TRENDS OF AND DAMAGES CAUSED BY SOME RICE DISEASES IN MAJOR IRRIGATION SCHEMES OF PENINSULAR MALAYSIA

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ABSTRACT

All major rice-growing areas of peninsular Malaysia have disease problems which are related to poor water control and associated rice cropping practices. Generally, all the schemes experience low seasonal incidences of rice blast, bacterial blight and sheath blight. But recent epidemics of Penyakit Merah or tungro have emphasized the importance of the disease incurring losses amounting to $US3.7 million in the Muda Irrigation Scheme in 1983 alone.

Control measures developed to date include host-plant resistance, chemical control and appropriate cultural management. Surveillance programs for timely forecasting and control of epidemics have been implemented. Despite all these measures, outbreaks continue to occur.

Introduction

Rice cultivation has been and is still an important activity in the Malaysian economy. Besides being a strategic commodity it also provides employment to no less than 150,000 farm families. Efforts to increase the production of rice are concentrated in the granary areas of Barat Laut Selangor, Kerian/Sg. Manik, Muda, Seberang Perai, Kemubu, Besut, Seberang Perak and Kemasin/Semarak (Fig. 1) which have been provided with sufficient infrastructure to enable the planting of two crops a year. Previous commendable achievements in rice production were more related to the increase in the planted acreage brought about by off-season cropping. However, since the mid-1970s the production situation and trends have been erratic and unstable. This general production instability has been due partly to the series of outbreaks, of pests and diseases.

Rice diseases that are of concern to us are the Penyakit Merah Virus disease (PMV) or tungro caused by a complex of bacilliform and spherical particle types (Saito *et al.*, 1975), rice blast caused by *Pyricularia oryzae*, leaf blight caused by *Xanthomonas oryzae* and sheath blight caused by *Thanatephorus oryzae*. At times they can be devastating and causing substantial yield losses. This paper reports the status of these diseases in selected granary areas in peninsular Malaysia and how they are managed to keep below level of epidemics.

Trend of disease occurrence and crop losses

Since 1981 rice in the major granary areas has been either directly sown onto the main fields or transplanted using seedlings from nurseries prepared in advance. During the period between 1981-1987, annually 20,000 to 30,000 ha of rice crops were damaged by pests and diseases excluding weeds. During the same period (1981-1987) a total of 55,042 ha was damaged by rice diseases alone, accounting for about 27% of the total area damaged by all pests (Table 1). Attacks by PMV were the most serious but those by other plant pathogens altogether had remained below 1,000 ha. The PMV epidemics started in 1981, with the granary areas of Muda, Kerian and Seberang Perai being the worst hit.

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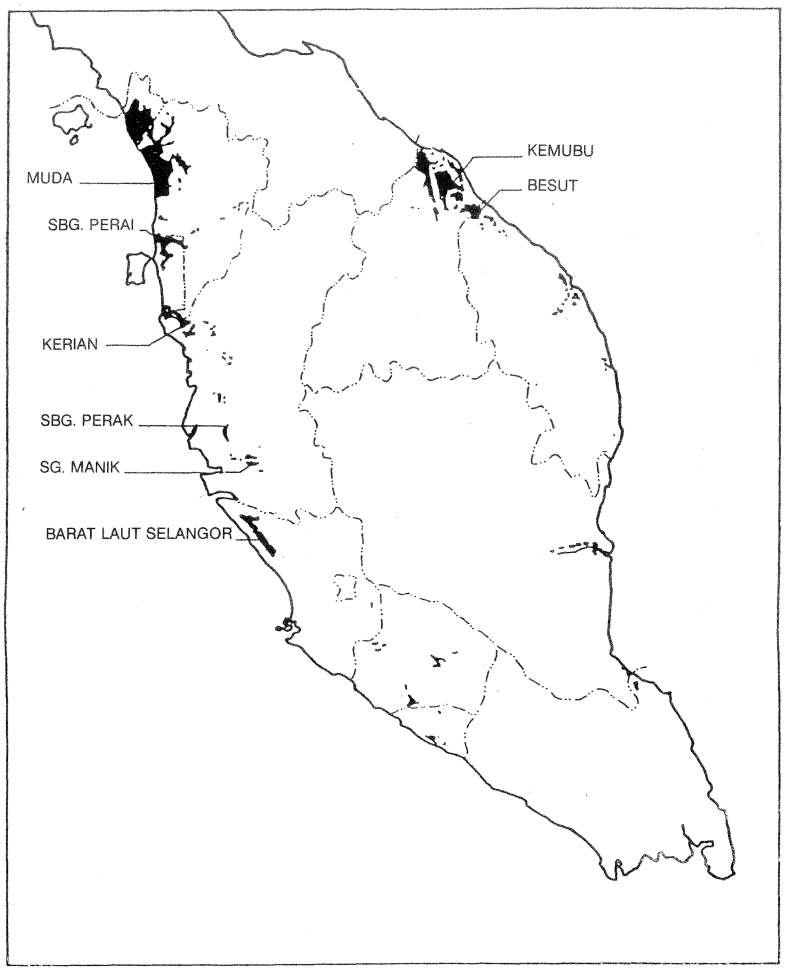

Fig. 1 Granary areas in Peninsular Malaysia.

Table 1 Extent of pest attacks in Peninsular Malaysia between 1981 to 1987 (ha)

Year	Insect Pests	PMV	Rats	Other diseases	Total area
1981	16,675	12,734	1,352	NA	30,761
1982	21,552	17,507	1,514	NA	40,573
1983	18,724	16,986	1,246	910	37,866
1984	20,208	3,133	6,743	668	30,752
1985	7,481	964	3,146	900	12,491
1986	21,141	328	3,107	380	24,956
1987	23,259	204	3,711	328	27,502
Total	129,040(63.0%)	51,856(25.3%)	20,019(10.1%)	3186(1.6%)	204,901

Source: Department of Agriculture.

Table 2 Occurrence of rice diseases in the Muda and Kerian Irrigation Schemes (1981-1985)

	Area affected (ha)[2]										
	1981		1982		1983		1984		1985		Total
	I[b]	II[c]	I	II	I	II	I	II	I	II	
Kerian (24,000 ha)											
1. PMV	66	2,251	1,631	310	1,615	997	735	78	108	30	7,816
2. Other diseases (rice blast, leaf blight and sheath blight)	-	-	-	-	-	-	-	-	-	-	-
Muda (96,000ha)											
1. PMV	5,870	14	5,570	269	8,460	197	436	64	93	1	20,973
2. Rice blast	-	285	-	172	-	44(25)[d]	57	152(29)	58	66(15)	834
3. Leaf blight	-	-	-	-	10	11	9	67	64	29	190
4. Sheath blight	-	-	-	-	3	-	-	-	-	26	19

Source : Department of Agriculture
I[b] : Off-season
II[c] : Main season
( )[d] : Figure in bracket indicating neck blast

The trend of occurrence of rice diseases for the period, 1981-1985, for the Muda and Kerian Irrigation Schemes which are the two large schemes devoted to double cropping is presented in Table 2. PMV was the most important disease, occurring from year to year and it appeared to be epidemic to the Kerian region. The disease frequently reaches epidemic levels and a devastating outbreak occurred in 1969 (Lim, 1972). During the same period there were no damages caused by other diseases.

In the Muda region the occurrence of PMV was first recorded in the 1981 off-season crop. Since then, epidemics have developed in off-season crops of subsequent years until the end of 1985 when it came under control. The outbreaks were less serious in the main seasons. Other diseases of importance which occurred sporadically from time to time were rice blast, leaf blight and sheath blight. Occasionally, under favourable weather conditions rice neck blast would become serious, whereas, leaf blight seldom occurred at early crop stages.

The PMV epidemics in the Muda region have caused substantial crop losses from 1981 to 1983 (Table 3). Based on yield differentials associated with the stages of the crops and the acreage attacked, the total loss was estimated at around 36,372 MT. The epidemics of off-season 1983 caused the highest loss in crop yield amounting to 15,482 MT of padi valued at M$10.2 million (or US$3.7 million).

The PMV damaged area of the main season crops of 1985 in the Muda area also experienced attacks of rodents, brown planthoppers, *Scotinophora, Leptocorisa* and leaf blight. Under such circumstances, it is difficult to apportion losses to each single cause.

Table 3 Economic loss due to PMV epidemics in the Muda Irrigation Scheme (1981-1983)

Year	Crop	Estimated grain loss (m.t)*	Value of loss** (in million)	
			M$	US$
1981	Off-season	5,617	3.7	3.6
	Main season	+	-	-
1982	Off-season	15,024	9.9	3.6
	Main season	249	0.3	0.1
1983	Off-season	15,482	10.2	3.7
	Main season	++	-	-
	Total	36,372	24.1	8.8

* Comparison is made to the average yield of off-season 1980 å 4.5 t/ha which did not experience epidemic of PMV

** Price of padi sold å M$660.50/m.t

+ All 14 ha affected had losses in yield less than 25% and considered not serious

++ Area also affected by rodents, brown plant hoppers, *Scotinophora, Leptocorisa* and leaf blight

Factors associated with outbreaks of diseases

The outbreaks of diseases were found to occur when the same variety had been continuously planted from season to season and its planting had extended over a larger area of the rice-growing region. Factors considered important in the epidemics of rice diseases are (1) varietal susceptibility to the disease, (2) availability of inoculum sources, (3) suitable environment, and (4) availability of vector species and their transmitting ability, in the case of PMV.

Outbreaks of PMV in Peninsular Malaysia have been attributed to changes in crop production

practices related to the intensification of rice cultivation; multi-rice cropping, staggered planting and extensive cultivation of susceptible varieties (Lim 1972; Lim *et al.*, 1974, Sogara, 1976; Inoue and Ruay-aree, 1977). When there was an outbreak of PMV in 1982, an estimated 62% of the Muda region was planted with the susceptible varieties of Seribu Gantang and Anak Dara (Supaad *et al.*, 1987). Rainfall in the off-season had made transplanting or sowing less depndent on irrigation water, thus allowing farmers to plant over a longer period. Prolonged availability of susceptible stages of these varieties to virus infestation caused by asynchronous cropping pattern coupled with vector abundance is believed to have led to the outbreak.

Methods of control

Epidemics of rice diseases are prevented from occurring, mainly through the use of resistant varieties, by cultural practices and through the proper use of chemicals. Regular feedback of disease status on farms would enable to detect possible outbreaks and prompt control measures initiated against them.

1 Plant resistance

Varieties resistant to these diseases are encouraged for planting to suppress damage to rice crops. Their use in the rice production system is known to reduce the production cost incurred by individual farmers, and furthermore it is compatible with most control methods adopted. For example, the use of resistant varieties has reduced extensive and severe occurrence of rice blast, PMV and leaf blight. Varieties like IR 42, MR 71 and MR 77 were used to check the spread of PMV, and since the end of 1985 it has come under control in the Muda area. However, under certain circumstances, the causal organisms can adapt fast to new varieties making them susceptible. In order to sustain their on-farm durability other methods of control have to be jointly considered.

2 Cultural practices

In some instances, suitable cultural practices implemented on an area-wide basis have provided good control, including destruction and burning of crop residues after harvest, leaving the land fallow during the dry period, changing varieties between seasons, synchronization of planting and encouraging the planting of a number of varieties in a rice-growing region.

3 Chemical control

Chemicals are also used, particularly to bring under control major pest epidemics. Use of chemicals aims more at the control of insect pests and rice field weeds than at the control of the disease. The chemicals are used by farmers when the pest becomes obvious and the pesticides are available. The decision to use the chemicals is very much dependent on the farmer experience and to some extent on the advice given by the local agricultural technicians as indicated through pest records obtained through the pest surveillance system.

4 Surveillance system

This system has been set up in all the granary areas with the objective of monitoring the pest status and at the same time to warn farmers of possible outbreaks so that they can take appropriate control measures. This involves regular collections of light trap catches, field scouting to detect occurrences of diseases and other major pests, and the use of various techniques including mobile nurseries to detect changes in pest situations. In spite of all these information gatherings and analysis, diseases and other pests do build up, from time to time to outbreak situations.

Conclusion

In an attempt to increase the national rice production through the increase of yields and double

cropping in existing granary areas, increased pest problem can be anticipated. Efforts to stabilize yields and production are underway and these involve the use of resistant varieties, monitoring of pests and diseases, proper water control and adoption of appropriate cultural practices. The introduction of a scheme-wide "fallow" period as was carried out in the Muda region is another way of breaking the vicious cycles of pests and diseases, and also of improving water control. The success of the control strategies in the overall crop management system depends very much on close cooperation among the implementing agencies and active participation by the farmers.

References

1) Inoue, H. and Ruay - Aree, S. (1977): Bionomics of green rice leafhoppers and epidemics of yellow orange leaf virus disease in Thailand. *In*: Proc. Symp. on Virus Diseases of Tropical Crops, 1976. Tropical Agriculture Research, No 10. pp. 117-121.
2) Lim, G.S. (1972): Studies on Penyakit Merah disease of rice III. Factors contributing to an epidemic in North Krian, Malaysia. Malays. Agric. J., 48, 278-294.
3) Lim, G.S., Ting, W.P. and Heong, K.L. (1974): Epidemiological studies on tungro virus in Malaysia. Malaysian Agr. Res. Dec. Inst. MARDI Rep. 21, 12pp
4) Saito, Y., Roeghan, Tantera, D.M. and Iwaki, M. (1975): Small bacilliform particles associated with penyakit habang (tungro-like) disease of rice in Indonesia. Phytopathol., 65, 793-76.
5) Sogara, K. (1976): Rice tungro virus and its vectors in tropical Asia. Rev. Plant Prot., 9, 21-46.
6) Supaad, M.A., Chang, P.M. and Azmi, M. (1986): Pests and diseases of rice in Malaysia—Diversity, trend and their management. *In*: Proc. Natn. Rice Conf. 1986, Unit Percetakan MARDI, Serdang, Malaysia. pp. 179-194.

Discussion

Haware, M.P. (ICARDA): I would like to know the method used in your studies for the estimation of losses due to diseases in the field.

Answer: The data presented referred to loss estimation due to tungro. They were derived based on yield differentials associated with the total affected acreage for each damage classification in keeping in mind that the infection taking place in early growth stages resulted in higher yield loss. The data were then compared to the average yield obtained in 1980, i.e. 4.5 t/ha before the tungro epidemics were recorded. Fields with yield losses less than 25% were not considered in accounting for total loss of the season. Practically the calculation was performed as follows: aggregation of loss classified as 100% when all the plants in the field are infected in the early stage of growth (no yield at all) × total acreage under category × 4.5 t/ha in the season before the occurrence of the disease.

Uritani, I. (Japan): 1. Did you observe that irrigation contributed to the reduction of tungro epidemics? Also is upland rice affected with tungro compared with irrigated rice? 2. Is there any difference in the severity of tungro disease between East and Peninsular Malaysia corresponding to the differences in the climate conditions between the two regions?

Answer: 1. I do not have records of tungro infection on upland rice (10,000 ha in Peninsular Malaysia and 40,000 ha in East Malaysia) but I presume that there would not be any difference if favorable factors for infection were present. The effect of irrigation can not be easily evaluated as the cropping schedule is not being rigidly followed by the farmers. Moreover the farmers cultivate susceptible varieties to tungro (Seribu Gantang and Anak Dara). On the other hand rainfall in the off-season has made transplanting or sowing less dependent on irrigation water thus allowing the farmers to plant over a longer period. To conclude, prolonged availability of susceptible stages of these varieties to virus infection caused by asynchronous cropping pattern coupled with vector abundance may have led to the outbreaks observed in 1982. 2. The severity of infection would remain the same but the extent of the

affected areas may differ between seasons. In the present case there were more areas affected in the off-season than in the main season.