PROBLEMS OF IMPLEMENTATION OF INSECT PEST MANAGEMENT FOR RURAL COMMUNITIES IN INDONESIA

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Introduction

The Indonesian five-year development plan is emphasizing the development of the agricultural sector. Approximately 70 percent of the population depends on the agricultural sector and related activities. Especially with respect to food supply we are faced with a challenging problem, as to date there is a deficit in the food supply. Even though our program of family planning can be considered as successful, our population increase of 2.4 percent still needs more food and in some parts of the country rice consumption per capita is still increasing. As rice is our staple food, activities of agricultural development are centered on rice production.

How should this challenge for food supply be overcome? To increase rice production per unit area, extension of rice planting area and crop diversification are the major priorities and pest problems may arise at this stage. Intensification programs are centered on the use of high yielding varieties, adequate water supply, application of heavy doses of fertilizer and better cultural practices which require good protection from pest damage.

In Indonesia, rice is planted on irrigated field, rainfed field, upland, tidal swamp land and "lebak" land. Pest problems as well as pest control approach may vary with each agro-ecosystem. Rats, rice stem borers and rice bug, stink bug, rice gall midge, virus diseases are the pests that mostly occur. To a limited extent army worms, white backed planthopper, leaf folder, fungal and bacterial diseases are also causing damage. In recent years since the early 1970s rice planthoppers and leafhoppers have caused a considerable damage to rice plants (Oka, 1977a). It is unfortunate that those insects are also transmitting dangerous virus diseases. In the wet season of 1973 tungro virus disease outbreak, transmitted by *Nephotettix virescens* and *Nephotettix bipunctatus* occurred in South Sulawesi. Since the wet season of 1975 brown planthopper damage has occurred mostly in the rice growing areas. Grassy stunt virus and lately ragged stunt virus diseases followed the brown planthopper damage (Hibino *et al*, 1977). Nowadays brown planthopper and rats are considered as the most important rice pests that need special attention. It is a fact that to control the pest population one can not rely upon a single control method. It is also unwise to aim at eradicating pest species. The integrated pest management concept is actually the answer to the problem. In any case of pest infestation the formulation of the pest control policy is based on the concept of integrated pest management. Are all the aspects of integrated pest control adapted to farmers' field? Implementation of integrated pest management requires knowledge, experience and skill. Can this concept be practised by the farmers? It will take time and patience to bring better plant protection measures to the farmers.

Need for integrated pest management for rice

It is evident that the development of the integrated pest management concept in rural communities is really difficult to achieve. It is obvious that the concept of integrated pest management should be approached from the angle of agro-ecosystem management. In the first instance the

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development of integrated pest management will be implemented on a rice ecosystem basis. This step is necessary because of the awareness that our food crop program is concentrated on rice production. Certainly, we are making this effort according to the principles of integrated pest management.

Through the intensification program, we demonstrate to the farmers how to increase rice production. Modern technology is really the answer to increase production as well as the farmer's income or wealth. Since the intensification program was launched the acreage has increased and at the same time the average yield per ha has also increased. As a result, the total rice production per year is also increasing. Nevertheless due to the high consumption of rice additional supply of food is still required. Special effort should be made to cover the deficit in food supply.

It was noted that insect pests had caused yield loss ranging between 19.4 and 24.1 percent of the yield potential (Soenardi, 1979). Apart from these figures, the recent situation shows that the brown planthopper and rats cause a considerable loss. Therefore the government has put a high priority on crop protection measures. Especially pest outbreaks should be quickly dealt with to prevent bigger losses.

Several studies have revealed that the application of a single control method is unlikely to enable to overcome pest incidence successfully. Besides of its utility, pesticidal control for instance might have several drawbacks e.i. pesticide resistance, pest resurgence, secondary pest outbreak and residue problems (Smith and Reynold, 1966). Planting resistant varieties may not either be expected to solve the pest problems. Our experience on brown planthopper control has proved it. After four crop seasons when resistant rice cultivars e.i. IR26, IR28 and IR30 had been planted a new biotype of brown planthopper was created. This new biotype had formerly been observed in North Sumatera (Mochida *et al*, 1977) and East Java (Oka, 1978), and in a short time spread to other provinces (Anonymous, 1978). Right now this brown planthopper biotype 2 dominates the brown planthopper damage areas. Other techniques can also contribute to the control of rice pests. Cultural practices for example can reliably control brown planthopper population through crop rotation and planting regulation (Oka, 1978). Biological control is another pest control component that might support the other control techniques. Dependence alone on biological control does not offer a completely satisfactory alternative to chemical control. In other cases, the biotic agents provide a significant degree of control which is not sufficient to keep the pest below the tolerable level. A pest population management system that utilizes all suitable techniques in a compatible manner to reduce pest population and maintain them at levels below the economic injury (so-called integrated pest control) (Smith and Reynolds, 1966), would be the answer to the solution of pest problems.

Development and implementation of integrated pest management

In Indonesia rice is cultivated on various kinds of land that reflect different agro-ecosystems e.i. irrigated fields, rainfed fields, upland, tidal swamp land, "lebak" land. The different agro-ecosystems are responsible for the reflection of pest complex in it (Anonymous, 1979).

Brown planthopper, rats, rice stem borers, rice bugs, rice gall midge are considered as the major rice pests. Pest control effort is mainly based on these pests. Severe attacks of brown planthopper in recent years had indirectly tested the pest control strategy of the nation-wide integrated pest control of brown planthopper. New resistant cultivars have played a dominant role in the control of the brown planthopper coupled with other control techniques. Even though the brown planthopper is relatively under control, other rice pests emerge and need attention. The situation shows that a more comprehensive pest control approach should be established to tackle more complex pest problems.

Integrated pest management concept is a sound approach to be developed. This concept is a multidisciplinary program which requires a smooth coordination. It does not only involve technological skill but also socio-economic as well as socio-cultural aspects. An overall development

pattern of integrated pest management strategy in specific agro-ecosystems should be defined and implemented.

To develop the integrated pest management concept, a pilot project has been carried out at 5 different locations. Each location is considered to represent the major rice ecosystems that will ultimately be used as a pest control model to be widely developed. This pilot project was designed to study the implementation of integrated pest management (IPM) on a rice ecosystem basis and at the same time to demonstrate its performance to the farmers. The pilot projects are located at Tanah Jawa, Simalungun (North Sumatera), Jatisari, Karawang (West Jawa), Sewon, Bantul (Yogyakarta) Tanggul, Jember (East Jawa) and Sereang II. Sidrap (South Sulawesi). The area of each pilot project coincides with the Rural Extension Center (REC) area covering approximately 10,000 ha of food crops. This approach which aims at creating good coordination, integration and synchronization in order to ensure the implementation of IPM can be practised effectively and efficiently. It means that REC area will be the lowest level of the basic implementation of IPM. The importance and priority of rice insect pests in each pilot project location are listed on Table 1.

Table 1 Importance and priority of rice insect pests in each pilot project location

No.	Rice insect pests	Importance and priority in				
		North Sumatra	West Java	Yogya-karta	East Java	South Sulawesi
1.	Brown planthopper	1	1	1	1	5
2.	Rice stem borers	2	2	2	2	1
3.	Rice bug	3	5	4	3	3
4.	Stink bug	4	4	5	5	6
5.	Green leafhoppers	–	–	–	–	2
6.	Rice gall midge	–	3	3	4	–
7.	White backed planthopper	5	6	–	–	4

Several activities are being conducted in these pilot project areas (Anonymous, 1979). Coordination meeting is organized periodically inviting institutions concerned with the IPM pilot project e.i. Directorate of Food Crop Protection, Mass Guidance Steering Unit, National Agriculture Extension Project, Agency for Agriculture Education Training and Extension, Agency for Agriculture Research and Development and Agricultural Universities. At this meeting all aspects and activities of IPM pilot project are discussed. Evaluation and monitoring of the implementation of IPM pilot project receive special attention.

A survey on socio-economic aspects was programmed in 3 steps e.i. base line survey, farm record and program evaluation. Another survey on agro-ecosystem aspects was also conducted.

Training and farmers' courses were also programmed in order to make the IPM pilot project well understood especially by the farmers. Demonstration plots, demonstration farms and demonstration areas were also programmed to show to the farmers that rice pests can be controlled effectively and efficiently through the implementation of IPM concept.

Observation and forecasting of pests as well as pest control recommendations play an important role. These activities in practice are at the center of the continuous integrated pest management program.

Some research work is still needed to support and to improve the IPM pilot project. Research work may be done on aspects of pesticide use, natural enemies, economic threshold of pests, etc.

As mentioned above, the REC area is the lowest level where the IPM is programmed and implemented. To make it clear, a flow chart of the IPM implementation in REC area is attached on

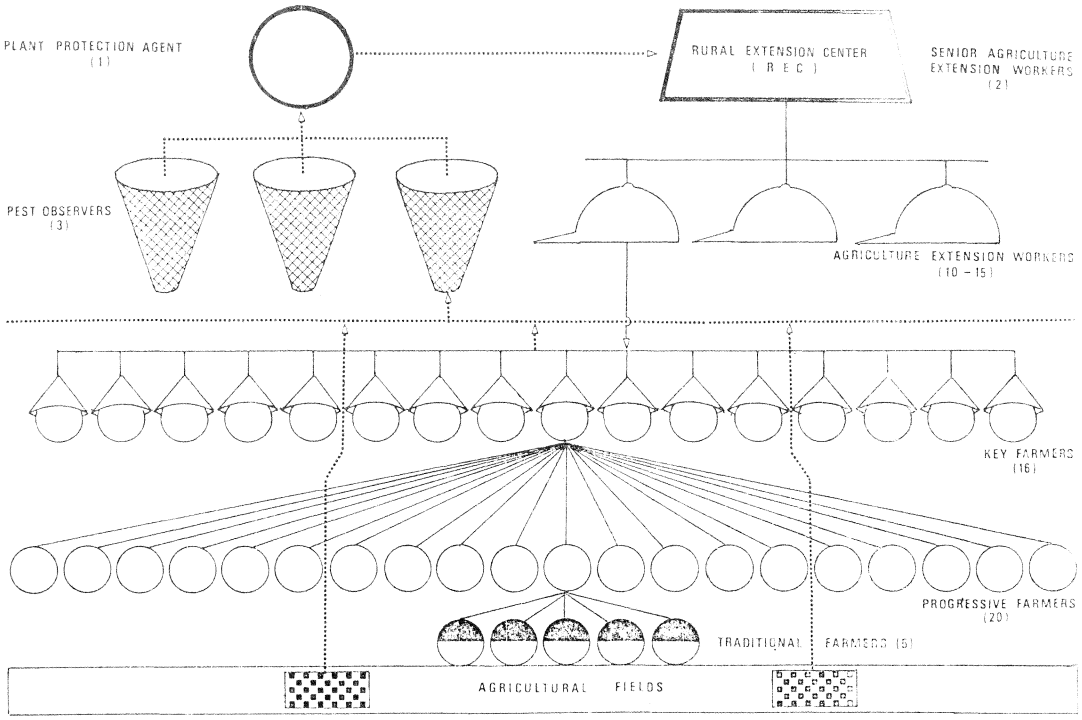

Fig. 1 Flow chart of the integrated pest management implementation in rural extension center area

Fig. 1. Programs and recommendations of IPM are made by a plant protection agent assisted by 3 pest observers. Each pest observer is responsible for the execution of observations on pest populations and their damage in 3 to 4 village units. Pest observation is carried out using 2 techniques e.i. periodic observation on permanent observatory plots and specific observations made by farmers and other sources. Periodic pest observation is done on 2 permanent plots in each village unit. It means that each pest observer will carry out weekly periodic pest observation in 6 to 8 permanent observatory plots. Specific observation is made by the pest observer in predicted pest incidence areas, or may be derived from information from key farmers, progressive farmers and agriculture extension workers. All the pest information collected by the pest observers is sent to the plant protection agent to be analyzed. Based on this data analysis the plant protection agent formulates weekly pest control recommendations and delivers them to the senior agriculture extension worker in the REC. Agricultural extension program including IPM program and recommendations is made by the senior agriculture extension worker and delivered to agriculture extension workers as agricultural extension material. Through training and visit system the IPM program and recommendations will be conveyed to the farmers especially key farmers and progressive farmers via agriculture extension worker. The agriculture extension worker will introduce and explain to the farmers all aspects relating to pest control works.

It is well understood that implementation of IPM concept is not an easy task. Therefore it is necessary to simplify the implementation of IPM. The IPM program and recommendations should be formulated as systematically and simply as possible in order to make the IPM concept applicable by the farmers. For this purpose general guidance for formulation of IPM program and recommendations on rice pests (Anonymous, 1979) is attached on Table 2. Modifications and improvement of this IPM program and recommendations may be done locally depending upon crop pattern, natural enemies, pest incidence, cultural practices, etc.

Table 2 General guidance for IPM program and recommendations on rice insect pests

No.	Pest Complex	Control Techniques
1.	Brown planthopper and associated virus diseases	* Crop rotation and simultaneous planting * Crop sanitation * Resistant cultivars: IR26, IR28, IR29, IR30, IR32, IR34, IR36, IR38, Asahan, Citarum, Serayu, Brantas, Cisadane, Semeru * Effective insecticides: – if brown planthopper is observed in GSV and RSV area – if 5 brown planthoppers per hill are observed 40 days after transplanting – if 20 brown planthoppers per hill are observed 40 days after transplanting.
2.	White backed planthopper	* Crop rotation and simultaneous planting * Crop sanitation * Resistant cultivar (Citarum) * Effective insecticides
3.	Green leafhoppers and tungro virus disease	* Crop rotation and simultaneous planting * Crop sanitation * Resistant cultivars: IR28, IR29, IR30, IR32, IR34, IR36, Asahan * Effective insecticides, if 10 green leafhoppers per 4 swings are observed in TV area
4.	Rice bug	* Simultaneous planting * Crop sanitation * Effective insecticides, if 1 – 2 bugs per square meter are observed
5.	Rice stem borers	* Crop rotation and simultaneous planting * Effective insecticides: – if 1 – 2 egg clusters per square meter rice plants are observed insecticide spraying is done one week later – if 10 percent plant damage is observed
6.	Rice gall midge	* Simultaneous and early planting * Resistant cultivars * Effective insecticides, if 5 percent plant damage is observed
7.	Brown bug	* Simultaneous planting * Crop sanitation * Effective insecticides, if one bug per hill is observed 40 days after transplanting
8.	Leaf folder	* Effective insecticides, if 10 – 15 percent leaf damage is observed
9.	Army worms	* Effective insecticides, if army worms are observed

Problems

It is evident that the educational level and socio-economic conditions of the farmers very much affect the rice intensification program including pest control measures chiefly because rice intensification cultivation requires higher production inputs and knowledge on how to apply them.

Modern rice cultivation in fact urges to grow high yielding varieties that need high doses of fertilizer and intensive cultivation. As a result pest problems may become more serious if not well handled. Knowledge of pests is sometimes hard to be understood by the farmers and far from their experience. Moreover as the control of pests requires additional cost, the economic condition of farmers will very much affect it.

As pest incidence varies from place to place and from time to time, it is quite hard to forecast and predict it. This situation creates problems to farmers. They do not notice the utility of pest control measures especially if pest damage does not occur periodically. Even though field experiments have revealed that pest control measures for crop damage are profitable from the economic point of view, it is still hard to convince the farmers especially the traditional ones. Awareness of farmers of aspects of pest and pest control is still a problem to overcome.

IPM concept is sound but difficult to implement. Successful IPM implementation might be achieved by relatively highly educated farmers. Concept of economy and the harmonious blending of several compatible control techniques are complicated tasks for farmers, especially in the developing countries. Farmers do not talk about theory of IPM, agro-ecosystem, pest status, side-effects of pesticide use, or host-parasite relation for instance. They talk about what happens now. Development and implementation of IPM concept requires time and patience.

Development and implementation of IPM concept is a huge task which can not be accomplished easily. We need specialized knowledge of the ecology, systematics, behaviour, and physiology of pests and their associates. It can not be expected that the individual farmer will practise this IPM concept successfully. The government should take steps to develop and to implement this IPM concept. In this case the government should have enough personnel on specialized fields as needed and construct a strong pest control organization to mobilize farmers in practising IPM concept.

IPM concept is a multidisciplinary approach and coordinated work. All kinds of technology on IPM aspects should get appropriate attention. It usually happens that when there is a powerful pest control technique, for instance an insecticide or a resistant cultivar, the other pest control techniques are neglected. Even though one or two pest control techniques have brought successful results, IPM concept should still pay attention to other IPM components. A consistent approach and implementation of IPM should be well understood by the other institutions concerned.

Research is the source of technologies. It means that research work should be promoted to support the development and implementation of IPM. Personnel, skill and facilities will very much affect the progress of research work. Research work should involve either basic research or applied research. At present, in the implementation of IPM, biological control techniques and cultural practices do not play a sufficient role. Especially, biological control techniques should get a considerable attention. Basic knowledge as well as practical implementation of biological control still requires more research.

References

1) ANONYMOUS (1978): Laporan pemetaan penyebaran biotipe hama wereng batang coklat, *Nilaparvata lugens* Stal, periode musim tanam 1977 - musim tanam 1977/1978. Direktorat Perlindungan Tanaman Pangan, Jakarta.
2) _____ (1979): Pertemuan teknis pengendalian hama terpadu. Bogor, 17 - 18 September 1979. Direktorat Perlindungan Tanaman Pangan, Jakarta.
3) HIBINO, H., ROECHAN, M., SUDARISMAN, S. and TANTERA, D.M. (1977): A virus disease of rice (kerdil hampa) transmitted by brown planthopper, *Nilaparvata lugens* Stal, in Indonesia *Contrib. Centr. Res. Inst. Agric.* **35**: 15 pp.
4) MOCHIDA, O., OKA, I.N., HARAHAP, Z., PARTOHARJONO, S. and BEACHELL, H.M. (1977): The brown planthopper situation on IR26 in North Sumatera in February 1977. Entomol. Survey Rept. No. 10. CRIA-IRRI, Sukamandi, Indonesia. 6 pp.
5) OKA, I.N. (1977 a): Cultural control of the brown planthopper, *Nilaparvata lugens*. Brown planthopper Symp., The International Rice Research Institute, Los Banos, Philippines. 32 pp.

6) _____ (1977 b): Occurrence of biotype 2 of the brown planthopper in Banyuwangi, East Java and Bali. Laporan Kemajuan Penelitian, Seri Hama-Penyakit No. 11: 63-67. CRIA Bogor, Indonesia.
7) _____ (1978): Implementing the integrated control program of the brown planthopper in Indonesia. FAO Panel of Experts on Integrated Control, Rome, 4 - 9 September 1978.
8) SMITH, R.F. and REYNOLDS, H.T. (1966): Principles, definitions and scope of integrated pest control. In Proc. FAO Symp. Integrated Pest Control. FAO, UN, Rome, Italy.
9) SOENARDI (1976): Impak ekonomis pemberantasan hama penyakit tanaman dalam produksi. Simposium Pestisida dalam Pengelolaan Hama-Penyakit dan Tumbuhan Pengganggu, Jakarta, 5 - 7 Juli 1976, 10 pp. (In Indonesian).