CONTROL OF RICE PESTS AND DISEASES IN THE MUDA IRRIGATION SCHEME

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ABSTRACT

The promotion of double cropping and associated increase in cropping intensity, the introduction and adoption of nitrogen-responsive varieties, increased application and quantities of fertilizer, have contributed to the increase of padi yield and production. In addition, the introduction of direct seeding as a cultivation technique characterized by a greater plant density and dense canopy has resulted in the creation of an environment conducive to pest and disease build-up affecting and destabilizing padi production. Strategies for pest and disease control adopted combine the Integrated Pest Management system which emphasizes the importance of the use of resistant varieties, the judicious use of agro-chemicals, pest surveillance and forecasting, rescheduling of planting activities to utilize fully the prevailing weather conditions peculiar to the scheme area, and the continuous training of and demonstrations to farmers of the virtues of acceptance and adherence to concerted efforts in pest control. Farmer acceptance and knowledge have been greatly enhanced and the pest control strategies implemented have begun to show results.

The Muda Irrigation Scheme

The Muda Irrigation Scheme on the coastal plains of the States of Kedah and Perlis is Malaysia's largest irrigation project for padi, covering an area of 96,000 hectares of padi land. The Kedah and Perlis plains have been a traditional rice-growing area and under rainfed conditions have been under a single crop of padi using traditional varieties. The soil is marine alluvial with pockets of fairly acidic areas.

The introduction of irrigation facilities and infrastructure enabled the Muda Scheme area to be double-cropped starting in 1970. The principal physical components of the Muda Scheme consist of: (a) The construction of two dams-the Muda and Pedu Dams which possess a total maximum storage capacity of 1 million acre feet of water; (b) The construction of a main conveyance canal 116 km long; (c) The provision of an internal network system which is made up of 970 km of secondary distribution canals and 870 km of secondary drains and; (d) The provision of a system of coastal embankment and burrow pits stretching some 96 km along the coastline of the Muda Scheme.

With the completion of the above physical components, the intensity of irrigation facilities was 10 m/ha which proved to be inadequate. Subsequently programs have been implemented in stages to increase the irrigation intensity to around 30 m/ha to enable land lots to have direct access to irrigation canals as well as drains. This phase of development entails the provision of tertiary infrastructure to provide a more efficient water control, hence higher crop yield and intensification of agriculture. The Muda Scheme supports 63,000 farm families with an average holding of 1.6 hectares.

Cropping and crop yields

Double cropping of padi in the Muda Area started in phases in 1970 with nearly half the area being double-cropped. Additional areas were subsequently added in phases and by 1974 full

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double cropping was achieved. Through the provision of irrigation infrastructure coupled with a very well coordinated and extensive extension program, cropping intensity has been maintained at around 190% except for fluctuations for some of the years.

Yields also increased compared to pre-project periods. Pre-project average yields stood at around 3.2 t/ha. In 1970 the recorded average yield was 3.7 t/ha which rose steadily to a record 4.7 tons in 1976. Except for certain years the average yield revolved around 4.4 tons, thus the total padi production from the Muda Area amounted to more than 800,000 tons which accounted for almost half of Peninsular Malaysia's total rice production. Data on cropping and crop yields are shown in Fig. 1.

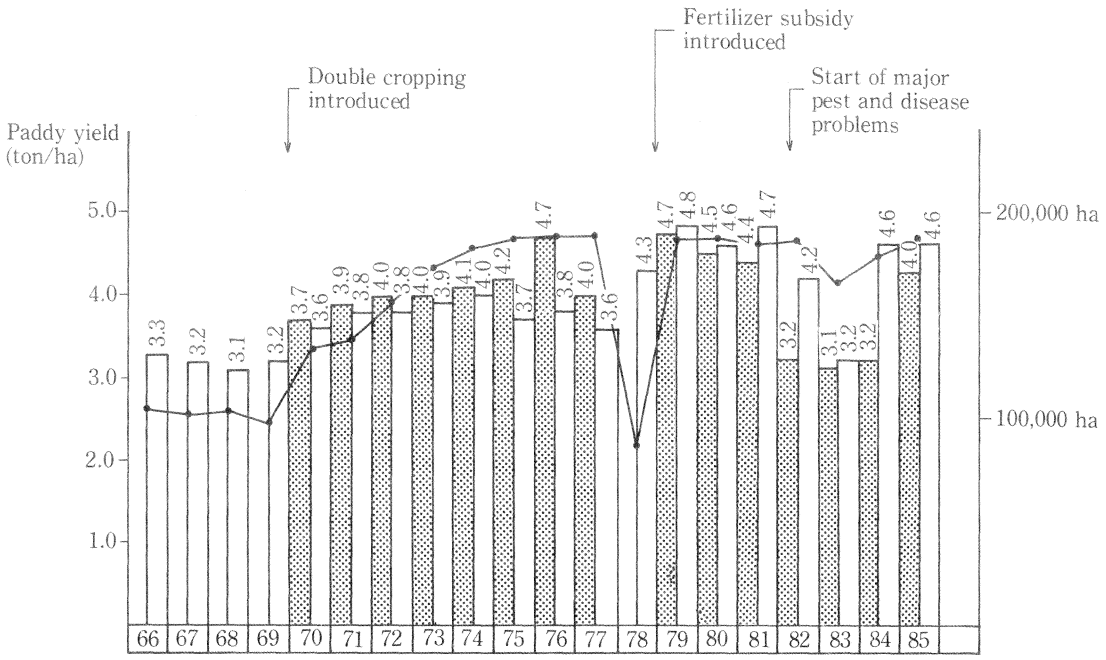

Fig. 1 Record of paddy yield and annual cropped area in Muda.

The intensification of rice cultivation through the increase of the cropping intensity, the introduction and adoption of nitrogen-responsive varieties and the application of increasing quantities of fertilizer have contributed to increase yields as discussed above. Recently in response to the labor shortage and rising transplanting costs, Muda farmers have resorted to direct seeding. The padi area under this crop establishment technique spread over the last few seasons and to date a little more than 50% of the total area is direct-seeded. Direct-seeded fields are characterized by greater plant density, and therefore a denser canopy. The above-mentioned factors have created an environment more conducive and prone to pests and diseases. This paper attempts to focus on the pests and diseases of padi plants and efforts to control and contain them in order to have a more stable rice production environment in the Muda Area.

Status of pests and diseases

Prior to 1979 occurrences of insect pests and diseases, rodent attacks had been limited and scattered. However a major pest problem surfaced in 1979 with the outbreak and attack of the brown planthopper (*Nilaparvata lugens*) and white-back planthopper (*Sogatella furcifera*). Since then these pests and diseases have been endemic in the Muda Area waiting for the right time and environment to spread. Table 1 indicates the extent of padi areas affected by the major rice pests and diseases. In 1979 more than 21,000 hectares of padi land had been affected and infected with the brown planthopper and white-back planthopper in varying degree of seriousness. Subsequent outbreaks occurred in 1981, 1982 and 1983 with large areas affected, causing extensive damage and resultant crop losses. In addition, the serious outbreak of tungro disease (PMV) vectored by green leafhoppers (*Nephotettix virescens*) in 1981, 1982 and 1983 caused a heavy toll on the padi crop. In 1981 and 1982, more than 5,800 hectares were affected, with an increase to 8,600 hectares in 1983. At the same time rodents especially *Rattus argentiventer* became another source of nuisance, causing damage to the padi plants. Other pests that appeared from time to time depending on the weather conditions were *Scotinophara coarctata, Nezara viridula, Leptocorisa* spp., other stemborers and leaf feeders. Besides these pests and diseases, another recent phenomenon which caused a great deal of concern was the spread of a certain type of weeds. This infestation is more prevalent in direct-seeded areas and a major contributory factor is the use of combine harvesters. The more rampant weeds include the *Echinochloa* spp., *Leptochloa chinensis, Marsilea crenata* and *Sphenoclea zeylanica,* while obnoxious weeds such as *Salvinia molesta* and *Salvinia cuccalata* began to appear in irrigation canals and drains. Field surveys indicate that crop losses ranged from 20% - 70% in fields infested. Crop damage inflicted by these pests and diseases was the main cause of unstable yields and hence production in the Muda Area during the last few years and has been a cause of concern to the planners and implementors alike.

Table 1 Status of major pest outbreaks in the Muda Area (hectares) (1979 - 1985)

Year	PMV	BPH/WBPH	Rodents	*Scotinophara coarctata*
1979	-	21,492	156	-
1980	-	668	547	-
1981	5,884	615	2,633	-
1982	5,839	7,761	100	-
1983	8,655	11,874	1,116	553
1984	499	1,006	6,794	2,366
1985	94	2,092	883	129

Factors contributing to pest and disease build-up

As indicated previously, the low canal and drain density of 10 m/ha results in inadequate water distribution. To overcome this problem, staggered planting was adopted. Besides, the occurrence of water shortage in certain years causing delayed planting resulted in vulnerable growth stages of padi coinciding with peaks of pest population, which promoted pest build-up. The adoption of direct seeding and volunteer seedlings to overcome rising costs and labor shortage results in (a) dense crop canopy and a microclimate conducive to pest multiplication, (b) difficult field access hindering early detection of pest build-up, (c) difficult field access and

thick canopy minimizing the effectiveness and efficiency of pesticide application. Furthermore, most of the common varieties planted by the farmers are susceptible to tungro and the brown planthopper. Combine harvesting of fields helps spreading weed seeds from one field to another and this in turn brings about the growth of weeds which provide alternate hosts to some insect pests.

Other factors include: (a) Increased density of bunds for canals and drains which if poorly maintained, provide breeding grounds for rodents; (b) The preference for curative rather than preventive measures among farmers for pest control; (c) The overdependence on Government pest control action; (d) The existence of non-resident farmers within a farming locality or village and the individualistic attitude of farmers in pesticide application; (e) Lack of cash for pesticide purchase which results in under-dosage of pesticide application.

Control measures

Pest and disease problems have been the cause of serious concern in MADA as well as nationally and before these problems grow out of control, effective control measures should be developed and implemented. The Muda Agricultural Development Authority (MADA) embarked on a very stringent course of action, to overcome these problems. Concepts of pest control were thoroughly discussed with various relevant agencies and departments. The innovative approach of Integrated Pest Management (IPM) has been adopted as the best approach to minimize pest attacks and crop damage. Integrated Pest Management places emphasis on the importance of the use of resistant varieties and the judicious use of agro-chemicals. For the successful implementation of IPM a very well coordinated pest surveillance and forecasting system to determine action thresholds must also be established. This choice of strategy in pest management is the result of MADA's concern over the undesirable problems of over-dependence on pesticides and their improper usage.

The Agriculture Division of MADA has been entrusted with ensuring the success of this strategy. To assist, supplement and complement this program a Regional Crop Protection Committee was set up to monitor the pest situation, to formulate action-oriented strategies and to tackle pressing pest problems which require prompt control action. Its members include an entomologist, pathologist and weed scientist from the Malaysian Agriculture Research Development Institute (MARDI), the pest surveillance and forecasting staff from the Crop Protection Branch of the Federal Department of Agriculture, the Kedah and Perlis State Agriculture Staff, the subject matter specialists for crop protection from the Division of Agriculture of MADA. This committee reviews fortnightly the pest and disease status for the Muda Area as well as that of the States of Kedah and Perlis based on results from net traps, light traps, field scoutings as well as feed-back information from farmers.

By far the best strategy adopted was the decision to reschedule the padi planting activity in 1983 in order to make use of the prevailing weather conditions peculiar to this part of Kedah and Perlis States, i.e. the existence of a marked dry weather in the months of January, February and March. In early 1983, MADA decided that the water supply for irrigation would be terminated in mid-January 1984 over the entire Muda Scheme and henceforth no water would be supplied for cropping in January and February, thus forcing a complete simultaneous and crop-free fallow period of at least one month over the entire scheme. At the same time farmers are required to burn their padi straws and wherever possible dry plowing of fields is effected. The purpose of this measure is to eradicate the viral inoculum source. The added advantages of this decision are (a) improvement in cropping scheduling, (b) better and more effective conservation of water for irrigation, (c) the maintenance and improvement of the padi soil bearing capacity necessary for continuous mechanization in the Muda area, (d) the enrichment of padi soils due to mineralization.

Other pest management strategies adopted in the Muda Area include: (a) To encourage

farmers to apply herbicides to destroy ratoon and volunteer crops in tungro-infested areas. They are also advised to clear field ridges to eliminate alternate host plants, remove diseased plants by hand, burn padi straws and stubbles and to dry plow immediately after harvesting; (b) The planting of resistant varieties; (c) A program of continuous training of extension workers to sharpen their skills in the identification of pests, the recognition of symptoms and familiarization with crop protection recommendations. These measures will then be disseminated to contact farmers and to the farming population at large.

Whatever the strategies developed, success depends a great deal on the response and acceptance of the farmers. In studies by HEONG, HO and JEGATHEESAN (1985) it is heartening to note the very high degree and level of perception of and response of the farmers to the measures and strategies pursued by MADA to combat pest problems. Farmers' response to questions as to what they would do if their padi plants or their neighbors' plants were attacked by tungro or hoppers are shown in Fig. 2 and 3. Their concern for the safety of their crops is borne out by their attendance in briefings and campaigns carried out by MADA officers as shown in Fig. 4. In the briefings and campaigns, farmers were asked to carry out quite unusual agronomic practices such as the use of weedicides to kill ratoon crops, the removal of diseased

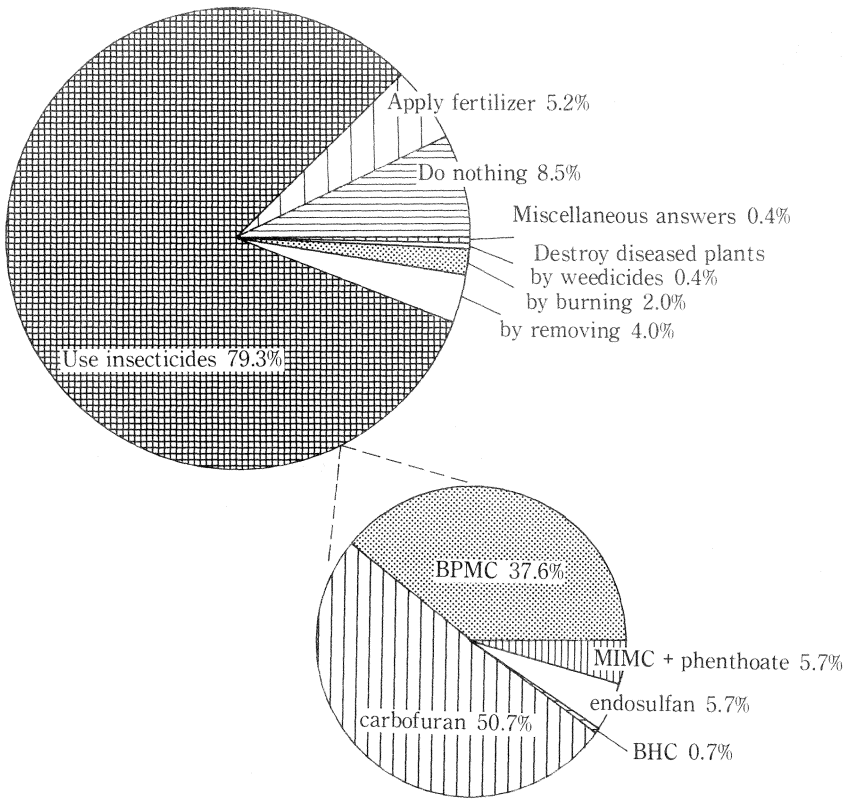

Fig. 2 What rice farmers in the Muda Irrigation Scheme would do if their crops were to be attacked by "Penyakit Merah"?

Source: MADA.

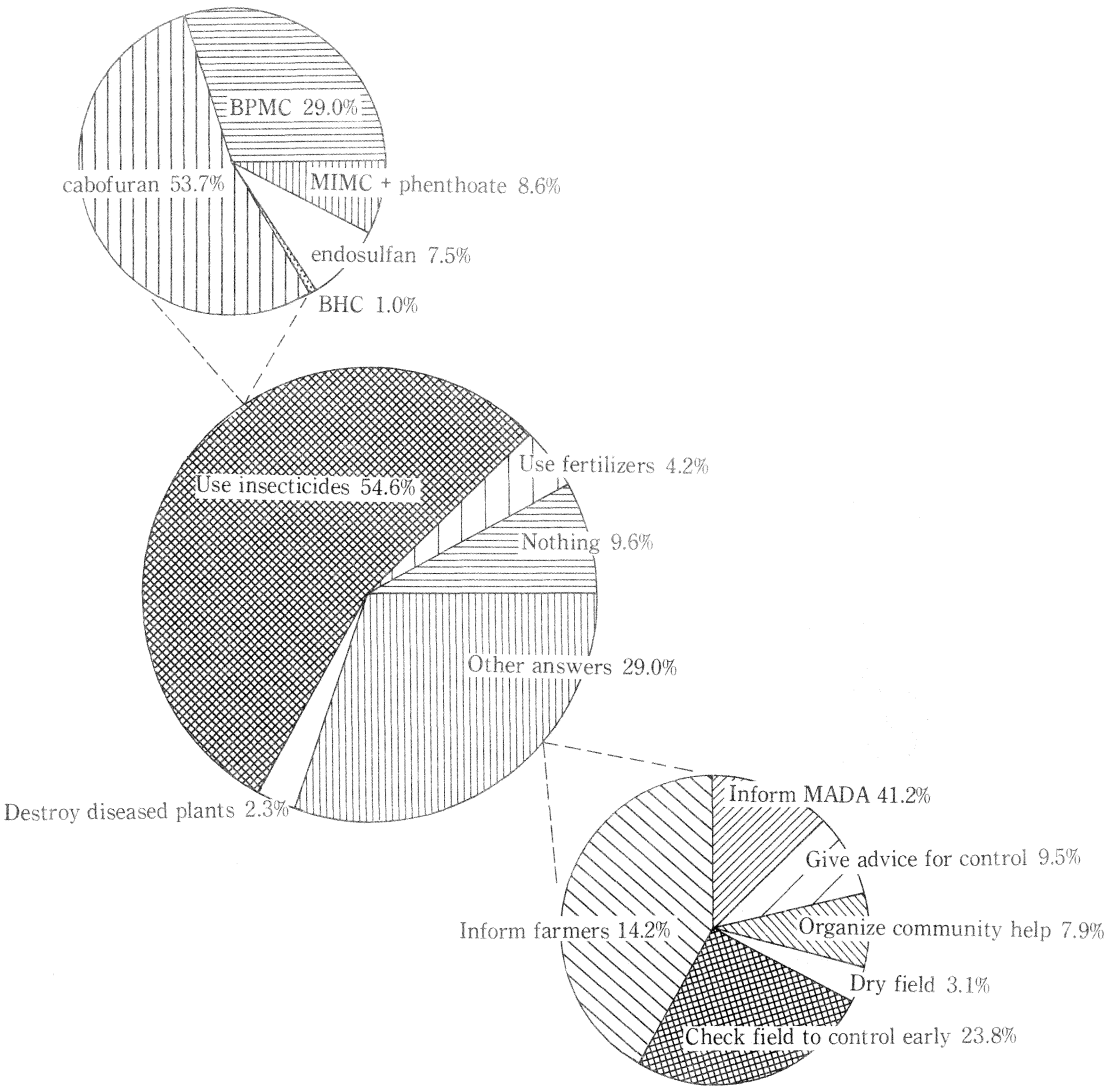

Fig. 3 What rice farmers in the Muda Irrigation Scheme would do if their neighbor's crops were to be attacked by "Penyakit Merah"?

Source: MADA.

plants by hand and dry plowing after the burning of straws. Nearly 80% of the farmers (Fig. 5) were in agreement with the control strategy proposed and adopted by MADA. This augured well for MADA, as evidenced by the reduced acreage affected by tungro, brown hopper and white-back planthoppers in 1984 and 1985, as shown in Table 1. These positive responses by the farmers together with the increasing participation of farmers in group farming have enabled to check the outbreak of pests and diseases. Group farming provides closer linkages between farmers and extension agents and their fellow farmers in the organic area of group

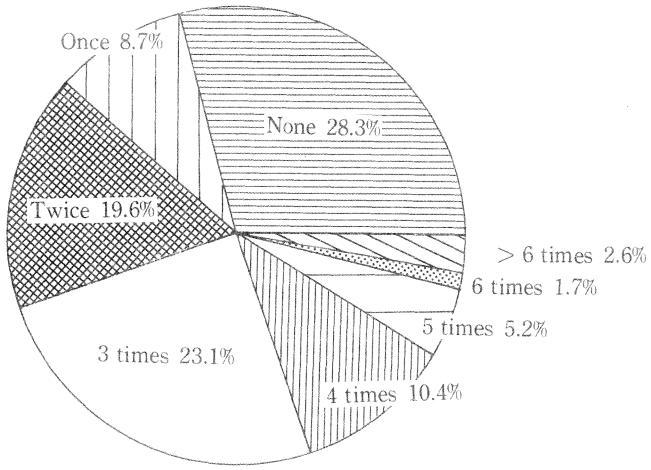

Fig. 4 Farmer attendance in the "Penyakit Merah" control campaign briefings or "Ceramah" in The Muda Irrigation Scheme.
Source: MADA.

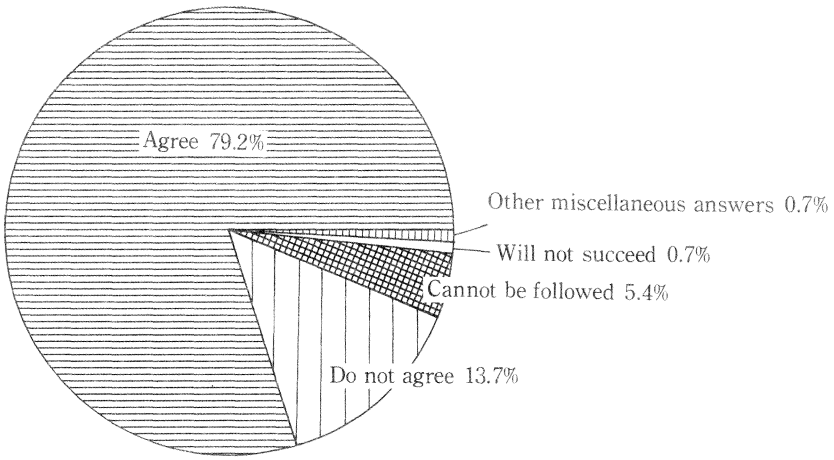

Fig. 5 Reactions of rice farmers in the Muda Irrigation Scheme to the control strategy of destroying diseased crops by burning after harvest, spraying weedicides and hand weeding.
Source: MADA.

projects and fosters closer cooperation in the fields. This provides a medium for communal efforts in crop protection works which is a very important component for the successful control of pests and diseases.

Discussion

The outbreak of pests and diseases has been the main obstacle to efforts to increase yields and production in the Muda Area. Since 1979 pests and diseases have been the main factor for unstable rice production not only in the Muda Area but also in Malaysia. The Integrated Pest Management system of control has been deemed to be more acceptable, and this together with the rescheduling of planting activities to make full use of the prevailing marked dry weather conditions in the first quarter of the year, which are peculiar to North Kedah and Perlis, has contributed to the decrease of the incidence of pests and diseases. These strategies are only half the battle and for the longer term the farmers themselves and their positive response to and acceptance of these strategies will see through the successful implementation of control measures. Existing indication is that the bulk of the farmers are responding well to these strategies and are participating in whatever programs for pest control are developed by MADA. Group farming which stresses communal efforts in crop protection works, the strict adherence to the planting schedule, and collective use of farm machinery results not only in lowering the cost of production and in increasing yields and production but also enhance the strategies adopted for the control of pests and diseases.

References

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Discussion

Soetjipto Partohardjono (Indonesia): I would like to know which herbicides are used to kill rice ratoons in paddy fields to avoid tungro disease in the Muda area. In Indonesia we recommend to spray pesticides on the rice nurseries to avoid tungro. This practice may be more economical than using herbicides.

Answer: The weedicide used is paraquat. Insecticide spray on nurseries is also carried out but the aim of using weedicides on ratoon crops is to minimize and to kill ratoon crops and other weeds that may provide a breeding ground for green leafhoppers and other insect pests. I would also like to emphasize that we do our utmost efforts to organize the farmers into cooperatives as in Indonesia.

Gour Chandra Munda (India): 1. What type of rodent species is responsible for the damage to paddy crops in the Muda area? 2. What were the favorable conditions for the outbreak of rodents which caused extensive damage to the rice crop in 1984?

Answer: 1. The major rodent species is *Rattus argentiventer*. 2. In the Muda area the conditions are always favorable for rodents to spread due to the increase in the density of the tertiary canals. In 1984 the outbreak was mainly due to less attention being paid by farmers to field hygiene and control measures. Plants such as bananas are being cultivated illegally along the canals. Moreover the rodent population exhibits fluctuations.

Abe, N. (Japan): What are the rice varieties resistant to tungro or planthoppers?

Answer: A few varieties are grown in the Muda area which are resistant to tungro disease, namely IR 42, MR 71, MR 73 and more to be released such as MR 77 and MR 84.