "army worms" affected most soybean fields, with varying intensity depending on the location of the field and the efficiency of the farmers' pest management. One farmer who tried growing soybean for the first time lost his whole crop because of lack of experience in spraying.

Yield variability is large in Karawang. It is higher for the farmers who applied the package

(C.V. 0.915, Figure 2) than for those who did not (c.v. 0.613, Figure 3).

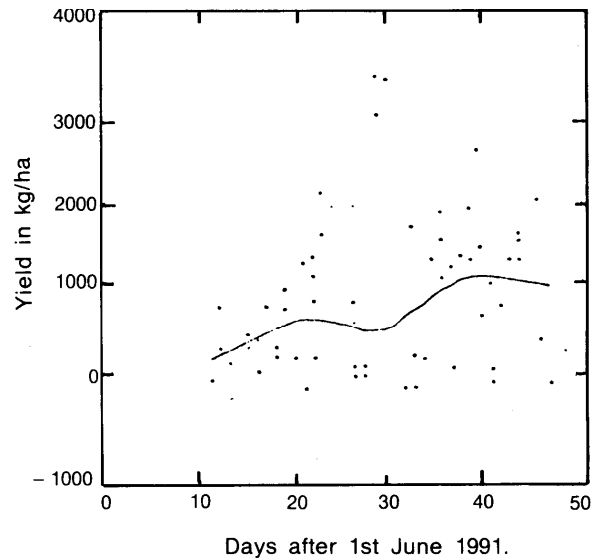


Figure 9 Date of planting and yield variation. SYGAP/ Karawang 1991.

The best yields were obtained in 72, 74 and 75 days, by 3 farmers who applied the recommended package. Their fields were located close to their houses and close to the main irrigation canal. Water was available on demand and the proximity of the houses to the fields facilitated permanent monitoring of crop development. Pest attacks were identified early enough to be controlled. In contrast two farmers lost their crop because of rat infestation.

The group of farmers whose yields varied from 200 to 500 kg/ha had their fields located lower than their neighbours' fields. They had great-difficulty in evacuating excess water coming from the surrounding irrigated fields, and therefore the soybean did not grow well.

#### Effects of water management.

Soybean yield is very variable and available technology does not reduce this heterogeneity except in the rainfed area of Wonogiri.

In most cases yield variability is caused by an inadequate water supply to the plant. As soybean is very sensitive to moisture stresses, any shortage or excess of water has an immediate effect on plant growth and ultimately yield.

In irrigated areas soil moisture management is complicated. The irrigation system is designed

for flooding the paddy field and maintaining a minimum level of water above the surface of the "sawah". Soybean, in contrast, likes humid but well-drained soil. The irrigation calendars are adapted to rice-growing and not to soybean moisture requirements. Soybean suffers from excess of water at certain periods and from water shortage at others because water is available only at fixed periods.

In the rainfed area of Wonogiri, soybean is planted in rainfed paddy fields, after two months of dry fallow. The soil structure is different from that of the irrigated paddy fields. When the rainy season starts the water supply to the plant is regular. Soybean then suffers from excess of water and any improvement in the drainage system is immediately effective.

#### Technical constraints; alleviation and labour requirements.

In irrigated areas the soil characteristics and the irrigation organisation system necessitate that time and work must be invested in soil preparation in order to avoid the flooding of soybean on the one hand while increasing the soil moisture storage capacity on the other hand, to reduce the effect of drought stress.

Although appropriate soil moisture management is a basic requirement for achieving stable soybean yields, other factors such as bad control of rats and pests can nullify the efforts of the farmers.

From our two years of observing farmers' practices we found that, in general, farmers are competent and knowledgeable about what should be done to increase soybean yields.

Farmers are aware of the importance of water supply to the soybean. They know when the plant needs water for optimum growth. Those who have free access to water achieve good yields as the best farmers in Karawang and the farmers who planted early in Jombang prove. In Karawang however, many farmers are not so fortunate as to have a field close to the main irrigation canal.

At Jombang and Karawang not everybody can plant early, because soybean planting is possible only once the rice is harvested. The cultivation calendar of rice is regulated by the irrigation calendar and thus by block, and the farmers have to wait for their turn to harvest the rice. Soybean planting is delayed accordingly and the yield and farmers' incomes suffer in turn.

One way to improve soybean productivity in irrigated areas is to reduce the period between

rice harvesting and soybean planting to allow early planting. Taking into account the high demand in labour at this period of rice harvesting, mechanization of soil preparation and planting must be envisaged and tested with farmers.

The location-specific package tested by the project with selected farmers increased the yield per ha in all locations but it also increased the cost of production and thus the risk for the farmers, except in Wonogiri.

As farmers are quite aware of this, the question regarding the choice of inputs and cultivation techniques presents itself. We will try to answer this question by looking at the profitability generated by the recommended intensification process of soybean growing.

#### 2. Intensification and returns for labour.

At Jombang (Figure 10 and 11) labour productivity decreases steadily when the amount of labour increases but the rupiah per hectare produced by the labour increases regularly up to 1,200 h/ha. Labour productivity is higher for non co-operators (687 Rp./h.) than for co-operators (430 Rp./h.). In Jombang if farmers are short of labour and labour opportunity costs are high, their choice will be to continue with their traditional practices. If, on the other hand, family labour is available, the recommended package will increase the family income.

As for Jombang, the return to labour is higher for non-co-operator farmers (306 Rp./h.) than for co-operators (136 Rp./h.).

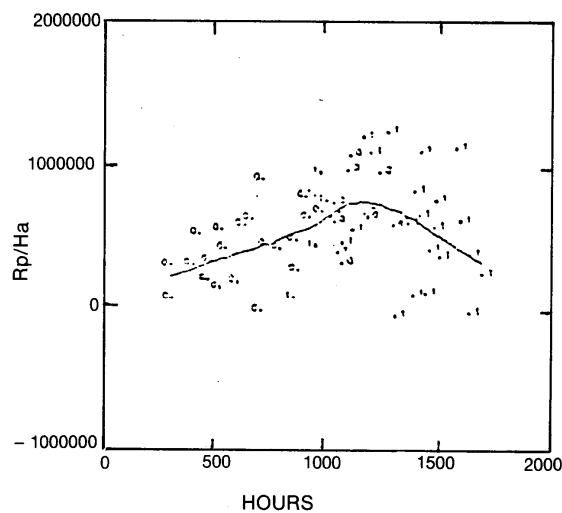


Figure 10 Changes in labour remuneration when labour intensity increases. SYGAP/Jombang 1991.

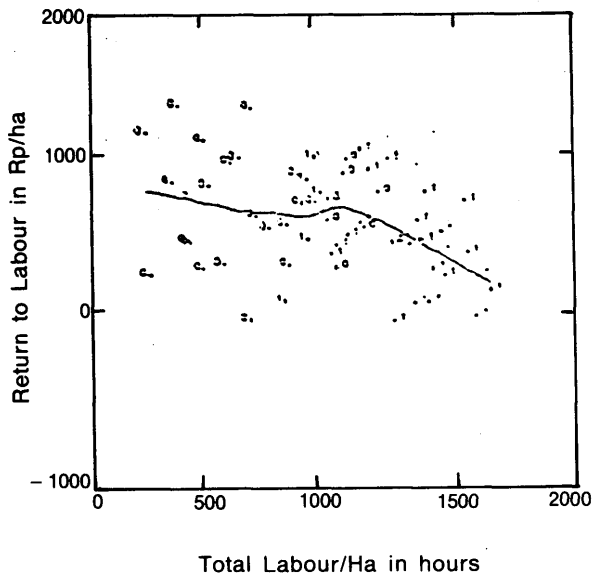


Figure 11 Changes in labour output per ha when labour intensity increases. SYGAP/Jombang 1991.

For Wonogiri Figure 12 and 13 show a larger dispersion of the return for labour per hour and the return for labour per hectare than for the non co-operator farmers (C.V. 0.625 and 0.675) than for the co-operators (C.V. 0.44 and 0.4710), which is consistent with the degree of yield variation for each group.

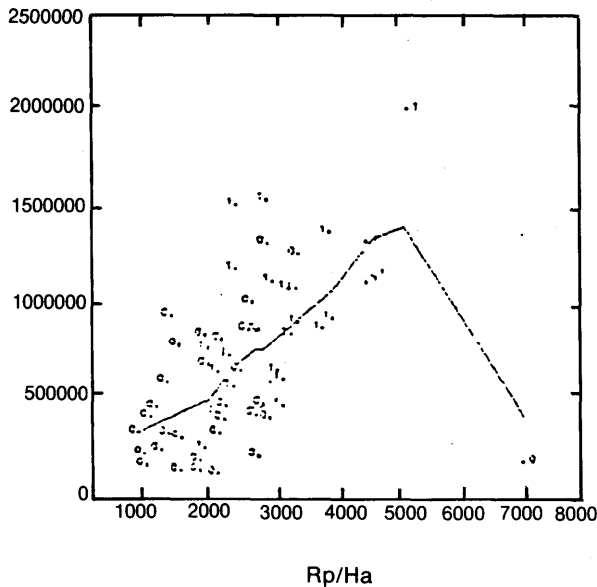


Figure 12 Changes in labour remuneration when labour intensity increases. SYGAP/Wonogiri 1990/1991.

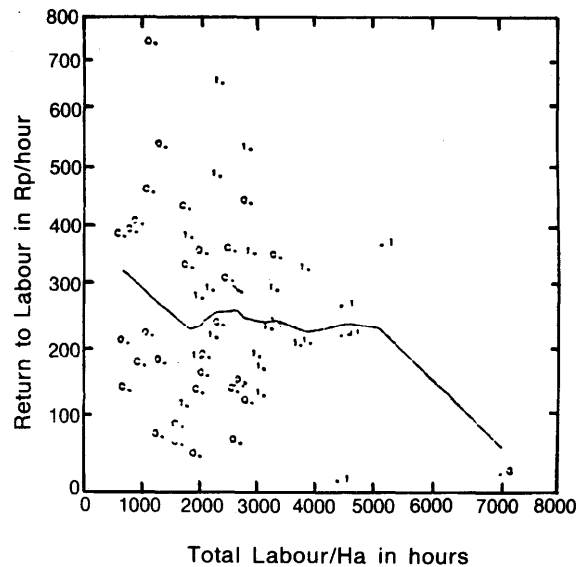


Figure 13 Changes in labour output per ha hour when labour intensity increases. SYGAP/Wonogiri 1990/1991.

There is only a small tendency for an increase in labour productivity when farmers allocate from 1,800 up to 2,800 hours/ha. The increase in Rupiah per ha is regular and obvious up to 4,000 hours/ha (Figure 12).

The average return for labour is low but higher for the farmer-co-operators (318.5 Rp./hours) than for the non-co-operators (288 Rp./hour), despite the fact that the package is labour-intensive. This indicates the efficiency of the techniques recommended and the ability of the farmers to use them. However the large dispersion of the data implies that improvement can still be made to increase efficiency.

In Karawang, the recommended technology as applied by the farmers is not reliable enough to be largely adopted. Further adaptive research is necessary to secure soybean yield. Farmers are still interested in being associated with the researchers and extension.

From the Karawang results, no reliable interpretation can be made for research purposes.

In Karawang the average return to labour is very low due to an unexpected army worm attack. Figures 14 and 15 do not show any significant tendency.

Assuming that the labour was unpaid family labour, the results show that among farmers who grew soybean, 28% lost all their investment and wasted their time. Only 16% made a profit.

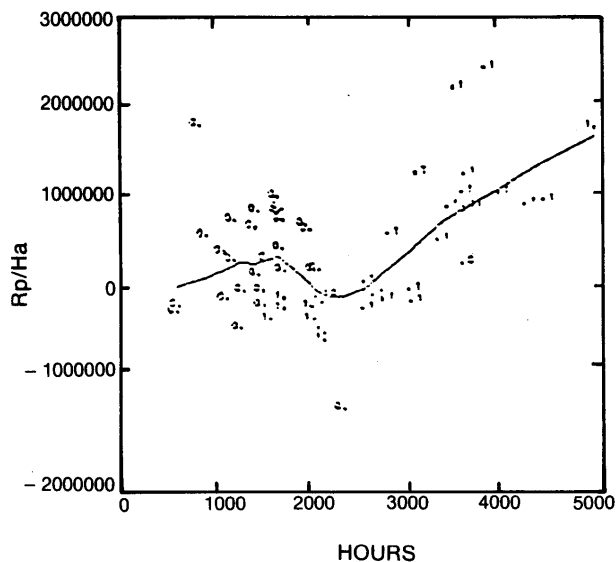


Figure 14 Changes in labour remuneration when labour intensity increases. SYGAP/Karawang 1991.

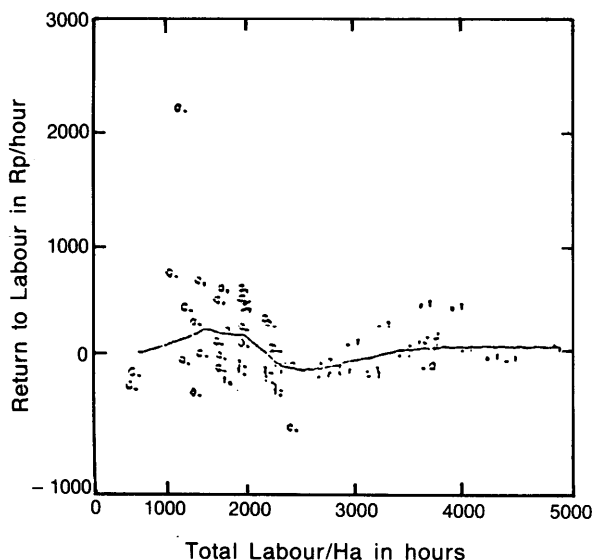


Figure 15 Changes in labour output per ha when labour intensity increases. SYGAP/Karawang 1991

### Conclusion

With the available technology and the existing market price, the intensification of soybean production is still profitable when water and pest management are successfully controlled.

Although improvement of pest management has already shown results, little has been done to improve water supply to soybean. More applied

research is needed to mechanise soybean soil preparation and planting, and to adapt the irrigation calendar to soybean requirements.

The tendency of the actual intensification process is to a reduction of labour productivity which is compensated for by an overall increase of the total output per hectare and finally, by an increase in the farmers' income.

When labour is scarce and when land is available, or else when off-farm job opportunities exist, farmers tend to continue with their traditional practices. In these cases increasing soybean production will only result from area expansion by mechanisation of some of the production process to increase labour productivity.

When labour is abundant and land is not available, intensification is a possible way to increase employment opportunities and farmers' income by improving the total output per hectare. Obviously in Jombang and Wonogiri this intensification process interests the farmers. But in Jombang competition among farming activities is important, labour is scarce or expensive and farmers cannot afford to prepare all of their land adequately prior to planting. The recommended technology has been adopted only in small fields (cf. Irawan, Lancon, 1991).

Ultimately, in order to stabilise and further increase soybean yields, improvement of soil moisture management through better soil preparation is necessary. Adapted machinery is needed to prepare the soil which will in turn prevent moisture stress and secure possible returns from soybean cultivation. In addition mechanisation will reduce production costs and increase labour productivity.

### 3. General conclusion.

Obviously there is no technique available which will dramatically enhance the competitiveness of Indonesian farmers on the soybean world market.

Nevertheless, some farmers already reach significant yields (about 2 tons/ha). More importantly, soybean production intensification cannot be considered only in terms of international competitiveness.

The intensification of soybean production in Indonesia is also a way to increase labour opportunities and family incomes in populated rural areas. The efficient traditional soybean economy in Indonesia is changing and trying to match the requirement of rapidly increasing local and urban demand. The remarkable network which links the farmers with the collectors, the

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traders, and the processors provides additional income to millions of families all over Java. The intensification of soybean cultivation will improve the efficiency of this network and the overall agricultural development of Indonesia. As such it should be considered as a contribution to reducing rural exodus and to maintaining an active population in the agricultural sector.

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## **Regional Workshop on Priorities for Soybean Development in Asia, December 3-6, 1991, Bogor, Indonesia**

A workshop on Priorities for Soybean Development in Asia, sponsored and organized by the Agency for Agricultural Research and Development of Indonesia, the ESCAP CGPRT Centre, the Commission of the European Communities and the UN/FAO/RAS 89/040 Regional Co-operative Programme for improvement of food legumes and coarse grains in Asia, took place at the CGPRT Centre from 3-6 December 1991. It was held to discuss findings of the Soybean Yield Gap Analysis Project (SYGAP I 1985-1988 and SYGAP II 1989-1991) which concluded in December, 1991, and covered several agro-ecological zones in Indonesia and Thailand. The workshop was attended by thirty-two participants from 5 countries.

The **objective** of the workshop was to set priorities for research and development activities for increasing soybean productivity in selected Asian countries. Its scope was the entire process of soybean production, marketing, processing and utilization and their mutual relationships.

### *Brief Review of Proceedings*

Dr. Syarifudin Baharsyah, the Junior Minister of Agriculture, gave the Keynote address. The workshop continued with presentations on soybean development in the Philippines, P.R. China, Viet Nam, Thailand and Indonesia. These were followed by detailed presentations of the findings of the Indonesian and Thai SYGAP programmes covering agronomic and socio-economic aspects as well as the issues of linkage between farmers,

research, and extension, and the transfer of technology.

A field day included opportunities to observe soybean experiments in the Muara Experimental farm and to visit a cottage industry producing tahu (coagulated soybean cake), tempe (fermented soybean cake), and oncom (fermented soybean cake).

A major output of the workshop was the friendly atmosphere which facilitated exchange of experiences and information on soybean development among participants.

Conclusions and recommendations, presented on the final day, are summarized as follows:

### **Conclusions**

1. Soybean production does not meet domestic demand in Asian countries represented at the workshop.
2. Yield is highly variable in each country, and production lags far behind domestic demand, particularly in Indonesia, Thailand and the Philippines.
3. Some causes of high yield variability include water stress, pests and disease, weeds, improper time of planting and soil related problems.
4. Water stress, either water logging at the early stage of growth or drought during the reproduction period is the main determinant of yield instability.
5. Soybean is an important cash crop in complex rice-based farming systems which induces labour competition at soybean planting time.
6. The traditional soybean market is for food, but market requirements in terms of quality and quantity are changing.

### **Recommendations**

1. More research should be oriented towards soil and water management at farm and field level. In irrigated areas, irrigation schedules should be compatible with soybean crop requirements.
2. Good quality seed, adapted to the specific environment and compatible with users' need, should be available at the right time. Breeding programmes should take into account the specific requirements of farmer and market. Seed multiplication programmes should also be strengthened.
3. To reduce cost of production and increase efficiency, farm mechanization should be envisaged for land preparation (such as bedding and drainage), planting, and even rice harvesting and threshing.

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4. The above mentioned production technology should be identified in close collaboration with farmers, extension and local government representatives. This is recognized by the workshop as the basis for starting the process of technology adoption. In this context, the SYGAP experience proved to be an efficient means of technology transfer, and could be incorporated into national agricultural research systems.
  5. For new production areas it is necessary to study the comparative advantages between crops at farm level, and to assess production potential and constraints as well as marketing and processing facilities.
  6. As imported soybean is preferred by processors due to its better grain quality, special efforts should be made to improve national soybean quality through appropriate grading and pricing systems.
  7. Domestic price policy should not only take into account the linkage between domestic price and import, but also its impact on farmer incomes.
  8. To help strengthen soybean technology transfer, extension activities should include local extension officers, farmer groups and local authorities. The inclusion of the private sector is also needed to facilitate the supply of farm inputs and a secure market.

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## CGPRT Centre News and Activities

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### ANNOUNCEMENT

#### APO Essay Contest 1992

The Asian Productivity Organization, as part of its extensive program to promote productivity development in the Asia and Pacific region, is soliciting entries for the annual APO Essay Contest. Essays are invited from any individual in APO member countries on the following theme: **Cooperation and Productivity for Growth** focusing on any one of the following sectors: industry, agriculture, agro-industry, and trade & service. The essay should be written in an understandable and interesting style starting with conceptualization of the theme, giving a logical sequence of facts and analysis, innovative ideas and proposals, and ending with sound conclusions and findings. The approach to the theme should be practical rather than academic, since the essays are intended for wide distribution to encourage promotion and development of productivity and business in APO member countries.

Two copies of the essay must be submitted to the APO Secretariat not later than July 31, 1992.

For further details, please contact Asian Productivity Organization, 4-14, Akasaka 8-chome, minato-ku, Tokyo, 107 Japan. Phone: (03) 3408-7221.

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### New Publication from CGPRT Centre

#### ***CGPRT Crops in the Philippines: A Statistical Profile, 1960-1990***

Librero, Aida R. et al. Working paper series. 1991. 130 ca. ISBN 979-8059-47-6.  
Price US\$ 12.50. US\$ 9.00 (developing countries)  
Rp 11.000

This report is the third in the series, which will be devoted statistical information regarding development of Coarse Grains, Pulses, Root and Tuber (CGPRT) crops in the Asia and Pacific region. A wealth of statistical data indicating progress of rice, maize, sweet potato, cassava, groundnut and mungbean is presented. It draws upon a newly established statistical database and provides unique data sets such as district level development in production over 20 years in selected provinces in Philippines. Moreover, it presents wholesale and farmgate prices movements based on monthly averages of major crops. The report presents a fraction of the data available in the database of PCARRD and the Centre. Supplementary data can be made available on request.

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***Agricultural Diversification in Indonesia: Price Responses and Linkages in the Foodcrop Sector, 1969-1988; an Outlook to 2000***

Bottema, JWT and Altemeier, Klaus. 1991. 136 p. ISBN 979-8059-44-1. Price US\$ 12.50. US\$ 9.00 (developing countries). Rp 11.000

In this working paper a multi commodity model which is an improved version of a model primarily used at the Bureau of Planning in Indonesia. It looks at the factor and the product market, generates elasticities and can therefore be used to make price based forecasts and policy scenarios.

The working paper also contains a bibliography of up-to-date relevant literature about agriculture in Indonesia. The paper could be of specific interest to teachers as it contains lengthy appendices with datasets and model specifications.

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Newly Available Publications from  
APO and AVRDC

***Training Manual on Japanese Management and Human Resource Development.***

121 p. APO. Rp 7.500

***Agricultural Extension in Asia and the Pacific.***

206 p. APO Rp 7.500

***Upgrading Technological Capabilities of Small Industry.***

168 p. APO. Rp 7.500

***Management of Irrigation Facilities in Asia and the Pacific.***

319 p. APO. Rp 10.000

**1990 Progress Report.** This 312-page report on AVRDC's research activities was published in April 1991. It includes lists of publications for 1990, professional staff and Board members. Distribution has been completed to our collaborators and selected libraries. Rp 28.000.

**Thrips in Southeast Asia.** N.S. Talekar (ed). Proceedings of a regional consultation workshop, Bangkok, Thailand, 13 March 1991. Organized to discuss the thrips problem in Southeast Asia, mainly Indonesia, Malaysia, the Philippines and Thailand, the potential areas for collaborative research, training and information-sharing. Con-

tains country reports and presentations from resource persons from Japan and Taiwan plus an AVRDC strategy paper. 74 p. Rp 12.000.

**Vegetable Soybean.** (Research Needs for Production and Quality Improvement). S. Shanmugasundaram (ed). Proceedings of a workshop held at Kenting, Taiwan, 29 April - 2 May 1991. The recommendations from this workshop provide a clear research agenda for the vegetable soybean industry, ranging from breeding to mechanization. The book contains the full text of the 17 papers presented and a detailed summary of discussion and recommendations. 150 p. Rp 17.500. AVRDC.

**Guidelines for Diagnostic Work in Plant Virology.** S.K. Green. Technical Bulletin 15 (Second Edition). The first edition of this book proved extremely popular and has been out of print for some time. The author has completely rewritten the text, adding new information on viruses and expanding most of the text. Many new references have been added. 62 p. Rp 8.000. AVRDC.

**Characteristics and Control of Viruses Infecting Peppers.** A Literature Review. S.K. Green and J.S. Kim. Technical Bulletin 18. Viruses present the most serious disease problem in both hot and sweet peppers. This report covers the literature on 45 viruses, including their geographic range, disease syndrome, vectors, diagnosis and control. J.S. Kim is a virologist at the Agricultural Sciences Institute, Rural Development Administration, Suweon, Korea. 61 p. Rp 8.500. AVRDC.

**Pepper Disease - A Field Guide.** L.L. Black, S.K. Green, G.L. Hartman and J.M. Poulos. This booklet is the first such guide on pepper diseases. Prof. L.L. Black teaches at Louisiana State University. Contains over 150 colour pictures and descriptions of bacterial, fungal, nematode and virus diseases, and viruslike and abiotic disorders. Indexed. 98 p. Rp 11.500. AVRDC.

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## Announcement of the ICLARM publication's distribution

We are proud to announce that the Publication Section of the CGPRT Centre has been given the right from the International Centre for Living Aquatic Resources Management (ICLARM), Philippines, to distribute the ICLARM publications in Indonesia with the titles as follows:

- Theory and Management of Tropical Fisheries. 1982. 360 p. Rp 52.500
- Length-based Methods in Fisheries Research. 1987. 468 p. Rp 52.500
- Detritus and Microbial Ecology in Aquaculture. 1987. 420 p. Rp 37.500
- The Second International Symposium on Tilapia in Aquaculture. 1989. Rp 75.000
- Tilapia Genetic Resources in Aquaculture. 1988. 108 p. Rp 15.000
- Coastal Area Management in Southeast Asia: Policies, Management Strategies and Case Studies. 1989. 254 p. Rp 27.000
- Biology, Epidemiology and Management of Pyrodinium Red Tides. 1989. 286 p. Rp 56.000
- The Accuracy of Some Length-based Methods for Fish. 1990. 81 p. Rp 12.000
- The ICLARM-CLSU INtegrated Animal-fish Farming Project: Final Report. 1982. 96 p. Rp 23.250
- Growth, Mortality and Recruitment of Commercially Important Fishes and Penaeid Shrimps in Indonesian Waters. 1986. 91 p. Rp 15.000
- The Coastal Environmental Profile of Segara Anakan-Cilacap, South Java, Indonesia. 1989. 102 p. Rp 6.000
- The Coastal Environmental Profile of Lingayen Gulf, Philippines. Rp 3.000
- Reservoir Fisheries and Aquaculture Development for Resettlement in Indonesia. Rp 40.500
- Theory and Management of Tropical Multispecies Stocks: A Review, with emphasis on the Southeast Asian Demersal Fisheries. 1979. reprinted 1983. 35 p. Rp 6.000
- A Research Framework for Traditional Fisheries. 1983. 40 p. Rp 6.000
- Food Potential Aquatic of Macrophytes. 1980. Reprinted 1984. 51 p. Rp 12.000
- Indonesian Marine Capture Fisheries. 1987. 196 p. Rp 30.000
- The Biology and Culture of Tropical Oysters. 1986. 42 p. Rp 9.000
- Research and Education for Development of Integrated Crop- livestock-fish Farming Systems in the Tropics. 1988. 53 p. Rp 10.500
- The Biology and Culture of Mussels of the Genus *Perna*. 1989. 63 p. Rp 10.500
- Aquaculture Systems Modeling: an introduction with emphasis on warmwater aquaculture. 1989. 46 p. Rp 9.000

- Artificial Reefs for Marine Habitat Enhancement. 1990. 45 p. Rp 3.000
- Culture of Common Carp in Floating Net Cages. 1989. 42 p. Rp 4.000
- Growing Fish in Pen Systems. 1989. 40 p. Rp 4.000
- Growing Fish in Cages. 1989. 43 p. Rp 4.000
- Cultured Fish of Southeast Asia. (Poster). 1983. Rp 15.000
- Directory of Institutions and Scientists in the ASEAN Region Involved in Research and/ or Management Related to Coastal Areas. 1989. Rp 10.000
- Directory of Educational and Training Opportunities in Fisheries and Aquaculture. 1989. 46 p. Rp 7.500.
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## New book on world efforts to control destructive insects

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27 February 1992

The global importance of a tiny insect called the diamondback moth is reflected in estimates that its control could be costing about US\$ 1 billion annually. This insect attacks cabbages, brocolli, radish and cauliflower worldwide.

Chemicals have been the main means of control, but the diamondback moth quickly develops resistance to every new insecticide introduced. With a world production of crucifers of over 42 million tons, new ways must be found to protect this valuable produce and reduce risks to farmers, consumers and the environment.

It was this challenge that encouraged AVRDC, in collaboration with the Council of Agriculture, Republic of China, and the Food and Fertilizer Technology Center, to hold a major conference on the subject that brought together 200 international experts to review the advances in research to control this pest. Emphasis was placed on an integrated pest management approach that combines cultural practices, breeding resistant varieties, and biological control. Chemicals also play a role in IPM, but they hopefully become less important.

The proceedings of this conference have just been published by AVRDC. Entitled "Diamondback Moth and Other Cruciferous Pests: Proceedings of an International Workshop. Tainan, Taiwan, December 1990," the 603-page book contains over 60 papers by world experts on global efforts to control diamondback moth and other important insect pests of cruciferous crops. The book was edited by N.S. Talekar, AVRDC entomologist and conference organizer.

Copies of the book are available from the Asian Vegetable Research and Development Center. P.O. Box 205, Taipei 10099 (US\$ 30 developing countries, US\$ 40 elsewhere).

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### CGPRT Centre

The Regional Co-ordination Centre for Research and Development of Coarse Grains, Pulses, Roots and Tuber Crops in the Humid Tropics of Asia and the Pacific (CGPRT Centre) was established in 1981 as a subsidiary body of UN/ESCAP.

### Objectives

In co-operation with ESCAP member countries, the Centre will initiate and promote research, training and dissemination of information on socio-economic and related aspects of CGPRT crops in Asia and the Pacific. In its activities, the Centre aims to serve the needs of institutions concerned with planning, research, extension and development in relation to CGPRT crop production, marketing and use.

### Programmes

In pursuit of its objectives, the Centre has three programmes which are mutually supportive:

1. Research, which entails the preparation and implementation of studies covering production, utilization and trade of CGPRT crops in the countries of Asia and the South Pacific;
2. Training of national research and extension workers;
3. Information and documentation which encompasses the collection, processing and dissemination of relevant information for use by researchers, policy makers, and extension workers.

### Palawija News

Contributors are invited to submit concise summaries of significant social research related to CGPRT crops for publication. Submissions should be limited to two to four double-spaced typewritten text. Two figures (graphs or tables) may accompany the article. Include only references cited. All articles are subject to editing to meet space limitations.

Please send all queries relating to articles in *Palawija News* to Head Publications Section, CGPRT Centre, Jalan Merdeka 145, Bogor 16111, Indonesia.

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CGPRT CENTRE  
Publications Section

Editor: Meryl Wilson  
Production: Deddy Subandi M.  
S. Tayanih (Yayan)  
Distribution: Dina A. Satrio  
Printer: SMT Grafika Desa Putera



### CGPRT Centre

Jalan Merdeka 145,  
Bogor 16111, Indonesia  
Telephone: (0251) 336290, 328399  
Fax: 62-251- 336290  
Telex : 48369 AARDMA IA  
Cable : ESCAP CGPRT Bogor

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