PALAWIJA NEWS

The CGPRT Centre Newsletter

Volume 11, Number 2 June 1994

The Integrated Management of Groundnut Pest – Farmers Like It

J.A. Wightman[1]

Introduction

Mr Appaji is a groundnut farmer who lives near Bapatla, a small town on the east coast of India. Why did he come to the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) to talk to Dr Jim Ryan, the Director General, on 24 February 1993? Strange though it may seem he was given advice by ICRISAT scientists not to spend money on certain agricultural inputs. He, in fact, came to Patancheru to express his thanks to ICRISAT for this advice. In recent years he had thought them to be essential for the profitability of his groundnut enterprise. To his surprise not applying them had beneficial effects on both crop and profit.

The inputs were insecticides. Until the 1992/93 season, he had been making five or six insecticide applications in one 90 day crop cycle. Despite this, his crops routinely suffered severe attacks from defoliating insects. Groundnut crop protection specialists from ICRISAT and Andhra Pradesh Agricultural University (Bapatla College) had persuaded Mr Appaji and five colleagues, all with large holdings, not to apply -pesticides, including fungicides, unless the need was forecasted. Some details about the farmers and their practices are given in Tables 1 and 2.

Table 1 Details of farmers surveyed.

	Farmers	
	Contact	Non-contact
Number	6	7
Average age	41	50
Education (%):		
Illiterate	0	28
Grade 5 or 6	33	57
Senior School Certificate	50	14
Graduate	17	0

Note: Non-contact farmers were in a neighbouring village of the same tract and had not discussed crop or pest management matters with the APAU/ICRISAT team. All grew variety TMV 2 and farmed land with sandy soil.

The net results were enhanced productivity and profitability among the farmers (Tables 3 and 4) and reduced pesticide pressure on the beneficial animals that live in the fields around the village. Furthermore, the scientists involved received sufficient feedback from the farmers to encourage them to continue the development of their technology.

IN THIS ISSUE

[1]Yale University, New Haven, Connecticut, USA.
This paper was presented at the Regional Seminar on Upland Agriculture in Asia, Bogor, April 6-8, 1993.

Table 2 Size of groundnut holding, and number of irrigations, weedings and pesticide applications performed by contact and non-contact farmers in 1992 and 1993.

	Contact farmers 1992	Contact farmers 1993	Non-contact farmers 1992	Non-contact farmers 1993
Size of groundnut holding (ha)	4.6	4.2	8.2	8.2
Number of operations per season				
Irrigation	1.5	3.2	3.0	5.0
Weeding	1.2	0.8	2.0	1.0
Fungicide application	2.2	2.2	4.0	2.3
Insecticide application	3.2	0	7.0	1.3

The advice not to apply insecticides was not ad hoc and neither was it given without backup. An ICRISAT technician (the scout) made observations on farm every day, just in case a pest flare-up was imminent.

This experiment, the first of its kind, was successful for several reasons:

* After some initial misgivings, the farmers, who were well educated, gave the researchers their enthusiastic support. They also made progressive innovations using their own initiative.
* The daily visits by the scouts reinforced the farmers' interest and confidence.
* The scientific team which included insect and disease specialists espoused sound technology.

This exercise is regarded as an example of the promotion of integrated pest management within the context of sustainable agriculture.

Groundnut in the study area

Along the east coast of peninsular India there is a strip of land that extends westward at an altitude of d m above sea level for 50 km or more. A network of ancient sand dunes and the flood plains of the rivers draining the Deccan Plateau combine to produce soils that are light and fertile.

Soil moisture levels remain high. Monsoon rains last from June to October, cyclonic rainfall occurs from November to February and there are major (canal) and minor (well) irrigation systems throughout the area. This means that many farmers can harvest two crops a year. Although 'rice-after- rice' is of prime concern, especially in the state of Orissa, many farmers have diversified into more lucrative crops.

Table 3 Costs and benefits of the groundnut enterprise in 1992 and 1993 by contact and non-contact farmers.

	Costs and benefits (Rs/ha)			
	Contact farmers 1992	Contact farmers 1993	Non-contact farmers 1992	Non-contact farmers 1993
Land preparation		1,072,200	762	887
Farmyard manure	1,082	847	1,328	1,484
Artificial fertilizer	1,213	1,438	887	1,620
Seed cost	409	2,714	492	3,733
Seed treatment	59	64	59	79
Gypsum	266	289	41	98
Weeding	1,099	360	1,278	645
Irrigation	318	801	24	21
Fungicides	446	975	464	811
Insecticides	972	0	989	474
Pulling	469	528	463	-.*
Stripping	635	1,047	723	-
Total input costs	11,045	10,729	11,153	-
Yield t/ha	2.1	3.2	2.3	
Rs/t	11,000	8,000	11,000	8,000
Rs/ha	23,100	25,659	24,911	-
By-product sales	523	523	573	473
Income	23,623	26,265	25,484	-
Net Profit	12,578	15,536	14,331	

* Missing data not received from the farmers.

Table 4 Results of on-farm trials: means from three locations*.

Genotype	Pod yield (t/ha) With fungicide	Pod yield (t/ha) Without fungicide
ICGS 44	5.6	28
ICGV 86031	3.2	29
ICGV 86590	3.4	33

• Notes:

Plot size was approximately 0.2 ha. Data were collected from five representative 1 m^2 quadrats in each field.

Fungicide treatment consisted of chlorothalonil, applied three times during the growing season at 2 kg/ha.

ICGS 44 is a high yielding variety with no marked resistance to pests and diseases.

ICGV 86031 has multiple pest resistance and some disease resistance, but may not have reached its potential yield in the conditions of the farm trial because it requires 10 more days to attain maturity than it was allowed.

ICGV 86590 is a disease resistant variety with a similar duration to ICGV 86031

Editorial

Sustainable Upland Agriculture

Seiji Shindo
Director
CGPRT Centre

Sustainable development has become a major concern of the world community. While sustainability is an elusive concept which can be interpreted in various ways, there appears to be consensus among those working in agriculture on what is meant by sustainable development in agriculture. It is understood to be a pattern of development which improves physical and economic benefits without depleting resources for the future.

In developing Asia, the main environmental problems stem from expansion of agricultural land use into areas of high but fragile ecological value, such as tropical forests, steep slopes and wetlands. Thus, sustainability is particularly of importance in upland agriculture where CGPRT crops are grown and often dominate.

Concern with sustainable agriculture leads to a new conceptual framework regarding appropriateness of technology. A good measure of appropriateness may be the cost benefit comparison of a technology; in addition to the conventional physical and financial cost/ benefit calculations, new criteria such as changes in resource endowments, environmental costs, and risk and time factors should be considered and incorporated into development activities.

One consequence of the new approach to research and development is an increase in inter-disciplinary studies. Since simple physical improvement in the short term is no longer the ultimate objective of technology development and transfer, economic and social assessments of long term effects to the environment or resources become necessary.

The CGPRT Centre is a coordinating research centre in the area of CGPRT crop development. Its objectives are to initiate and promote research, training and dissemination on socio-economic and related aspects of CGPRT crops in Asia and the Pacific. Thus, the Centre is in an advantageous position to address inter-disciplinary issues like sustainable agriculture. In an effort to further strengthen its position, the Centre has adopted a thematic approach in its program activities in which programs and projects are formulated in line with five major themes, which include sustainable upland agriculture, agricultural diversification and rural poverty alleviation. Inter-disciplinary issues can be tackled effectively within this framework. The Centre will continue to take the initiative in promoting these research and development activities in close cooperation with its partner institutes.

Foremost among these is groundnut. This crop has a high risk factor because seed and cultivation are expensive and crop failures are possible because of a number of biotic and abiotic factors. However, high market prices and sustained demand combined with assured residual soil moisture and/or irrigation water have encouraged farmers to grow groundnut all through this tract. Sowing in November or December (the beginning of the rabi season that spans winter and summer), often in rice fallows, is an attractive prospect because yields of 2 t/ha are normally attainable. This represents more than twice the national average yield.

The problems

One reason for this high potential yield is that attacks by insect pests and pathogens have traditionally been thought of as mild. However, discussions with farmers have indicated that yields and profitability have decreased since the early 1980s. They attribute this to an increase in pest (insect and disease) incidence. The main disease is late leaf spot, *Phaeoisariopsis personata,* and the main insect pest is *Spodoptera litura,* the tobacco armyworm. It has this common name in India because it was only known as a pest of tobacco up to the early 1970s. Since that time it has spread onto other crops such as groundnut, castor and okra. The polyphagous and ubiquitous *Helicoverpa armigera* can also be a serious groundnut defoliator in this area.

The early 1970s were marked by the proliferation of irrigation systems that have permitted farmers to grow a succession of crops during an 8-month rather than a 4-month growing season. This meant that *Spodoptera* larvae were exposed to a wider range of hosts over succeeding generations than was previously the case. The selection of individuals and then populations habituated to a wide range of crop hosts has presumably resulted from this process.

In the past farmers have responded to the leaf damage caused by these caterpillars. by applying insecticides, even when no yield loss was likely. This has lead to population explosions and crop destruction to the extent that caterpillars were walking from one field to another in the thousands looking for something to eat, despite the liberal application of pesticides. This happened because the insecticides disrupted the natural control processes that would otherwise maintain caterpillars at densities below levels at which they could cause reduction in yield.

The pest managers tool box

Spodoptera was selected in 1984 as one of the groundnut pests that would be studied in detail by entomologists at ICRISAT, in association with cooperators in national programs and experts from centres of excellence in developed countries. This insect was chosen because of its potential and actual pest status in India and other Asian countries. The objective was to develop ecologically sound management procedures relevant to the needs of Asian farmers. The approach was broad based. It was known from the outset of this undertaking that it would would be necessary to consolidate information about the ecology of this species as well as to investigate the various control options.

Ecological research has covered studies of its parasites and predators, population dynamics, the determination of the relationship between temperature and development rate (necessary data for computerized forecasting) and an investigation of migratory patterns. The latter has involved the development of pheromone trap technology, in cooperation with what is now the Natural Resources Institute (NRI), Chatham, UK. Once the male moth attractant had been identified and synthesized, research on this topic led to the selection of the most appropriate trapping technique.

This has been applied to monitor the flight activity of moths throughout the year. Within the pattern of *Spodoptera* management that is emerging, unusually high levels of moth activity are the signal that an infestation is going to take place. The data have indicated that in India a major migratory flight can be expected in late February. The implication is that farmers should sow their crops in November so that they avoid the possibility of defoliation caused by the progeny of these migrating moths. This is a cultural control process called pest avoidance.

The mathematical relationship between the number of moths caught in a trap and the number of eggs laid in adjacent fields is subject to continuous updating. It is necessary to quantify this process and the subsequent larval mortality to predict the number of larvae that will survive to a particular stage. These survivors are the ones that cause the damage. It may be necessary to kill them with insecticides if there are too many of them. If this can be done, farmers can be advised when to apply insecticides to kill larvae while they are still small.

Small larvae can be killed by lower concentrations of insecticides than large larvae. Cash is conserved and so are the natural enemies. This aspect of Spodoptera management, the judicious use of insecticides by means of pest forecasting, was available to the group of study farmers but was not employed per se. Moth catches did not attain a critical level.

It is important for crop protectors to understand the relationships between pest density, damage to the crop plants, (defoliation in this case) and crop yield. These data were collected for Spodoptera living on a range of host genotypes on the ICRISAT farm. Specially reared larvae were released onto plants growing in metal enclosures. These experiments showed that once the plants had reached the flowering stage they could tolerate as much as 50% defoliation without significant yield loss. This means that the plants were considerably more tolerant to defoliator activity than had previously been suspected. Experimental data indicate that the economic threshold is as high as one large larva per plant at the flowering stage and two per plant once the pods have begun to swell.

The groundnut specialists at ICRISAT had been aware for many years of the cattle egrets that move slowly through their fields as well as the fields of millions of farmers across the tropics. They had not realized until recently that the egrets were searching for caterpillars among the plants. Experiments on the ICRISAT farm have shown the potential importance of these birds as natural control agents.

The Bapatla farmers were quick to realize the importance of having birds in their own fields. First, they stopped people catching them to eat. Then they encouraged other birds, notably the drongos, into their fields by making perches so that these birds could sit just above the canopy and pick off caterpillars as they revealed themselves among the leaves of nearby plants. What they may not have realized is that this process would also promote the spread of insect diseases through the birds' faeces. This component of the pest managers tool box is called the enhancement of natural control.

The cattle egrets remained in the unsprayed fields during the crop cycle. This was because they had plenty of food. The low density of insects present was enough to keep them in the areas. Furthermore, they also ate the frogs and other prey items that would otherwise have been killed by insecticides. In addition, the entomologists were able to show the farmers how many predacious insects lived in the unsprayed fields. Ladybirds and lacewings were abundant, as were spiders.

Confidence in the ability of natural enemies to keep *Spodoptera* under control has developed over the years from experience gained on the ICRISAT farm. First, it was observed that defoliator activity was always greater where insecticides had been applied. This was linked experimentally with a reduction in natural enemy density in the sprayed areas and increased damage levels. In addition, the entomologists have also advised the ICRISAT Farm Manager when insecticides are needed. This has resulted in the number of applications being reduced from more than five to less than two per season over a period of 5 years, even accounting for high levels of protection needed for some experimental plots on the research farm. Insect densities on the ICRISAT farm are now so low that it is difficult to carry out experiments on groundnut pest management.

In recent years farmers have been concerned that they have not been able to kill *Spodoptera* with insecticides. There are several reasons why this could be so. Assuming that the technology adopted to apply the insecticide was suitable, there is the possibility that local pest populations have become resistant to certain insecticide classes. This was first reported for *Spodoptera* in this area in 1986. Tests carried out on larvae collected from the study village in 1993 have shown that they were highly resistant to endosulfan but susceptible to cypermethrin, a pyrethroid. *Helicoverpa* larvae collected from nearby Guntur have high levels of resistance to pyrethroids and other insecticide classes.

The implications are that further tests on a wider range of insecticides are needed to determine the full extent of insecticide resistance and possibly, cross-resistance. Once this has been done farmers can be given definitive advice about which insecticides they should apply (if needed).

The emphasis so far in this report has been on insect management. However, one of the characteristics of this pest management exercise is that it has included a groundnut disease specialist. He advised farmers exactly when they should apply fungicides, mainly for the control of late leaf spot. This resulted in the same amount of fungicide being applied, but the optimization of the timing gave better disease control than in previous years. The farmers were pleased with this because the lower leaves remained on the plants for longer than normal, which they thought was beneficial. The inclusion of the disease specialist in the team means that the activity as a whole can honestly be described as integrated pest management (IPM).

IPM and sustainability

IPM involves management activities that are carried out by farmers that result in the density of potential pest populations being maintained below levels at which they become pests. These processes should not endanger the productivity and profitability of the farming system as a whole, the health of the farm family and its livestock, and the quality of the adjacent and downstream environments. If this definition is accepted, it will be seen that the Bapatla farmers have become proponents of IPM.

Sustainability issues are often best perceived by considering the various processes that can lead to unsustainable systems. If a sustainable farming system is one in which:

> *its long term productivity and quality and that of its environment are maintained at the status quo or are improved with time, its annual productivity is optimized and seasonal variations in productivity are minimized at an optimal level,*

it can be seen that the unwarranted application of insecticides is a procedure that will lead to unsustainable farming systems. This can be easily observed along the tract of land in consideration. Insecticide application has led to the destruction of natural enemy populations and the build up of insecticide resistance in the target organisms. Both of these processes result in farmers feeling the need to apply more and more insecticides, which aggravates the situation. This is the insecticide treadmill. The elimination of the treadmill is the pest managers' main contribution to sustainable agriculture.

The future

The first attempt at influencing farmers has been a success. But the number of farmers contacted is minute compared to the total. How can the ideas engendered be spread?

Already there is evidence that farmer to farmer communication will play an important role in this process. In 1992 non-contact farmers applied insecticides to their fields 7 times; this was reduced to 1.3 sprays per season in 1993 (Table 2). Is it possible to draw any other conclusion than the non-contact farmers stopped spraying because they heard about the exercise that seemed to be working in the next village?

It is not known how well this technology will remain as part of the farmers' technology. Insecticide sales will drop in direct proportion to the spread of this technology and the agrochemical industry is known for its ability to sell its products in adverse conditions. A counter move from this sector can be anticipated. Perhaps the industry should concentrate more on fungicide sales. A key part of the success of this pilot run was the provision of highly competent scouts who were in daily contact with the farmers. A scheme to train others to do this job will be necessary.

Can we stop the February migration? We have regularly observed that there is a heavy flight of *Spodoptera* moths in late February. This results in heavy infestations of late sown crops. The farmers panic, understandably, and reach for the pesticide can. Where do these moths come from? It must be from the fields of (other) farmers who have induced outbreaks by over-applying insecticides. If the message about IPM is passed around and acted upon, perhaps this dangerous migratory flight will not occur, thereby reducing the pest pressure, and the constraints on sowing dates.

Farmers in the tract grow a groundnut variety called TMV 2. This is probably rather variable in genome but, characteristically, it has a relatively short duration. This is needed when farmers grow their crops on residual soil moisture or when the irrigation water is not guaranteed beyond a certain date. The disadvantages are that it is susceptible to many pests and diseases and has a yield potential below that of certain improved varieties, even when fully protected from pests (Table 4).

We can suggest that farmers grow varieties with higher yields and/or other desirable characteristics. For instance one of the contact farmers grew an evaluation plot of 0.2 ha of ICGS 44 and harvested the equivalent of 5.5 t/ha. His TMV 2 crops yielded 4.2 t/ha. There is also a pest resistant line (ICGV 86031) that would be a suitable rainy season crop for any area where the strategy of not applying insecticides was not satisfactory. Disease resistant ICGS 76 and ICGV 86590 also have potential where, or if, fungicides are not applied.

It is accepted that the need to apply insecticides within the context of IPM may arise. This is why considerable time has been devoted by the ICRISAT scientists to determining the pest density at which this is needed. This has been done in the context of synthetic wide-spectrum pesticides. How much better it would be to apply a material that will kill only the pest and not the natural enemies. Such an option is in sight in the form of a wettable powder containing disease organisms (virus particles) specific to *Spodoptera* or *Helicoverpa.* It is hoped that farmers will be able to buy such a preparation within the foreseeable future.

Much of the basic research that has been carried out has been oriented towards understanding the ecology of Spodoptera. This information is now being assembled in a form that can be incorporated into a computer program. The purpose of this exercise is to produce a procedure that will forecast the need for farmers to apply an insecticide for Spodoptera management.

It is not envisaged that a farmer would need to purchase a computer and software. It is more practical for a scout to service several villages a day and to pass relevant data by telephone to a computer operator located in a central office. The scout could be a specially trained member of a farming family, or a self-, government- or NGO-employed extension specialist. The basic data required for the model include pheromone trap catches or egg counts, plus meteorological data. Information could then be returned to a village by whatever means was available, including public media. The output from the computer could be further collated by means of a geographical information system to fill in the gaps between monitoring sites. There is a very good chance of adding other pests and disease forecasting to the basic *Spodoptera* model.

Conclusion

It is not surprising that farmers like a procedure that has the potential to increase their profits by spending less money. The experience gained this season has indicated to farmers and scientists that they are on the right track. However, there is still much to do in terms of refining existing technology and in developing more. The provision of trained scouts backed up by a forecasting scheme will, it is believed, be the key issue that will lead to the permanent success of this scheme.

Palawija IPM and the Transferability of a Successful Training Model

*Elske van de Fliert**

Introduction

Research and development of integrated pest management (IPM) and IPM training in rice cultivation has, so far, obtained more attention in comparison to secondary food crops *(palawija).* How far are the lessons learned through IPM training and implementation in rice applicable to these other crops?

In Indonesia, a major innovative effort to devise a new type of IPM training for farmers was made by the government in cooperation with the Food and Agriculture Organization's (FAO) Inter-country IPM Programme, which had almost a decade of experience in IPM training in Asian rice growing to build on. The so-called National IPM Programme, which began in 1989, applied a completely different, unconventional extension approach, enabling farmers to follow IPM principles, rather than only applying standard recommendations. Some main principles of non-formal education were employed to design the farmer field school's as the basic model for IPM training. Pest observers from the Subdirectorate of Food Crops Protection were intensively trained in both rice and *palawija* IPM, as well as in IPM extension.

Presently, over 200,000 Indonesian farmers have been trained in rice IPM through the National IPM Programme, and a few thousand more through local NGO IPM projects supported by World Education's Improved Environmental Management and Advocacy programme, which adopted the IPM farmer field school model. Both programmes have also conducted farmer field schools for *palawija* and horticulture crops with varying results. Main problems encountered are the scarcity of detailed knowledge about *palawija and* vegetable ecosystems, and of pest management alternatives. The field school model, however, seems to provide ample opportunities to solve together with the farmers many of the problems encountered.

* Consultant on Extension for Sustainable Agriculture, Yogyakarta, Indonesia.

IPM farmer field school model

IPM as promoted through the IPM farmer field school starts from four major principles, rather than from a set of standard recommendations: (1) grow a healthy crop; (2) monitor the field weekly; (3) encourage natural enemies; and (4) farmers be IPM experts. Application of these principles by farmers as a tool for pest management decision making requires a good understanding of ecological processes. IPM training should, therefore, provide opportunities for farmers to develop such understanding.

The non-formal education approach used to design the IPM farmer field school emphasizes learning through experience and experimentation of real (field) problems. Training according to these principles implies facilitation of the learning process, rather than instruction. The main ingredients of an IPM farmer field school are described below.

Main ingredients of the IPM farmer field school

The philosophy behind the farmer field school is that farmers go back to school, a place reputed for learning, where they can obtain a certificate and become IPM experts and trainers. The school is located in or close to the field, and all activities deal with real field problems. A field school group consists of twenty-five farmers selected either from one farmer group (kelompok tam) as designated by the Extension Service, or across such groups within one village. During the training, farmers work in small subgroups of five. The farmer field school lasts for the main part of an entire cultivation season to follow all stages of crop development. The school meets once a week for ten to twelve weeks.

The proposed time schedule for a field school day takes 4.5 hours, preferably starting early morning:

07:30 – 08:30	Field observation: the participants sample an observation field in five small subgroups;
08:30 – 09:45	Agro-ecosystem analysis: the subgroups make drawings of what they have found in the field; each drawing contains pictures of the plants, pests and diseases, natural enemies, and weather, soil and water conditions;
09:45 – 10:00	Presentation and discussion: the subgroups present their drawings, discuss the field situation, and participants take a decision together whether a pest control measure should be taken or not, and if so what measure;
10:00 – 10:15	Break with tea and snacks;
10:15 –10:30	Group dynamic exercise: to enliven the school, and strengthen the training groups;
10:30 – 12:00	Special topic: experiments, lessons, exercises, and discussions on special topics dealing with problems that the field school farmers are facing at that particular moment.

Lecturing is preferably not used in the field schools. The trainers, performing as facilitators, do not allow themselves to be forced into the role of expert. They do not answer questions directly, but try to make farmers think for themselves instead. 'What did you find?' 'What did it do?' 'What do you think?'. This is called the *Apa ini* principle, meaning literally 'What is this?'. Answering a question directly is considered a lost opportunity for learning.

IPM for palawija

The success of rice IPM can be attributed mainly to the relatively simple pest complex and the favourable ecological conditions of the rice cropping system, allowing a high reliance on the capacity of natural enemies to suppress pest populations. Consequently, rice IPM training can be relatively simple, which encourages the adoption process. *Palawija* cropping systems, however, usually have a more complex ecological structure, and, hence, higher susceptibility to pest damage. In addition, the regenerative and compensatory capacity of most *palawija* crops is not as strong as that of rice. Therefore, IPM for *palawija* seems to require more distinct pest management alternatives than rice IPM.

Farmers' perception of IPM and IPM training

Many farmer field school participants and graduates in Central Java and North Sumatra from both the National IPM programme and local NGO projects were observed and interviewed over several seasons. Farmers are generally excited about what they have learned in the field school. Pest and natural enemy identification, the ecological importance of natural enemies, and analysis of costs and benefits in pest management are their favourite topics. They have also become better aware of the hazardous effects of chemical pest control to the agro-ecosystem.

The importance of economic advantage of IPM practices was encountered mainly among non-rice farmers, and farmers in Sumatra. In this respect, a direct relationship is visible between the previous high level of pesticide use and the relative importance of economic aspects in the IPM adoption process. Nevertheless, even farmers who previously applied pesticides just once or twice per season, counting for only 5-6% of the total crop cultivation cost, can feel the difference of the savings. in their household budget.

Farmers highly appreciate the field-oriented and facilitation approaches that are applied in the IPM farmer field school model. The many discussion and experimentation opportunities leave ample room for farmers' local knowledge and experience to be integrated with IPM guidelines, often resulting in adapted and, thus, highly suitable pest management alternatives. A main step forward with regard to sustained IPM implementation is presently achieved by the World Education supported NGO programmes, where farmers are trained and recruited as the IPM field school facilitators.

It was observed that IPM implementation in rice almost always causes a reduction of pesticide use, whereas yields and crop quality tend to increase. Yield increases seem to be mainly a result of subtle changes in crop cultivation practices by IPM trained farmers. These changes mainly involve a higher level of adequacy and timeliness of common cultivation practices due to a more rational and empowered attitude of farmers towards their profession. Such changed behaviour is assumed to be favourable to a more productive and profitable cultivation of other crops, as well.

Conclusions

The IPM farmer field school model, which has proven to be successful in rice growing, seems to have a high potential, as well for palawija. Changed crop management behaviours, installed by the experience of season-long experiential and field-based learning in an IPM field school, are expected or result in improved palawija production especially in areas where palawija is grown as an intermediary crop, often with low rate of crop cure. When farmers adopt the habit of doing regular field observation to monitor for pest occurrence, they automatically seem to pay more attention to other cultivation aspects, such as nutrient, water and weed management. In addition, cultivation practices by field school graduates are generally implemented in more timely fashion and to a greater extent. These improved cultivation methods are considered of great importance, especially for palawija IPM, to help prevent the build up of pest populations.

Adaptation of the rice IPM field school model for optimal applicability in palawija crops seems to be necessary, mainly with regard to the development of a strong understanding among farmers of ecological processes with a perspective broader than pest - natural enemy relations only. In addition, palawija IPM field schools need to focus more on (development of) alternative pest prevention and control methods. Such adaptations might require a field school model allowing more intensive and/or longer lasting contact of training participants and facilitators.

Field Observation on the Use of Sex Pheromone to Control *Spodoptera Litura* in Soybean

*C.C. Chiu, M.L. Hseu and L.S. Hsu**

Introduction

Biological control of agricultural pests is an old but very sound practice. It was practiced long before the golden age of pesticides which began just after World War II. Experience with many pesticides has shown that no single method will give permanent control. Recent problems, such as the development of pesticide resistance, risks to non-target organisms, and increased costs of pest control have led to demands for new pest control methods. The strategy for pest control now is directed less on killing, and more on controlling, for instance by attractant chemicals, sex pheromones, growth regulators, and insect disease agents. The control agents will be good alternatives in the future because they are neither toxic nor produce other environmental hazards. In Indonesia, there is a great diversity of crops, farming practices, and pests. Biological control in such a diversified and intensified agricultural system is different from that of mono-cultural crops in other parts of the world. To develop new approaches to biological control, it is necessary to have a good working knowledge on biological control concepts and agro-ecosystem management, so that natural enemies can be used effectively and the use of pesticides minimized.

Soybean is one of the most important upland crops in Indonesia. It is a major source of protein in the daily menu for local people and in feed for animals. The consumption of soybean is continuously increasing, but domestic production cannot meet the demand, even though the government has attempted to increase production. Insect pests were generally considered the main constraint to maximum soybean production in East Java. About 23 species of insects were found to damage soybean in Indonesia. Among them, soybean root miner (*Melanagromyea centro-sematis*) and tobacco cutworm or armyworm (*Spodoptera litura*) were common in East Java,

* Agricultural Technical Mission of Rep. of China to Indonesia, Jend. A. Yani 152, Surabaya, Indonesia.

causing severe damage. A combination of Marshal with a soybean seeding technique was found very effective in controlling soybean root miner, but damage by tobacco cutworm usually required 7 to 9 applications of insecticides for control. Recently, a new approach using sex pheromone has proved very successful for controlling *(Spodoptera litura)* in Taiwan and many other countries.

The sex pheromone of *Spodoptera litura* was introduced from Taiwan by the Mission. The sex pheromone for *Spodoptera litura)* control was about a 10:1 mixture of *cis-9,* trans-11-tetra-decadienyl acetate and *cis-9,* trans-12-tetra-decadienyl acetate. The pheromone dispensers consisting of polyethylene tubes (5.5 cm x 10 mm 0.D.) were loaded with 1 mg of this sex pheromone. Since the lifetime of the sex pheromone was about 45 days in Taiwan and the soybean growing period 75-80 days, two sex pheromone tubes were used. The first one was installed one week after seeding, and it was replaced with the second 35 days later. Some research and extension activities on the sex pheromone for controlling *Spodoptera litura* on soybean were conducted in East Java. Results of the studies are discussed here.

Efficiency of combined sex pheromone and Dursban

A study on the combination of sex pheromone and Dursban to control tobacco cutworm in soybean was conducted at Balai Berik Utama, Teje, Jombang in July-October, 1989. Soybean VVilis variety was planted with a spacing of 60x20 cm on July 20, 1989. Two treatments, a combination of sex pheromone with Dursban and application only Dursban, were employed for comparison. The total area for this study was 0.25 ha. Tobacco cutworm trapping stations were arranged to collect the male insects attracted by the sex pheromone. The damage to soybean leaf was calculated by:

$$N\% = \frac{(NO + N1 + N2 + N3 + N4)}{N \times LAI} \times 100$$

where: NO = leaf without injury .... index 0
N1 = leaf with injury area 1-5% .... index 1
N2 = leaf with injury area 6-25% .... index 3
N3 = leaf with injury area 26-50% .... index 5
N4 = leaf with injury area above 51% .... index 9
N = number of plants investigated
LAI = leaf area index

In a lifecycle study of tobacco cutworm by the Mission in 1988/89, at least three generations of tobacco cutworm were found in each soybean crop season. The population of this insect was very low in the first generation and slowly increased in the second generation. Finally, a heavy population was established in the third generation and caused severe damage during the maturing stage of the soybean. However, a quite different variation of insect population was found in the present study. The highest population was found in the first generation, and very low populations were found in second and third generations. There was no heavy population established during the maturity of soybean to cause damage to soybean. Very good results of control of insects were obtained from both treatments. The levels of injury to soybean leaves were 16.2% and 15.0% for the combination sex pheromone with Dursban and application of only Dursban, respectively (Table 1).

Table 1 Injury of soybean leaf by tobacco cutworm.

Crop Season	Sex pheromone + Dursban (4x)				Dursban alone (7x)			
	Class	No.	Plants	N%	Class	No.	Plants	N%
MK I	NO	11			NO	14		
	N1	30			N1	26		
	N2	3		17.3	N2	5		16.4
	N3	4			N3	3		
	N4	2			N4	2		
MK II	NO	16			NO	23		
	N1	24			N1	19		
	N2	5		15.1	N2	3		13.6
	N3	4			N3	3		
	N4	1			N4	2		
Mean				16.2				15.0

However, the total application of Dursban was decreased from 7 applications of Dursban to only 4 applications of Dursban when combined with sex pheromone. About 3 insecticide applications could be saved in the combined treatment of sex pheromone plus Dursban.

Primary testing of the efficiency of sex pheromone

A comparison study was carried out at four locations in 1991 and 1992 to test the efficiency of sex pheromone traps. In 1991, the study was conducted in Kabupaten Gresik and Lamongan on 50 hectares at each location. The study in 1992 was conducted in Kabupaten Ngawi and

Jombang with 120 ha at Ngawi and 50 ha at Jombang. Three sex pheromone traps were installed per hectare one week after soybean was planted. Killed insects were recorded every week. The soybean yield was also recorded after harvest.

In 1991, the study was carried out in Gresik during MK I (dry season I) and Lamongan during MK II (dry season II) with 50 hectares at each location. The wet type sex pheromone trap was employed. Unfortunately, the captured insect number was not recorded in Gresik during MK I. The soybean yield at the two locations was around 1.9 ton/ha, which was much higher than 1.0-1.2 ton/ha of the control site (Table 2).

Similar results were found in the 1992 experiment during the MK II crop season. An average of 615 insects/ha and 591 insects/ha were caught at the sites in Ngawi and Jombang, respectively. The soybean yields of the test sites were 1.5-1.6 ton/ha, higher than the control area (1.3 ton/ha). The costs of wet and dry traps were about Rp 2,500 and Rp 200 each, respectively. Since there were several advantages of the dry type trap compared to the wet type trap, the dry type trap was used for future demonstration and extension projects. More insects were captured by the sex pheromone trap during the early stage than the late stage of soybean growth. The majority of insects were captured in the first five weeks of the growing period (65-75%), while only about 25-35% were caught the last five weeks (Table 3).

The effect of number of traps

This study was conducted from June to September 1993 at desa (village) Diwek, Keras, Mojojejer, Bahjor Agung, and Tebel, Kabupaten Jombang. The total testing area was 50 hectares, comprising five hectares of soybean field at each desa, with 2, 4, 6, 8, or 10 traps installed per hectare to compare the effects of number of traps. The traps were installed one week after soybean was planted. The number of insects captured was recorded every week. This experiment was a complete randomized block

Table 2

Soybean yield with and without sex pheromone trap.

Location	Crop season	Area (ha)	Soybean yield (kg/ha) with trap	Soybean yield (kg/ha) without trap	Trap type	Insects killed (no./ha)
Gresik (1991)	MK I	50	1,901	1,281	wet	
Lamongan (1991)	MK II	50	1,970	1,024	wet	416.6
Ngawi (1992)	MK II	120	1,544	1,382	wet	615.4
Jombang (1992)	MK II	50	1,653	1,365	dry	591.3

Table 3 **Insects captured during different soybean growth periods (MK II).**

Week	Lamongan (1991) (insects/ha)		Ngawi (1992) (insects/ha)		Jombang (1992) (insects/ha)	
	50.4	12.1	84.9	13.8	114.6	19.4
2	67.2	16.1	91.7	14.8	101.6	17.2
3	58.2	14.0	89.8	14.0	89.8	15.2
4	53.7	12.9	77.4	12.8	80.9	13.6
5	49.8	12.0	59.1	9.5	64.5	10.9
6	37.8	9.1	55.6	9.0	44.8	7.6
7	36.4	8.7	55.5	9.0	39.2	6.6
8	35.5	8.5	45.3	2.4	18.9	3.2
9	22.8	5.5	34.4	5.8	23.2	3.9
10	4.8	1.1	24.5	3.9	14.0	2.4
Total	416.6	100	615.4	100	591.3	100

design with 5 replications. Each desa was considered as one replication.

The results taken from the five villages were very similar, that is, the more traps installed the more insects captured. The efficiency of capture by sex pheromone traps was greatly influenced by the number of traps. With 2 traps per hectare, and average of 289 insects/ha was captured (Table 4). The number of insects captured by sex pheromone traps increased as more traps were installed. A total of 1,044 insects/ha on the average was captured when 10 traps were installed, which is about 3 times higher than 2 traps per hectare. Although the absolute number of insects captured by traps varied at different locations, the trend, the more traps installed, the more insects captured, remained constant.

According to the data from five villages, more insects were captured during the early stages of plant growth (Table 5). It was very clear that the number of insects killed decreased with time after the traps were installed. More than 77% of insects were captured during the first five weeks after traps were installed, and less than 23% of insects were captured during the last five weeks. This phenomenon was almost the same for all treatments despite different numbers of traps installed. The decrease in the number of insects captured may have been caused by the decreasing insect population, because a great number of insects were caught during the early period after trap installation.

Soybean yield was not influenced by the number of traps installed in this study, possibly due to the good insect control program. The area covered by this experiment was part of a 3,000 ha soybean demonstration project. Under suitable field management, good soybean yield was maintained. The yields where two traps were installed averaged 1,520 kg/ha which were slightly lower than the 4, 6, 8 and 10 trap treatments (Table 6). The average yields of those treatments varied; however, there were no significant differences of yields related to different numbers of traps installed.

Tab 6 Soybean yield (kg/ha) by site and number of traps.

Traps	Diwek	Bahjar	Tebel	Keras	Mojojejer	Average
2	1,464	1,392	1,498	1,748	1,498	1,520
4	1,658	1,592	1,604	1,900	1,640	1,679
6	1,687	1,598	1,569	1,924	1,604	1,676
8	1,711	1,616	1,604	1,930	1,634	1,699
10	1,687	1,592	1,640	1,894	1,640	1,991
Mean	1,642	1,558	1,583	1,879	1,603	1,653

Table 4 Insects captured by different numbers of traps.

Number of	Diwek	Bahjar	Tebel	Keras	Mojojejer	Total	Mean Traps	
2	166	410	434	131	306	1,447	289.4	100
4	265	540	655	214	344	2,018	403.6	139
6	310	584	702	378	557	2,531	506.2	175
8	499	798	1,139	425	707	3,568	713.6	247
10	590	1,353	1,397	815	1,064	5,219	1,043.8	316

Table 5 Insects captured during different soybean growth periods.

	Number of Traps							
Week	2	4	6	8	10	Total	Mean	%
1	66.2	83.2	108.2	150.0	165.2	572.8	114.6	19.4
2	81.0	69.8	75.8	107.4	174.2	508.2	106.6	18.0
3	36.4	59.8	86.8	108.2	157.6	448.8	89.8	15.2
4	23.4	57.6	68.0	88.4	166.0	403.4	80.7	13.6
5	20.4	46.2	35.2	72.8	147.8	322.4	64.5	10.9
6	15.8	31.4	37.4	47.0	93.6	244.2	44.8	7.6
7	21.2	34.0	42.8	50.6	47.6	196.2	39.2	6.6
8	4.6	10.0	14.6	28.2	37.2	94.6	18.9	3.2
9	13.8	6.2	23.4	43.0	29.6	116.0	23.2	3.9
10	6.6	5.4	14.0	19.0	25.0	70.0	14.0	2.4
Total	289.4	403.6	506.2	713.6	1,043.8	2,956.6	591.3	100

Economic study on the use of sex pheromone

The economic study was conducted at Karanglo, Sukotber, and Jombang June to September, 1992. Fifty-four ha of demonstration area with 94 farming families and 15 ha of control area with 30 farming families were chosen for this study. All the production costs and soybean sales were recorded (Table 7). Farmers in the demonstration area had higher fertilizer inputs which would contribute towards higher yields. The production costs for the demonstration area were a little less than for the control area, due to the decreased pesticide investment. From this economic analysis, it appears that the usage of sex pheromone can significantly reduce the financial input for pesticides. The other production inputs were not very different between demonstration and control areas. The net income for sex pheromone demonstration farming families was Rp 702,413/ha, 15.7% higher than for the control families, who received Rp 607,117/ha.

Table 7 Economic analysis of sex pheromone demonstration.

Item	Demonstration	Control
Area (ha)	54	15
Farmer (family)	94	30
Yield (kg/ha)	1,765	1644
Price (Rp/kg)	731	731
Total income (Rp/ha)	1290215	1201764
Seeds (Rp)	44593	48589
Fertilizer (Rp)	53187	48354
Pesticide (Rp)	44976	65204
Labour cost (Rp)	445046	432500
Production Cost (Rp/ha)	592849	604647
Net income (Rp/ha)	702413	607117

Although all combinations of treatments, for example a control treatment with Dursban (4x) without sex pheromone, were not tried, these initial experiments suggest that sex pheromone in combination with pesticides can reduce pesticide inputs.

CGPRT Centre News and Activities

Report of the 50th Session of the ESCAP Commission

The Fiftieth Session of the Economic and Social Commission for Asia and the Pacific (ESCAP) was held in New Delhi, India, from 5 to 13 April 1994. H E Mr P.V. Narasimha Rao, Prime Minister of India, delivered the inaugural address. Mr S.P. Mukherjee, Minister of Commerce of India, chaired the session attended by 49 members and associate members of the Commission and other states, a number of representatives of UN bodies, inter-governmental organizations and NGOs.

The 50th Session of the Commission was held during a time of remarkable economic growth in South Asia, in spite of recession in other parts of the world, and in contrast to the situation of the Commission's first meetings. Similarly, rapid growth of trade marks another salient feature of the region. Regional economic cooperation has been increasing, and involves stimulation and deregulation of trade and investment, development of infrastructure such as roads and other transportation components, electricity and water supplies, and communication facilities, which are constraints to development in many countries. The session's theme was "infrastructure development as a key to economic growth and regional economic cooperation". The Commission adopted resolutions called "the Delhi Declaration on Strengthening Regional Economic Cooperation in Asia and the Pacific Towards the Twenty-First Century", and "the Action Plan on Infrastructure in Asia and the Pacific".

The Commission was restructured along thematic lines two years ago and at least one meeting of each thematic committee has been held since then. The session acknowledged that the Commission was now moving towards its new objectives.

The session was important for the regional institutions, including the CGPRT Centre in several ways. For instance, the regional institutions were discussed for the first time in a separate agenda item, reflecting their unique position and role in the entire framework of the Commission. Secondly, several developing countries have increased their contributions to the three regional institutions and the Regional Network for Agricultural Mechanization. These activities, together with the move to the new premises of the Asia and Pacific Centre of Technology Transfer in New Delhi, gave a sense of start of an expansion era for the regional institutions, including the CGPRT Centre.

Several developing countries, including India, Indonesia, Papua New Guinea, Republic of Korea, and Thailand announced an increase or commencement of their contributions to the institutional resources of the CGPRT Centre. Although these contributions are not sufficient to overcome the financial difficulties that the Centre is facing, they are certainly a promising sign. They will stabilize the financial situation and operations with sustained benefits for the Centre's partners. The increased contributions also represent the reaction of developing members to the Informal Consultative Meeting for the CGPRT Centre held on 3 March, 1994, in Jakarta under the auspices of the Government of Indonesia.

During the session, the Governing Board members of the Centre were elected for a three year term. They are: Bangladesh, France, India, Japan, Myanmar, Pakistan, Papua New Guinea, the Philippines, Republic of Korea, Sri Lanka, Thailand and Viet Nam, in addition to the host country, Indonesia, totaling 13 countries.

The Centre's report covering the program activities in 1993, together with the financial situation and other issues, was discussed and Commission members made a number of suggestions for future program directions. This should be interpreted as a sign of increasing interest by member countries in the Centre and its activities. To respond to the expectations and demands, the Centre will further strengthen and expand its activities.

CGPRT Research Projects

Diversification of Agriculture in South Asia

Three CGPRT Centre economists Dr. Fredrick, Dr. Francois Gerard, and Isabelle Marty visited Thailand, February 27 - March 8, 1994. The mission's objective was to determine how to develop analytical tools to examine agricultural diversification in South Asia.

The team will develop the first prototype of an agricultural diversification model for South Asia. The model initially focuses on the impacts of policy changes on soybean production in Indonesia. Eventually, the model will be applied to other agricultural commodities and other counties in the Asian region.

The CGPRT team was assisted in development of their model by Dr. Daniel Debey (CIRAD), who was on a mission at the CGPRT Centre from May 25 - June 16, 1994. In addition, the team has been assisted by Bambang Irawan (Phd candidate, University Montpellier, France).

Women's Role in Upland Farming Development (WIDUP)

Charles van Santen of the CGPRT Centre has been coordinating the Indonesian and Sri Lankan national research teams participating in this project. The field work has now been completed, and the teams will be presenting their preliminary results at workshops to be held in their respective nations in the third quarter of 1994.

The Centre's director, Dr. Seiji Shindo, and Mr van Santen attended the "Second Asian and Pacific Ministerial Conference on Women in Development", held in Jakarta in June 1994. It is noteworthy that the recommendations from this conference with regards to women's role in agricultural development are similar to the preliminary findings of WIDUP.

Staff

In June 1994 Mr Klaus Zambra joined the Research and Development Programme of the CGPRT Centre as a researcher. Mr. Zambra obtained his Masters of Agronomy at the University of Agriculture and Soil Science, Vienna in 1991.

Indonesia Assessment *1993, Labour: Sharing in the Benefits of Growth?*

Edited by Chris Manning and Joan Hardjono

This monograph is based on papers presented to the ANU's Indonesia Update 1993, organized by the Indonesia Project, Department of Economics, and the Department of Political and Social Change. This volume consists of two parts: an overview of recent economic and political trends and a major theme in contemporary development in Indonesia. The theme on this occasion: is labour sharing in the benefits of growth?

$A20 per copy plus postage ($3 within Australia and $5 for overseas seamail) from:

Department of Political & Social Change
Research School of Pacific Studies
Australian National University
Canberra ACT 0200, AUSTRALIA
Tel: (06) 249 5915 Fax: (06) 249 5523
Email: bevley@coombs.anu.edu.au

Publications available from the Asia-Pacific Association of Agricultural Research Institutions (APAARI)

Baby Corn Production in Thailand - A Success Story. 20 pp. APAARI Publication: 1994/1.

Tilapia Farming in the Philippines - A Success Story. 15 pp. APAARI Publication: 1994/2.

For copies, write to:
The Executive Secretary
Asia-Pacific Association of Agricultural Research Institutions (APAARI)
FAO Regional Office
Phra Atit Road
Bangkok 10200, THAILAND

International Course on R&D Management

21 November - 2 December 1994, Australia

This course on the management of research and its application in developing countries is designed for senior research scientists or active R&D managers from developing countries. While the course addresses management issues specific to science and technology, it does not focus on any particular discipline. The course approach is skill-based and intensive. Most topics include workshop sessions where participants immediately practice the principles just learned.

Topics will include: roles of research managers and leaders, management styles, team management, managing change, key management issues in CSIRO, research planning and evaluation, application of research, presentation skills, and research performance indicators.

The course will be held at the Thredbo Alpine Resort in Australia's Snowy Mountains, two hours drive from Canberra, Australia. Fees (AUD$ 5,000) include airport pickup, accommodation, meals, conference travel, tuition and course materials.

For further information contact:

International Training Officer, CSIRO
PO Box 225, Dickson ACT 2602, AUSTRALIA
Tel: 61 6 276 6463 Fax: 61 6 276 6292
Telex: AA 62003

International Development Training Program in Human and Resource Management for Developing Countries

University. of New England, Armidale, Australia

NGO's in Development

27 July - 30 August, 1994

This course is targeted at practitioners, planners and managers either working for, or closely involved with, NGO's in developing countries. *Fee: A$8,700.*

Management for Community Health Planners

21 September - 1 November, 1994

A course for professionals involved in community health care who require a high level of management skills to run efficient and effective health programs. Fee: *A$10,000.*

Agro forestry Management

16 January - 17 February, 1995

The course is intended for agriculturists, foresters and rural development practitioners from developing countries. *Fee: A$8,700.*

Water Resources Planning and Management

8 March - 4 April, 1995

The target audience are water resource planners and managers, both in government and non-government sectors, including conservation agencies, water distribution and marketing bodies and other water-related institutions. Fee *A$7,500.*

Urban and Rural Planning and Local Development Policy

3 May - 6 June, 1995

This course will integrate the social economic and physical aspects of local planning policy relating to the management of change in town and country, and the facilitation of economic development in small town situations. *Fee: A$8, 700*.

National Park and Wildlife Management

20 September - 24 October, 1995

This course with cover the design and management of national parks and reserves as well as upgrading the skills of national park managers. *Fee: A$8,700*.

For further information contact:

Program Director,
International Development Training Program
PO Box U298, University of New England
Armidale NSW 2351, AUSTRALIA
Telephone: (6167) 73 3248 *or* 73 2290
Fax: (6167) 73 3799
Telex: AA166050
E-Mail: DSP@UNE.Edu.au

25th International Course on Applied Plant Breeding

International Agricultural Centre, Wageningen, the Netherlands
March 12 - June 24, 1995

The course is an in-service training course intended for university trained specialists in plant breeding, mainly from developing countries, who have not recently had the opportunity to acquaint themselves with modern plant breeding techniques.

Its aim is to upgrade the participants' knowledge of and to give information on new developments in applied plant breeding through lectures and practical training. To be eligible, candidates should have been engaged in plant breeding activities for several years, either in a breeding program, in teaching or in a crop improvement program where breeding is a major component.

Total tuition fees amount to 4,500 Dutch guilders. This amount includes administration fees, lecture materials, excursions, etc.

For further information, contact:
International Agricultural Centre
(See below)

8th International Course on Seed Production and Seed Technology

International Agricultural Centre, Wageningen, the Netherlands
April 9 - July 12, 1995

Through the course, the International Agricultural Centre proposes to hamess relevant knowledge and available experience in the Netherlands towards the training of seed agronomists and seed technologists in developing countries.

Total fees amount to 5,000 Dutch guilders.

For further information, contact:
International Agricultural Centre
(See below)

24th International Course on Integrated Pest Management

International Agricultural Centre, Wageningen. the Netherlands
March 19 - July 1, 1995

The course intends to broaden the participants' view on plant protection and its role in plant production, and to strengthen the knowledge of and the skills in plant protection methods with emphasis on IPM, in order to allow the participants to use IPM, its concepts and related techniques, in their own working situations.

Total fees amount to 5,000 Dutch guilders.

For further information, contact
International Agricultural Centre
(See below)

24th International Potato Course: Production, Storage and Seed Technology

International Agricultural Centre, Wageningen, the Netherlands April 9 - July 14, 1995

The objective of the course is to provide persons working in developing countries who are engaged in aspects of potato production, with further knowledge and understanding of and skills in various aspects of their work. These aspects include: physiology, growth and production; storage, handling and utilization; diseases and pests; seed technology; seed production and seed supply; breeding and varieties.

Total fees amount to 4,500 Dutch guilders.

For further information, contact:
International Agricultural Centre
P.O. Box 88, 6700 AB Wageningen
the NETHERLANDS
Telegram: INTAS
Telephone : +31-8370-90111
Telex : 45888-INTAS NL
Telefax : +31-8370-18552
E-mail: IACcIAC.AGRO.NL.

International Association of Agricultural Information Specialists IXth World Congress

Melbourne, Australia 23 - 26 January, 1995

Communicating Agricultural Information in Remote Places

Technologically Geographically
Linguistically Culturally
Use of Electronic Networks to Overcome Isolation

The Congress will consist of plenary sessions at which a series of invited papers related to the themes will be presented. There will also be the opportunity for special interest groups to meet in parallel sessions. Further information about the Congress program will be issued in later circulars, or can be obtained from the Chairman of the Organizing Committee, Dr H S Hawkins, School of Agriculture & Forestry, The University of Melbourne, Parkville 3052 Australia. Telephone: 61 3 344 5012 Facsimile: 61 3 344 5570. Internet e-mail: Stuart_Hawkins@muwayf.unimelb.edu.au.

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. Figures (graphs or tables) may accompany the article. All articles are subject to editing to meet space limitations.

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

Palawija News is distributed free of charge to interested individuals and institutions. Please send address corrections and additions to the Distribution Officer, Publications Section.

CGPRT CENTRE
Publications Section

Editor:	Douglas R. Stoltz
Production:	Deddy Subandi M.
	S. Tayanih (Yayan)
Distribution:	Fetty Prihastini
	Deddy Subandi M.
Printer:	SMT Grafika Desa Putera

CGPRT Centre
Jalan Merdeka 145,
Bogor 16111, Indonesia
Telephone: (0251) 336290, 343277
Fax: 62-251- 336290
Cable: ESCAP CGPRT Bogor

Palawija News
Volume 11, Number 2