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PEST MANAGEMENT IN THE NEXT DECADE IN THE PHILIPPINES[1]

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It has been coming out to the fore among the advanced nations even as early as the 60's that a viable alternative must be sought to replace the conventional one shot strategy in dealing with pest population if food production must be increased to feed the world's burgeoning population while maintaining the integrity of the environment for healthful living. As a developing country we are related to them by way of our basic economy and technology, and it is therefore not surprising that we find ourselves likewise discussing the current trend of pest control — the so-called, pest management.

The concept of pest management, its rationale, potential, needs and implementation, has been the subject of various symposia in the 70's participated in by the world's authority on pest control in an attempt to articulate and crystallize its philosophy. Numerous publications have been put out on this matter and notable among them are those of Smith 1964, 1976; Rabb & Guthrie 1970; Rabb 1972; and many others.

As Rabb (1972) defines it, "pest management is the selection, integration and implementation of pest control actions on the basis of predicted economic, ecological and sociological consequences." Similarly, as early as 1966, the FAO Panel of Experts on Integrated Pest Control defined it as . . . "a management system that in the context of the associated environment and the population dynamics of the pest species, utlizes all suitable techniques and methods in as compatible a manner as possible and maintains the pest populations at levels below those causing economic injury." The term "pest" is broadly defined as any biological entity that is harmful to man, and this includes among other things, rats, insects, mites, nematodes, weeds, and pathogenic organisms such as viruses, mycoplasma, bacteria, rickettsia and fungi. Taken in this context, pest management is not a new method of control and if you pardon a lame analogy, it is just like several good wines from old jugs being concocted into a sophisticated cocktail for discriminating dinner guests. In Philippine experience, allusions to pest management had been indicated by the works of Uichanco in the

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1930's (Baltazar 1980), so that if it is any consolation at all, the concept is not strange to our vocabulary. Implicit, however, to the concept of pest management is having at our disposal a big body of knowledge that is carefully coordinated before any measure of success can be achieved. It is along this line of implication that I should like to view our version of pest management. Let us bear in mind, however, that even among the advanced nations, pest management programs are still to be widely practiced because of certain problems inherently their own. If I give a not-too-encouraging picture of our readiness to implement such promising concept of pest control, its is simply because I would like to re-assess as realistically as possible our position and capability so that we might see the applicability of these principles within our conditions and resources.

On Developing a Pest Management Program

Pest management is not a method of control; it is a set of guidelines which provide sound decisions as to what, when, where and how methods are used to optimize the end results. It draws particular combination of principles from the basic disciplines, thus it has no unique principles all its own; it is clearly an applied science (Rabb 1972). I tend to emphasize this relationship so that a better perspective on the importance of the basic sciences could come into focus in terms of setting up priorities in developing pest management programs.

Rabb (1972) mentions three major steps in developing a pest management program:

I. Developing an ecological framework

II. Developing control agents

III. Making decisions for implementation

I. *Developing an ecological framework*

Pest management draws heavily from the basic principles of ecology. Very briefly, let us enumerate the more important considerations in this framework and then justapose them against the available Philippine data.

1. Population levels and damage
2. Consider the agroecosystem
3. Controlling disruptive agents (i.e. diversity, utilization of indigenous natural enemies, maintenance of sub-economic populations, identification of real and induced pests, manipulation of food, soil and water)
4. Population dispersal
5. Prevention of new pest invasion
6. Prediction of population trend

1. *Population levels and damage:* To put it simply, one of the objectives of pest management is to control population levels below the "economic injury level." The determination of levels of tolerable pest damage in agricultural crops lands and in forests is an essential pre-requisite to the development of a pest management program. The relationship between the number of pests and severity of damage must be ascertained at the outset and expressed in terms of monetary losses as a base for establishing economic thresholds. This is a complex process and cannot be accomplished readily. However, the initial data may be refined if the process becomes a continuing part of a management program and the ecological and pest dimensions become available. It is within safe certainty to state at the moment that no appreciable data are available to guide us in establishing the "economic injury level" of most crops except perhaps rice and corn, and possibly cabbage and legumes. Thus, the preoccupation of research in the next decade will heavily emphasize this aspect.

2. *Consider the agroecosystem:* The term emphasizes the special characteristics of agricultural ecosystems in contrast to natural ecosystem. This is a man-dominated part of the world ecosystem and this is where he does not want natural balance. Instead, he manipulates the environmental factors for his crops. The choice of manipulations must be such that ecological processes such as invasion, competition, symbiosis, parasitism and predation are managed optimally.

Changes in culutral practices, crop variety or pest control procedure can greatly modify the agroecosystem. The newer concept of farming system such as the no-tillage agriculture and the multicropping system may very well contribute to drastic changes in our agroecosystem. Within the unabated energy crisis, shifts to less fuel-consuming farm operations are inevitable, thus we must consequently brace up for another angle in studying our agroecosystems with particular emphasis on changes in pest complexes.

3. *Controlling disruptive actions:* The greatest alteration in agroecosystem is the replacement of complex and intermixed communities with pure stands of crops or monoculture. The relationship of diversity and stability has been the focus of so much research in ecology and there seems to be a consensus that developing complex polyculture is more desirable for pest management. Reconstruction of diversity in an agroecosystem requires an in-depth understanding of ecological relationships and processes. The disruptive effects of crop production certainly affects the natural control of pest species. In practice, the crops are manipulated to regulate the food quality of the pest species through breeding, fertilization, growth regulators and irrigation. Or in severe cases of persistent pest problem, the crops are produced only when the pest problem can be handled with certainty.

4. *Population dispersal:* One of the requisites for planning a pest management program is to define the size and shape of the area where the mean level of pest abundance is expected to be lowered. Pests differ in range and dispersal characteristics so that pest complexes present different areal requirements for management. Needless to say that we do not have accurate data on this matter.

5. *Prevention of new pest invasion:* Many of our pests are largely introduced, and with the increased efficiency of the international transportation system, many more are likely to land our shores. More efforts should be done regarding quarantine check-ups and more should be learned on how to maintain potential pest invaders.

6. *Prediction of population trend:* Basic to any type of pest control is the detailed life history studies of the pest to enable us to predict the pattern of seasonal populations relative to the host plant. An understanding of the intrinsic and extrinsic factors that cause pest population fluctuation is required implying that the life system of the pest must be mathematically construed as a functioning part of the agroecosystem. Some attention must also be given to bionomics and population behavior as products of interaction with the weather.

II. *Developing Control Agents*

Clark, et al (1967) divided insect control agents into a) those which affect the inherent qualities of the pest species to cause sterility or deleterious genetical modifications, and b) those which affect the attributes of the pest's effective environment to cause direct mortality. Since pest management is the utilization and integration of appropriate control methods, the traditional direct control tactics can be employed such as breeding for pest resistance, cultural control, biological control, autocidal control, pesticides, application techniques, attractants and repellants and growth regulators. In this regard, we can consider ourselves as having quite an adequate experience in matters of direct control tactic especially on the use of pesticides. Smith (1970) emphasizes that pesticides remain, in spite of their adverse publicity, as the most powerful tool in the management of pests. The training program on the proper use of pesticides of the UPLB-NCPC is a commendable one as this will increase public awareness on the merits of this tool. However, we must also recognize, on the other hand, that this tool has limitations.

The development of our technology, regarding control agents has been very uneven. Our studies on plant breeding for pest resistance have barely taken off the ground except perhaps for rice. We can safely say the same for biological control and the other tactics. Our meager output in these areas is not caused by neglect or non-recognition of the problem. Rather, the non-support to these type of studies seems to be the villain. One encouraging tool that we must explore is the use of insect growth regulators.

The results of the studies of Dr. Morallo-Rejesus on *Attacus* juvenile hormone fairly indicate that it can be an effective tool. However, the cost of developing the hormone into a control agent must be assessed in terms of its practicability and cost.

III. *Making Decisions for Implementation*

The application of economic principles is fundamental to any pest control program (Smith 1971). A decision to initiate action can be made on the basis of economic analysis of the "economic injury level." Rabb (1972) suggests the following guidelines for calculation assuming that the following information are based on current prices:

a. Amount of physical damage associated with various pest densities.
b. Monetary value and production cost of the crop at various levels of physical damage.
c. Monetary loss associated with various levels of damage.
d. Amount of physical damage.
e. Monetary value of the portion of the crop which can be saved by control measure.
f. Monetary cost of the control measure.

With these data, the population level at which the control measure can be applied to save enough crop value to equal the cost of control can be determined. This is perhaps a gross over-simplification of the process for making a decision relative to initiation of feasible control measure. It does not consider the costs and benefits external to those associated with a single crop such as environmental quality, long-range or short-range effects, etc. In this context, ecological and economic systems have much in common. Both are dynamic, open-ended and subject to change in response to unpredictable environmental factors. Thus, there is always an uncertainty factor in making decisions on the basis of ecological and economic consequences. The responsibility of pest management, however, is to provide leadership in improving the decision making process.

Pest Management Research for the Next Decade

In view of the principles involved in developing a pest management program and the present state of knowledge on our pests, necessarily our researches will reorient towards problem areas that will yield fundamental data that are useful in developing the strategy for this pest management concept.

While we are truly wanting in the basic data required for establishing a sound ecological framework, our efforts have been towards amassing the needed information. More studies on the basic and applied phases of ecology will predominate and we shall be doing this for a long period of

time. The Hydroecology Program of UPLB has been accumulating valuable information: more program involving the various types of ecosystems will further evolve. It is obvious that there will be greater priority towards devloping the ecological framework for pest management systems and this will be done without impairing the development of specific control techniques. Both must proceed hand in hand, and the role and importance of sampling techniques must also be given more attention. By their very nature the types of research needed are fundamental and basic and can encompass all the levels of biological organization from the molecular up to community levels. Basic research will not be construed as pursuits of idle inquiry, it will be recognized as "cogs and wheels" of pest management. Life history studies of the pests will be more involved than the usual longevity approach. The genetics of pest species and complexes will gradually unfold for better manipulation in relation to the host plants. Many sophisticated biological methods of research now available will be employed for greater precision of results. On top of all these a system of greater and faster distribution of information among workers will gradually develop. It seems that although we have accumulated a lot of information from our research, the results do not find themselves in print. And the journals are few and come far in between. The need for more and timely information will trigger more publications.

Since pest management is the integration of several appropriate techniques, it is necessarily multi-disciplinary in approach which unfortunately is easier said than done. The team approach may evolve more effectively for our complex problems. Perhaps we can learn much from the experience of the Institute of Plant Breeding at UPLB which employs a team of plant breeder, an entomologist, pathologist, crop physiologist, nematologist, biometrician and an economist for each crop commodity. The team approach to research is understandably a very sensitive subject among scientists who are deeply entrenched in a research pattern which essentially is a mosaic of individual projects.

Possible Pest Management Programs in the Next Decade

At present, there are possibly several pest management programs that can be developed and implemented in the next decade.

1. *Rice:* Our data on the breeding of varietal resistance of rice against stemborers are adequate to indicate that this could be used to advantage in a management system together with seasonal planting and application technique of pesticides to harness the usefulness of natural enemies. In addition, are varietal resistance already developed against the green leafhoppers and the brown planthoppers. It would seem that resistance breeding is specific against particular pests. An advancement to this endeavor would be one which will incorporate resistance against a wide variety of insect pests.

2. *Corn:* The intensive corn breeding program of the IPB has isolated several varieties resistant to the downy mildew. This resistance factor can be interplayed in a management with pesticide and intercropping system. It has been found out that if corn is intercropped with peanuts or other legumes, the weeds are sufficiently suppressed because of the double canopy effect.

3. *Legumes:* The IPB breeding program of legumes particularly mungbean has yielded results that varietal resistance is going to be a vital component to management system. Legumes are ideal intercrops to corn and sugarcane.

There are indications that management systems can be evolved for cotton and tobacco. With the emphasis given by the government as evidenced by the establishment of the Cotton Research Center and the Tobacco Research Center, it should not be long before a viable program of pest management can be developed.

On Manpower Training

Theory is only as sound as it leads to practice, but all this soundness shall go for naught if man does not carry it out. In the final analysis, it is still man that invents and carries out the sound principles which he evolves. In this regard, the concept of pest management requires a type of training and orientation which I am dubious if we are curricularly conscious of producing. In view of this situation as against the need for better prepared graduates in pest management curricular innovation will evolve to answer such need. In entomology alone, the need to train more and better graduates is badly needed to create that critical mass necessary to propel the development of entomology as a science in response to needs of increased food production. Thus our curricula in crop protection will tend to provide a broad, ecologically-oriented training in pest management. On the other hand, training for high-caliber specialists for in-depth analysis of complex problems will continue to exist.

Lastly, when we view pest management in a larger context, we see it as the classic issue between science, technology and the well-being of society. How this issue is resolved has far-reaching implications not only in terms of adequate food supply but in terms of public confidence in research and education.