PESTICIDE USE IN THE PHILIPPINES

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Abstract

The Philippine expenditures for insecticides are greater than for other classes of pesticides followed by herbicides and fungicides. The fungicide market in 1981 was 100% greater than the 1977 market. Herbicide expenditure has been nearly steady for the last five years.

Pesticide consumption is mainly for crop production and for public health and a small percentage for the control of structural and stored product pests.

For crop production, the major users of pesticides are the rice and vegetable farmers followed by the banana, pineapple and mango growers.

The main use for public health is for the anti-malarial programs of the government. The control of household and structural pests is entrusted to private pest control operators.

As more and more integrated pest management schemes are developed for the major crops in the Philippines coupled with the gradual withdrawal of government financing and stricter pesticide regulations, the amount of pesticide use will slightly decrease in the coming years, unless otherwise the market of our export crops is expanded and new export crops are developed.

Introduction

Pest protection is particularly important in the Philippines where agriculture is the major industry and vital source of the economy. The country's overall food and commercial crop production in 1979 amounted to 26.6 million kg and the value amounted to US$3.9 billion (Bureau Agr. Economics). Profitable high yields of the major food crops grown in the Philippines where crop pests are abundant require that adequate measures are taken to control pests. For the last 15 years pest protection, particularly crop protection, in the country has been synonymous with the use of chemical pesticides. Crop protection is farmer-oriented and government-directed while the public health and stored product pest protection is effected mainly through government agencies. Private pesticide industry also provides assistance but has concentrated its effort on the sale and marketing of pesticides.

The pesticide supply is imported from multi-national companies through their representatives or subsidiaries, most of which are members of the Agricultural Pesticide Institute of the Philippines (APIP). This trade organization composed of 24 members is responsible for 90% of the country's pesticide sale (Gaston, 1980). There is only one manufacturing plant, the Ag Chem. Manufacturing Corporation which produces phenoxy herbicide (2,4-D and MCPA acid) and formulates emulsifiable concentrates, amines, sodium and potassium salts and granules at a rated capacity of 5,000 million tons of granules.

The Philippine importation of pesticides markedly increased from 1972 to 1977 (Fig. 1). This remarkable increase has been largely due to the government rice, vegetable and corn production programs launched in 1972. In 1972, the importation amounted to US$45 million as compared to the 1977 importation of US$16.7 million worth of technical (14%) and formulated pesticides (86%). Insecticides accounted for 51% followed by fungicides (29%), herbicides (11%) and other types (9%) (Fig. 2). At the end of 1979, the Philippines imported US$25.3 million worth of pesticide materials. The importation in 1981 only amounted to US$23.3 million, 7.9% less than the 1979 importation.

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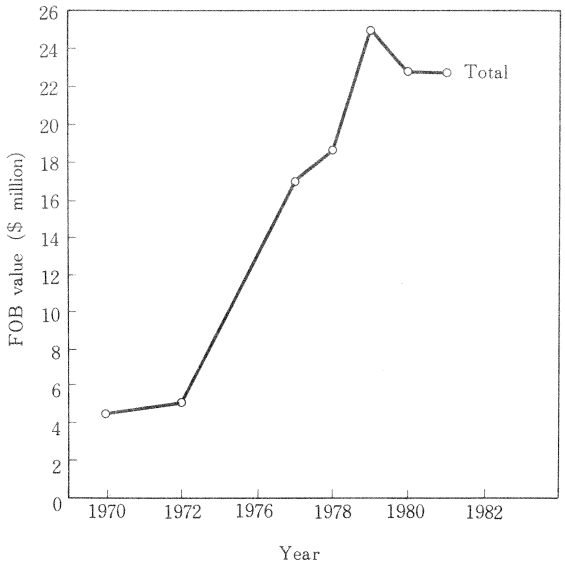

Fig. 1 Total pesticide importation.

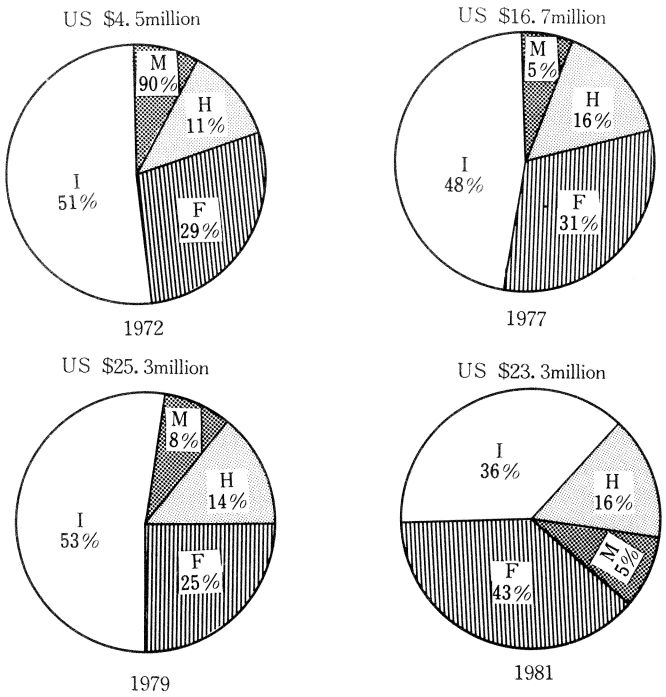

Fig. 2 Percent pesticide importation by groups.
I : Insecticides F: Fungicides
H: Herbicides M: Miscellaneous

Sixty percent of the importation consists of formulated products and 40% of technical materials which undergo formulation by the existing 22 formulators (Gaston, 1980). Almost 30% of the technical materials imported are used for insecticide formulation while most fungicides are imported as finished products. A very small percent of these locally formulated pesticides is being exported and the rest is sold locally.

Pesticide use

In the Philippines, pesticide usage cannot be evaluated for all classes of pesticides. The evaluation of the end use of pesticides by crops is complicated by the fact that most farmers grow several crops and use the same pesticide on more than one crop or use several pesticides for one crop. Moreover, most farmers do not maintain a record of farm operations. The quantities of pesticides used by individual farmers are very small making the collection of data and categorization by classes of pesticides and by crop almost impossible. Although household and structural pest control is handled mainly by private pest control operators, data collection is also difficult since some of them do not keep records while some are secretive about it.

Very limited reliable figures on the relative uses of pesticides by sector and by crops are available. Thus, the evaluation of the use of certain classes of pesticides in this paper was mainly derived from sales record of pesticide industry, cited figures and through personal communication.

There has been a marked increase in the use of pesticides in the last 12 years. The annual expenditures for pesticides increased about six times, from less than US$10 million in 1970 (Capinpin, 1970) to US$58 million in 1981 (APIP Sales Statistics). A substantial share of the increase was the result of price increases especially from 1979 to 1981.

The expenditures for insecticides are greater than for other classes of pesticides (Fig. 3)

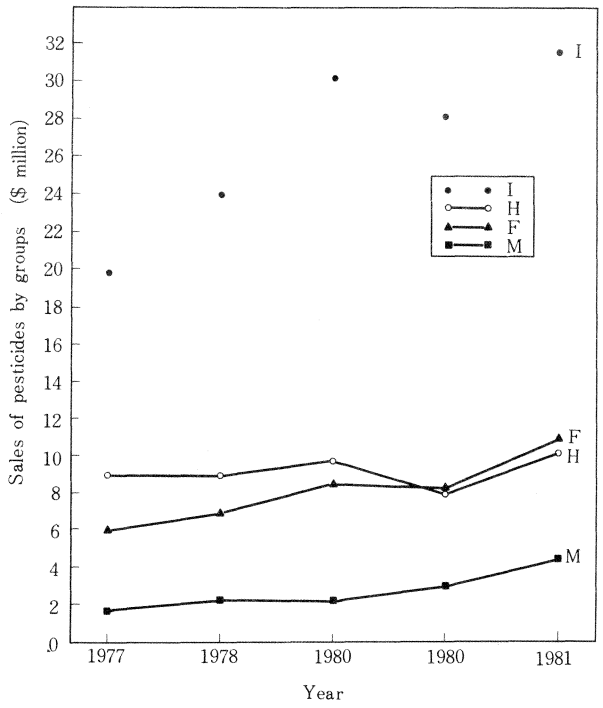

Fig. 3 Expenditures for pesticides.
I : Insecticides F : Fungicides
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followed by herbicides and fungicides. The fungicide market in 1977 was 10% greater than the 1970 market; the figures doubled in 1981. Herbicide expenditure has been nearly steady for the last five years.

Pesticide consumption is mainly for crop production and for public health; a small percentage of pesticide use is for the control of animal, structural and stored product pests.

1 Crop production

The major users of pesticides in the Philippines are the rice and vegetable farmers, followed by banana, pineapple and mango growers (Fig. 4) in large organized farms (plantations). Others

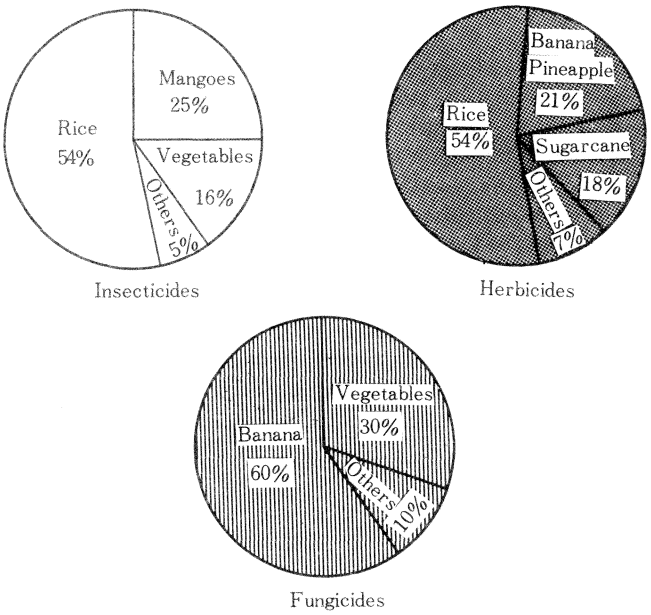

Fig. 4 Estimated usage of pesticides by major crops (based on APIP sales statistics, 1976).

who account for less than 10% of pesticide use are tobacco, corn, cotton and sugarcane growers.

The common or small farmers (till about 0.5 to 2 ha) used more insecticides than fungicides and herbicides. The common farmers used 70.9% insecticides while the plantation farmers used 79.7% fungicides (Fig. 5) (Anonymous, 1978). Fungicides and fumigants are mainly used in banana production. Fumigants are mainly applied as postharvest treatment before exportation of banana abroad. Nematocides have become an important input for banana and pineapple production since 1978 (Labadan, 1978). In terms of the quantity of pesticides used, the individual plantation farmer used more than the common farmers. The application of pesticides in plantations is regulated by the residual tolerance limits established by their markets as well as the recommendations of their mother companies. Since the usage and operation in plantations are done in an organized basis and where economics of crop protection is weighed carefully, the occurrence of excessive use of materials is negligible. On the other hand, the application of pesticides by common farmers is influenced by the availability and cost of pesticides, the kind of crop produced and particularly the availability of funds for pesticides.

Therefore, the pesticides commonly used by the farmers are those included in the recommendation of the government. About 60% of the pesticide products available in the market are

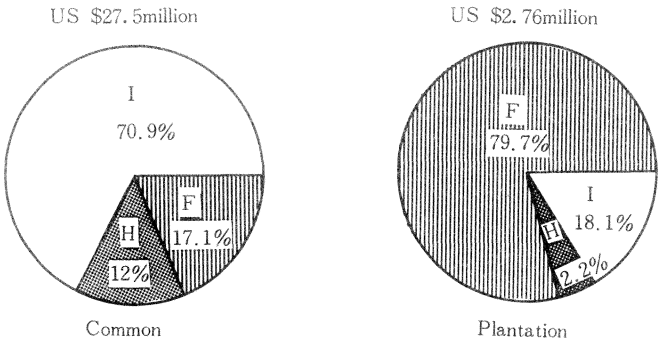

Fig. 5 Extent of pesticide usage by common and plantation farmers.
I: Insecticides F: Fungicides H: Herbicides

recommended for the government food production (rice, corn, vegetable) and commercial crop production (cotton, tobacco) programs. The commonly used pesticides for the crops are shown in Table 1. These are mainly organophosphates, carbamates and pyrethroids. Endosulfan is the sole chlorinated compound in the listing and it is recommended only for cotton, perennial fruits, rice, corn and ornamentals.

Table 1 Commonly used insecticides by crops.

Insecticides	Rice	Corn	Vegetables	Cotton	Tobacco	Mango	Banana
Carbofuran	x	x		x			x
Monocrotophos	x	x		x			
Methomyl		x		x	x		
Endosulfan	x	x		x			
Azinphos-ethyl	x			x			
Triazophos			x				
B. thuringiensis			x				
Cypermethrin			x	x			
Fenvalerate			x	x	x	x	
Decamethrin				x			
Carbaryl		x		x			
Cartap			x				
BPMC	x					x	
Diazinon	x						x

Although rice is still the No. 1 user of insecticides, there has been a drop in the quantities used as exemplified by BPMC, endosulfan and carbofuran (Table 2). The decrease is due to better pest control recommendations and reduction of government financing. In corn and cotton, where there is a limited financing, the insecticide usage is about 3–5% while usage in crops without financing except vegetables is approximately 1–2%. The market of vegetables has been always favorable, so farmers continue to use pesticides in vegetable production even without financing.

Table 2 Percent usage of selected widely used insecticides by crops.

Crops	1979	1980	1981
		BPMC	
Rice	90.00	90.02	90.01
Mango	7.49	7.49	7.49
Others	2.51	2.49	2.50
Total amount (qts.)	12,192	11,208	6,504
		Endosulfan	
Rice	89.91	90.00	90.00
Corn	5.00	5.00	5.00
Others	5.09	5.00	5.00
Total amount (qts.)	49,714	41,554	29,794
		Carbofuran	
Rice	63.96	34.38	27.58
Banana	36.04	62.50	68.98
Corn	–	1.56	2.07
Cotton	–	1.56	1.37
Total amount (metric ton)	55.5	128	145
		Azinphos-ethyl	
Rice	60.05	60.00	55.00
Cotton	5.00	5.00	5.00
Others	39.95	35.00	40.00
Total amount (metric ton)	114.9	120.00	148.2

The enormous increase in carbofuran usage is due to its application in banana (an export crop) against nematodes while in mango, (another export crop) the quantity of insecticides used has been steady for the last three years. Chlorothalonil and mancozeb are the main fungicides used in banana, which accounts for about 60% of the fungicides used in the Philippines.

2 Stored product pests

Insecticides and fungicides are not commonly used by farmers against stored product pest except for seed treatment. The National Food Authority, a government agency responsible for the procurement and maintenance of an adequate supply of food stock, does most of the stored product pest control.

Big private companies such as flour mills and feed millers, seed producers and other processors who store their raw materials hire private Pest Control Operators (PCO) to fumigate their stocks and storage facilities.

Methyl bromide and aluminum phosphide are the common fumigants used while malathion, chlorpyrifos-methyl, tetrachlorvinphos, pirimiphos-methyl, diazinon and fenitrothion are used for residual sprays of facilities. The first four compounds are also recommended for sack and seed

treatments. The materials used for spraying piled stocks (bagged) are malathion, pirimiphos-methyl and pyrethrin. Captan and metalaxyl are used by seed producers for treating seeds especially corn.

3 Public health

The main use of pesticides in public health in the Philippines is for anti-malarial programs which are mainly the responsibility of the Malaria Eradication Division of the Ministry of Health.

DDT, malathion, temephos and propoxur are the insecticides used for mosquito control. In spite of the outcry against DDT, it is still being used, because it is cheap and has longer residual activity when sprayed on houses. However, the amount used has declined considerably in the last 21 years (Table 3). From 1961 to 1970 the average annual consumption was 513,572.88 kg

Table 3 Amount (kg) of DDT used and number of houses sprayed for mosquito control from 1961 to 1981.

Year	Number of houses	kg
1961	535,162	293,177.72
1962	648,504	450,597.72
1963	574,487	471,945.00
1964	978,111	634,719.54
1965	1,235,031	832,962.71
1966	676,215	407,604.54
1967	1,048,379	584,965.90
1968	923,819	626,481.36
1969	1,797,224	109,877.54
1970	1,273,412	723,396.81
1971	468,628	192,784.09
1972	537,627	377,795.45
1973	543,401	382,095.45
1974	832,644	456,639.09
1975	1,058,654	827,575.00
1976	972,001	730,310.00
1977	242,779	163,119.00
1978	606,084	138,719.00
1979	622,471	188,940.00
1980	408,170	148,455.00
1981	339,903	130,227.00

and the average number of sprayed houses was 969,034 as compared to the average annual consumption of 360,643 kg and average number of houses sprayed of 629,245 in 1971 to 1980. At present, DDT is not used in forests and near water reservoirs. Malathion, temephos and propoxur which exhibit short residual toxicity and low mammalian toxicity are used for these areas. Temephos is used as larvicide. Malathion and propoxur are rarely used for spraying dwellings due to their high cost. Moreover, residents refuse the use of malathion due to its

obnoxious smell and of propoxur due to its staining effect. In addition, nausea and dizziness have been reported by residents of houses sprayed with propoxur (Malaria Eradication Service, pers. comm.). Formulated products that are marketed for mosquito control and other household pests contain pyrethrin, bioallethrin, and dichlorvos and are usually used by housewives.

The control of household pests (flies, cockroaches, mice, rats and mosquitoes) especially in urban centers is entrusted to private PCO. Control of household pests accounts for 40% of the bulk of the PCO business. Gonzales (1981) reported that the quantity used by the pest control operator is enormous, but it is impossible to determine the exact quantity and kind of chemical being used because only a few of them keep accurate records.

The rodenticides that are commonly used are Paris green, white arsenic and the anticoagulants (warfarin, diphacinone, chlorophacinone, coumatetralyl). As of September 1981, the importation of the first two compounds has been banned by the Fertilizer and Pesticide Authority (FPA). Dichlorvos, dioxacarb, naled, malathion, propoxur, diazinon and pyrethroids are being used against flies and cockroaches.

4 Structural and animal pests

Structural pest protection is entrusted to private PCO. Sixty percent of their business activity consists of the control of subterranean termites infesting the houses, offices, warehouses, schools, hospitals, churches and other buildings. Wood treatments are usually done by the lumber companies.

The products utilized for termite and wood-boring beetles are aldrin, chlordane and dieldrin. The materials are applied in the soil or by injection or spraying or by other methods of wood treatment.

A very small amount of pesticide is used for animal protection mainly against pests of dogs and cats. The formulated products used for the control of ticks, fleas and lice of dogs and cats consist of clodrin, fenchlorfos, lindane and carbaryl.

Pesticide regulations

Realizing that pesticides are indispensable to modern agriculture and public health and that pesticides are dangerous to man and its environment if used indiscriminately, the presidential decree No. 1144 was promulgated on May 30, 1977 in the Philippines creating the Fertilizer and Pesticide Authority (FPA). FPA issues rules and regulations governing the importation, manufacture, formulation, repacking, distribution, delivery, sale, storage and use of pesticides and other agricultural chemicals in the interest of improving agricultural production, protecting public health and enhancing environmental quality.

FPA has jurisdiction over all handlers of pesticides and other agricultural chemicals. All pesticides handlers are to be registered with and licensed by FPA.

It regulates the importation and exportation of agricultural chemicals that are highly toxic and those with residues above tolerance levels. It is empowered to issue a stop-sale, stop-use, removal and hold-orders of pesticides included in the restricted list. As of September 1981, there were 55 pesticides included in the restricted list of pesticides. Ten (parathion-ethyl, 2,4,5-T, leptophos, technical BHC, DBCP, nitrofen, EPN, endrin, Paris green and DDT) are not allowed to be imported unless in emergency as determined by authority. Eight rodenticides (arsenic trioxide, elemental phosphorus, thalium sulfate, 1-napthyl thiourea, gophacide, sodium fluoroacetate, sodium fluoro acetamide and strychnine) are not allowed for importation, sale or use. DDT and mercuric fungicides are not allowed in agricultural crops. Aldrin, chlordane, dieldrin and heptachlor are not for direct application to agricultural crops; they may be used for soil treatment only. Some pesticides are not allowed to be used in rice, in vegetables, in edible portion of crops and near aquatic systems. Some pesticides are for institutional use only. Fumigants and other chemicals can only be used by licensed pest control operators.

The rules and regulations No. 1, Series 1977 of FPA are published in Magallona's (1980) book on pesticide management.

Future outlook

While the important role of pesticides in the strategy for increasing food production through crop protection is recognized, there are criticisms and constraints attached to the prospect of continuously increasing usage of this input. The undesirable side-effects of synthetic pesticides, the tight supply situation and the high cost of chemicals pose serious problems. Already pesticide prices have become prohibitive to small farmers. Our Masagana 99 rice farmers, for example, have to pay as much as US$50.00 per hectare for pesticides alone. It is a common contention that were it not for the credit extended through the Masagana 99 or similar programs and the realistic price support scheme adequately funded by the government, Filipino farmers would have ceased by now to apply pesticides to their crops. In fact, the survey of Litsinger *et al.* (1980) indicated that Filipino ordinary rice farmers are underdosing insecticide application in rice by a factor of 3 to 10 to save on insecticide expenses.

The government and the researchers are aware of the harmful effects of the pesticides to the environment and the continuing rise in price, thus careful consideration has been given in recent years to the development of an integrated pest management system using resistant varieties, cultural practices including cropping systems, pest surveillance, use of practical economic threshold, use of biological and microbial agents, use of insecticides which are less toxic to natural enemies and more efficient application of insecticides and possible use of botanical insecticides.

A simple integrated pest control system has been developed on rice using resistant varieties, practical economic thresholds, minimum rates and pesticides that are effective against a big number of key species but less toxic to parasites and predators, thereby reducing insecticide use (Sanchez, 1981). For example, BPMC had been widely used in the past years for the control of leafhoppers and planthoppers. But with the use of resistant varieties and economic threshold as a basis for spraying, application of this compound was markedly reduced, thereby curtailing resurgence of these pests.

The continuous use of pesticides by the small farmers will depend very much on government financing. In the next five to ten years, the pesticide use may remain at its present level or slightly increase because of the availability of limited government financing for corn, rice and cotton. Thereafter, as the government financing is withdrawn and as more and more integrated pest management schemes are developed for the major crops in the Philippines, the amount of pesticide use by the farmers will slightly decrease to a degree that will maintain levels of production adequate to feed our population. However, the use of pesticides in export crops may increase, if the market for these crops is favorable.

Conclusions

It is a known fact that although pesticides have played a great role in increasing world food supply, many problems have been raised about their use. As a result, the integrated pest management schemes have been evolved. The Philippines, just like any other country in the world, has been giving considerable attention to the development of pest control measures that are practical, economical and less disruptive to the environment.

As more and more integrated pest management schemes are developed for the major crops in the Philippines coupled with the gradual withdrawal of government financing and stricter pesticide regulations, the amount of pesticide use will slightly decrease in the coming years, unless otherwise the market of our export crops is expanded and new export crops are developed.

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Discussion

Thyagarajan, G. (India): You referred to individual farmers using very small amounts of pesticides and also variations in the use practice. What is the average consumption of pesticides per hectare in the Philippines?

Answer: I do not have detailed figures but it appears that as a whole, the farmers use small amounts of pesticides. In rice they apply 3 to 10 times less than the recommended dosage. As for insecticide applications in rice, the farmers use an average of 0.38 kg a.i./ha per application and insecticides are applied 4 times during the cropping season.

Soekarna, D. (Indonesia): 1. What is the reason for the decrease in the use of carbofuran? 2. Do you observe cases of pest resurgence in the Philippines? If so, what kind of pesticide is involved and what kind of insect?

Answer: 1. The use of resistant varieties, consideration of economic threshold, etc. have resulted in a marked decrease in the use of insecticides against leaf- and planthoppers, thereby curtailing pest resurgence. However, the use of carbofuran is slightly increasing in banana. In rice, since hopper problem is sporadic, the use of carbofuran is also decreasing. 2. Pest resurgence has been observed in many crops but is only well documented in rice.

Mochida, O. (IRRI): You showed that presently the volume of stock sales of pesticides is almost the same as that of indent sales. Which one experienced a higher progression?

Answer: Individual farmers are using less pesticides for common crops than the plantation owners. However the farmers use more insecticides than the plantation owners who are using more fungicides than the individual farmers.

Ishikura, H. (Japan): You indicated that 54% of insecticides and 50% of herbicides are consumed for protecting rice. What is the reason for such a large proportion? Is the reason socio-economic or biological? In other words, are there no appropriate control measures for rice insects and weeds or is it because the government is subsidizing pesticides for rice production?

Answer: Of the total use of pesticides, insecticides account for 53%, fungicides for 25% and herbicides for 14% (1979). In the case of herbicides, 54% of the total amount is used for rice while 54% of the sales of insecticides are directed to rice control. Indeed, there are more insect problems than weed problems. Also the farmers are able to control weeds manually whereas there

is no mechanical device to control insects. The government subsidizes or gives loans for pesticides to be used for rice and corn production.