CONSTRAINTS TO THE IMPLEMENTATION OF INTEGRATED PEST CONTROL OF PADDY INSECT PESTS IN MALAYSIA

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Introduction

Malaysia is currently only about 85% self-sufficient in rice. In view of the uncertainties in world rice production, it is desirable that the country should be able to produce enough to meet its own requirements. To achieve this goal, there are limited plans to open up new paddy-growing areas, and there is an on-going World Bank project to provide small irrigation schemes to areas presently under single-crop rainfed conditions. Besides these programmes, there is a concerted effort towards boosting the yield per unit area in order to increase production, through the introduction of high yielding varieties, increased fertilization, and increased pesticide use when necessary.

With this rapid intensification of paddy farming, the pest situation is expected to increase. In the case of insects, although the stem borers have generally maintained a low level due to the suppressive effects of double-cropping and staggered planting, the planthoppers in recent years have proved to be a potentially serious threat to rice production in Malaysia. In addition, the leaf folder *Cnaphalocrosis medinalis* has been observed to be more common, infesting the crop up to harvest and damaging the flag leaves even. These and other rice pests can cause serious crop losses and thus hinder the drive towards self-sufficiency. At the same time, the 300,000 farmer families involved in paddy farming represent the poorer segment of the population, and it is the Government's policy to provide every assistance to them including the need to protect their source of livelihood from pest problems.

The Crop Protection scientists of the Department of Agriculture and the Malaysian Agricultural Research and Development Institute (MARDI) have recognised the need to implement an Integrated Pest Control (IPC) programme for rice at the farmer's level as a systematic and rational approach to protect the crop from undue losses due to pests both in the short-term and long-term, instead of the *ad hoc* chemical control practised in the past. A stable rice production without unexpected large-scale losses due to pests is highly beneficial not only to the individual farmer but to the nation as a whole.

This paper highlights certain constraints to the implementation of IPC for insect pests in rice with particular emphasis on the current situation in Peninsular Malaysia.

Current developmental constraints

There are several constraints to the full implementation of IPC for insect pests in rice on a national scale.

1 Research

Although there is sufficient core information on various ecological, sampling, and control aspects of the various rice pests, large gaps exist in our complete understanding of the complexities of the rice agro-ecosystem. In particular, we do not have full quantitative information on the role of the various local natural enemies and their ecological relationships with their hosts. Precise yield loss data to determine the Economic Injury Levels (EIL's) and Tentative Economic Thresholds (TET's) in relation to plant stage is also lacking. Refinements have to be continually made with regard to

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chemical usage, sampling and surveillance methods. Meteorological data, useful cultural practices, new sources of plant resistance, and screening methods have to be continually examined and evaluated.

2 Surveillance and forecasting

Pest Forecasting and Surveillance Centres in the major rice-growing areas of Peninsular Malaysia (Kedah, Perlis, Penang, Perak, Selangor, Trengganu and Kelantan) are being established by the Crop Protection Division of the Department of Agriculture. Initially, field counts of the major insect pests species, especially planthoppers, together with light trap, high-suspended net trap, and meteorological data are being relayed to the Crop Protection Division headquarters in Kuala Lumpur. Weekly surveys by Agricultural Technicians and trained labourers are conducted in blocks of about 4,000 ha of farmers' fields at the rate of about 5 sites/160 ha (Anon., 1979).

The application of systems science will help in identifying the inputs required for the development of EIL's and TET's and the actual model building of the pest population dynamics for forecasting purposes (Heong, 1979). A great gap exists yet between theory and practice since this is a very new area of research in Malaysia.

3 Training

Both the Department of Agriculture and MARDI conduct training courses. MARDI caters to mainly technical staff while the Department of Agriculture is presently training its technicians and labourers. The main objectives are to

- sharpen the participants' skills at the identification of insect pest species, their damage symptoms, and their natural enemies.
- provide them with sampling techniques for estimating pest abundance in the field.
- introduce the concept of IPC.

It is hoped that they will form the core of a pool of trained field staff who will be actively involved in the transfer of the IPC technology to the farmer.

4 Control measures

An effective control system must be able to function at short notice and is especially valuable in curtailing small trouble spots in order to prevent a widespread outbreak. The recent planthopper outbreaks in Malaysia have geared up this control system for chemical application in several locations with regard to manpower, chemical supply, application equipment, transport and communication facilities, but the point is made that in other areas where these components of a control system are lacking or inadequate, this could pose a serious constraint to the success of the IPC programme.

5 Social and economic constraints

Afifuddin (1980) and Mohd. Yusof *et al.* (1980) have elaborated on the social and economic constraints facing the Malaysia rice farmer. These very real and important constraints must be appreciated and overcome before an IPC programme can be successfully implemented.

With regard to the chemical pesticide subsidies now provided to the farmer, most of the implementing agencies do not hand out insecticides for prophylatic application but the subsidies are kept for use only when a pest build-up is imminent or outbreak occurs. Otherwise, the prophylatic insecticide applications would work against the proper implementation of IPC which employs chemical application on a treat-when-necessary basis.

Agencies involved and their respective roles

The two agencies presently involved in the development of IPC are MARDI and the Department of Agriculture. The Crop Protection scientists from the Rice Branch and Crop Protection Branch (Basic Sciences) of MARDI work closely and conduct research to generate various component information for building an IPC programme. The Department of Agriculture is responsible for

demonstrating and extending the IPC programme to the farmers as well as for the smooth running of surveillance systems in the various paddy-growing areas. In addition, should treatment be necessary, the Department of Agriculture organizes and coordinates the control actions by the farmers, jointly with the various State implementing agencies and farmers' organizations. This type of inter-agency involvement and cooperation is necessary in the implementation of IPC programmes and was successfully utilized in combatting the planthopper outbreaks in the Tanjong Karang and MUDA irrigation schemes. The first alerts of potential build-up came from surveillance data compiled by the Department of Agriculture. Analysis of the data with MARDI resulted in decisions as to whether to continue or increase surveillance or to initiate control measures. In the case of chemical applications, recommendations of effective chemicals and application methods have come from MARDI's research findings. The actual control programmes were coordinated by the Department of Agriculture together with State implementing agencies, and various chemical companies helped ensure a steady supply of chemicals when required.

Current developments in integrated pest control for paddy insect pests in Penisular Malaysia

Heong (1977a) proposed a management programme for paddy insect pests in Malaysia with TET's for each pest species. He also called for a country-wide surveillance system for the early detection of pest build-up as a requisite for any IPC programme (Heong, 1977b). Recently, a Task Force Committee comprising Crop Protection scientists from MARDI and the Department of Agriculture has drawn up a project proposal for IPC for rice in Malaysia, in which a tentative IPC programme was prepared for insect pests and diseases, with the intention of incorporating rats and weeds later on. At each crop stage, the probable insect pests are listed with the technique for their sampling, TET, and recommended control. Remarks on cultural control and natural enemies are given. One of the objectives of the proposal is to compare the application of this tentative IPC programme against existing farmer practices in about 2 ha plots in Tanjong Karang and the Kedah and Perlis areas (Anon., 1980).

One such comparison has been made in the Sungai Petani area of Kedah during the second cropping season (main season) 1979. Besides the Farmers's Practice and IPC plots, a third plot was treated prophylactically with two sprays in the nursery stage and four sprays after transplanting—two for stem borers, one for brown planthopper, and one for *Leptocorisa*. The farmers' variety Padi Seratus Hari was planted throughout and a common fertilizer rate was provided by the Department of Agriculture. Weekly counts of insects or insect damage were made visually and egg parasitism by *Anagrus* was monitored by exposing brown planthopper eggs in the field. The counts in the IPC plot showed that there was no necessity to apply insecticides against any of the major insect pests as they did not exceed their specified TET's. No applications were made in the 'Farmer's Practice' plot either. In general, the insect counts were very low probably due to the prevalent drought conditions during the crop period.

Stem borer damage was low and it was interesting to note that a proportion of the white heads that occurred were the result of physiological stress from the drought. Whorl maggot damage was obvious but below the TET of 10% leaf damage. The planthopper counts were also very low and *Leptocorisa* was almost absent. Among the natural enemies, the spider population was clearly dominant and *Cyrtorhinus*, *Paederus*, coccinellids, and carabids were insignificant. Egg parasitism by *Anagrus* was high and could be found as early as the nursery stage. Tables 1a, 1b, and 1c show some of the results from these plots.

The yields from the different plots could have varied due to the following factors which could have been more important in determining yield rather than the insect pest population for that season.

The planting distance in each plot showed great variation. Contract labour had been used for transplanting.

There could have been variations in the soil conditions although the 3 plots were within the same general area. The farmer owning the IPC plot had complained of acid conditions in his field.

Table 1a Comparing different treatments for paddy insect pests in farmers' fields, Sungai Petani, Kedah, Peninsular Malaysia, Second Crop (Main season) 1979: Size of plots, planting density, and yield

	Plot	Size (ha)	Planting density* (No. plants/sq. m)	Yield* (kg/ha)
1.	Farmer's Practice	0.54	16.8	4393
2.	IPC	0.34	13.2	2260
3.	Prophylatic Treatment	0.39	15.2	2780

* Average from 5 x 1 sq. m plots.

Table 1b Comparing different treatments for paddy insect pests in farmers' fields, Sungai Petani, Kedah, Peninsular Malaysia, Second Crop (Main season) 1979: Whorl maggot and stem borer damage

	Plot	% leaves damaged by whorl maggot** (28DAT*)	Stem borer damage***		
			% Dead hearts (23DAT*)	(35DAT*)	% White heads at harvest, adjusted for effects of drought
1.	Farmer's Practice	7.64	0.76	1.17	1.46
2.	IPC	7.49	0.44	0.92	1.26
3.	Prophylatic Treatment	6.58	5.13	1.73	1.57

* DAT = Days after transplanting

** Average from 100 hills

*** Average from 25 hills

The drought that season may have had different effects on the plots due to differences in the water tables.

At any rate, it was interesting to note that it was possible to apply the tentative IPC programme under farmers' conditions and that there was no necessity to apply insecticides since the pest numbers did not exceed their TET's.

The importance of natural enemies especially spiders and egg parasitism by *Anagrus* sp. parallel other observations in a farmer's field in Province Wellesley in the first crop (off-season) 1979, where weekly visual counts were made of the brown planthopper *Nilaparvata lugens* and the white backed planthopper *Sogatella furcifera* and some of their natural enemies including monitoring for *Anagrus*. In that season, it appears that the abundance of the predators especially spiders and parasitism by *Anagrus* probably played the dominant role in planthopper reduction. In comparison, in the same season, elsewhere in the MUDA irrigation scheme, a predominantly white backed planthopper outbreak occurred over 21,492 ha. It was observed that initially, the natural enemy count was very low in those areas (MARDI, 1980).

Future trials along similar lines to test the tentative IPC programme will provide further information as to whether the programme is suitable or not. There may be regional differences which only on-farm testing can bring out. In which case, suitable modifications to the programme can be made and the programme retested until it is found to be satisfactory. From that point, the various implementing agencies can extend and spread the successful programme to farmers over large areas. It is anticipated that there will be continual reviewing and up-dating of the IPC programme from research findings and feedback from project evaluation.

Table 1c Comparing different treatments for paddy insect pest control in farmer's fields, Sungai Petani, Kedah, Peninsular Malaysia, Second Crop (Main Season) 1979: Weekly counts of *Nilaparvata lugens, Sogatella furcifera,* spiders, and % parasitism by *Anagrus* sp.

Weeks after transplanting	*N. lugens**			*S. furcifera**			Spiders*			% parasitism by *Anagrus* sp.**		
	1	2	3	1	2	3	1	2	3	1	2	3
1	–	–	–	–	–	–	–	–	–	14	35	20
2	0	1	0	1	0	0	2	5	4	5	3	13
3	5	0	0	2	3	4	24	2	23	46	22	23
4	0	0	0	0	0	0	5	9	7	21	13	7
5	1	0	0	9	1	0	5	11	9	45	32	44
6	1	1	0	0	0	0	5	11	4	31	54	41
7	4	5	5	9	9	9	25	31	37	28	34	45
8	1	1	2	0	1	1	2	8	13	32	39	38
9	0	0	0	0	0	0	4	2	4	57	63	38
10	0	0	0	0	0	0	5	7	7	14	0	23
11	0	0	0	0	0	0	7	9	8	15	21	22

* Counts for 25 hills/plot

** Monitored by exposing *N. lugens* eggs in the field.

1 = Farmer's Practice plot

2 = IPC plot

3 = Prophylatic treatment plot

Conclusion

It may be many years still before an IPC programme for paddy insect pests can be successfully implemented on a national scale in Malaysia. There are many problems to be surmounted in the process of the development and implementation of the programme. However, the awareness of these problems has led to positive steps being taken to overcome them. Active research in the various components of an IPC programme is being carried out and an effective surveillance system is beginning to be operative in some areas. Training of all levels of staff involved with IPC is being conducted, and the testing of a tentative IPC programme for paddy insect pests shows that it is possible to apply the programme under farmers' conditions. It is expected that several changes and improvements can still be added to the existing programme. This reflects the inherent dynamic nature of IPC to even better manage the various paddy insect pests and thus serve the vital roles of increasing national production and protecting the income of the paddy farmer.

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Discussion

A. Otake, (Japan): I believe that the artificial setting of planthopper eggs in the field is a useful measure for monitoring the activity of egg parasites. However the results of the monitoring do not necessarily parallel the fluctuations in the intensity of natural parasitism in the field in the case of egg parasites.

Answer: Thank you for your comment. We are aware of the shortcomings of this method as we sometimes do not know the percentage of sterile or unhatched eggs or the level of egg predation by *Cyrtorhinus*. However, until we have more staff, this method is still very useful for the time being as it gives us an indication of the actual field situation with respect to the pest population and activity.