

GENERAL DISCUSSION

Chairman: Yamamoto, I. (Japan): I would like to outline briefly the topics which will be taken up during the general discussion. Dr. A.J. Pieters (FAO/WHO) will introduce the activities of the Codex Committee on Pesticide Residues, Dr. A.H. El Sabae (UNARC, Egypt) will present some data relating to the use of pesticides in Egypt, Drs. C.Y. Yang (AVRDC), O. Mochida (IRRI) and M. Sundaru (Indonesia) will discuss in more detail problems pertaining to the use of fungicides, insecticides and herbicides, respectively. Finally there will be a discussion on safety programs, registration of pesticides as well as pesticide residue regulations, under the chairmanship of Dr. A.J. Pieters (FAO/WHO) with a presentation by Dr. H. Ishikura, followed by exchanges of views on priorities for research areas, contribution of industry and international cooperation in the field of pesticide development and use.

Chairman: Pieters, A.J. (FAO/WHO): I was struck by the fact that in most of the presentations of the last two days little mention was made of the role that FAO/WHO can play in the various manipulations of pesticides. I am thus pleased to have the opportunity to present some aspects of the work carried out by FAO/WHO in this regard.

In the field of pesticide residues, FAO/WHO sponsors two types of activities: (1) A joint meeting on pesticide residues (WHO/FAO) which has been held each year since 1963. In this meeting participate scientists, mainly toxicologists invited by the Director General of WHO as well as agronomists and residue chemists invited by the Director General of FAO. These experts who belong to university circles or are government officials meet for a period of one to two weeks to evaluate as objectively as possible toxicological data on a series of pesticides with regard to the acceptable daily intake (WHO scientists). FAO scientists study the residue data made available to them during the meeting and set up a list of maximum residue limits of pesticides on certain foods. Conclusions are based on two aspects: a) definition of good agricultural practice for a given pesticide (registered use of a pesticide in a given country) with regard to the acceptable level of residues, b) decision on whether a given pesticide is safe to use. The outcome of the joint meeting is contained in a report which also includes the list of the proposed maximum residue limits. This report is made available to various agencies worldwide. (2) In 1963 it was proposed by WHO and FAO that a harmonization program on food legislation should be initiated. During the first meeting of the so-called Codex Alimentarius Commission it was decided that one of the sub-committees of this Commission would deal with pesticide residues. Thus the first meeting of the Codex Committee on Pesticide Residues actually took place in Holland in 1966. The Codex Alimentarius Commission covers a wide range of foods and it was eventually decided that the U.S.A. would be responsible for several food products, Norway for fish, Switzerland for cocoa and the Netherlands for food additives and pesticide residues (the first meeting took place in 1974).

There is a very close relation between the work of this Committee and the outcome of the work of the joint meeting on pesticide residues which forms the basis of the work of the Codex Committee.

This year, representatives from 10 international organizations and 46 countries including 17 developing countries attended the meeting of the Codex Committee.

The aim is to reach a situation whereby as many countries as possible accept the maximum residue limits recommended by the joint meeting. Also, the meeting of the Codex Committee offers a good opportunity to discuss the proposals relating to good agricultural practices, toxicological aspects of pesticides, etc. and hence contributes to free trade of safe food worldwide.

Unfortunately, it is regrettable that many data on residues which have been presented during the present meeting have never been made available to the scientists of the joint meeting.

Chairman: Yamamoto, I. (Japan): May I ask Dr. El Sabae to make his presentation.

El Sabae, A.H. (UNARC, Egypt): In Egypt, most of the pesticides used and imported are insecticides due to the importance of insect pests problems in the country. Most of these insecticides are directed to the control of cotton pests since cotton is the major cash crop of Egypt.

Organochlorine insecticides such as DDT and toxaphene lost their efficacy and are no longer being used in Egypt due to the development of resistance in the cotton leaf worm. In 1961 the carbamates were substituted for the organochlorine insecticides to control an outbreak of cotton leaf worm while organophosphorus compounds which had been introduced in 1961 had to be abandoned due to the development of cross-resistance. Few of these are still effective and used for the control of the cotton leaf worm. Egypt has now reached the stage where most of the compounds already registered have been used and are no longer effective due to the development of resistance. Therefore, there is a risk of using new compounds which have not yet been registered in the producing or developed countries. In 1971 the use of leptophos was associated with the death of a large number of water buffaloes while humans were also affected as documented by the experts of FAO in Cairo. It is also known that in the organophosphorus group there are sub-groups among which the delayed neuro-toxicants cause ataxia on a short-term exposure in the form of semichronic toxicity. Yet leptophos and other organophosphorus compounds are still in use in the developing countries and manufactured in the industrialized countries. Other problems caused by a wide range of pesticides with chronic toxicity, such as toxaphene are related to their mutagenic and carcinogenic properties. Therefore it is of paramount importance that data on chronic toxicity to mammals, plants and fish be included for the evaluation of pesticides for registration.

In the developing countries regulations on pesticides are not as thorough as in the developed countries, as in the case of the pyrethroids. Therefore, we need the experience and assistance of the developed countries and UN agencies to establish the infrastructure for the analysis of pesticide residue levels, which requires facilities and equipment not always available in the developing countries. Indeed the growing interdependence between developed and developing countries for food resources requires that safe use of pesticides be promoted worldwide.

Chairman: Yamamoto, I. (Japan): I should now like to ask Dr. Yang to preside over the discussion on fungicide use.

Chairman: Yang, C.Y. (AVRDC): In the future the application and development of fungicides should cover the following 4 aspects: (1) The diversity and coexistence of several diseases caused by different fungi on the same crop in a given field; (2) The control of pathogens attacking high-yielding cultivars with moderate resistance which are released from the breeding programs from either national or international crop research institutes; (3) The existence of new pathogen races developed in the field either due to resistance to more selective fungicides or to the utilization of resistant crop cultivars building up selective pressure on the pathogens; (4) Fit in the multiple cropping systems promoted in the developing countries while meeting the strict criteria of safety for both environmental and ecological requirements.

I would like to ask Dr. Kajiwara to present some data on fungicide use in the developing countries.

Kajiwara, T. (Japan): Small amounts of fungicides are used in the developing countries although severe outbreaks of fungal diseases may occur, chiefly for economic reasons and because fungicides are not always effective due to their narrow spectrum of action.

I would like to illustrate these points in taking the example of mungbean scab occurring in Indonesia which affects the pods and stems of the plant, causing severe damage. When new shoots are attacked, in particular, the growth of mungbean is interrupted. The disease is caused by a newly identified fungus, *Elsinoe iwataae*. Yields can be increased by 2.5 to 3 times if appropriate fungicides are applied [thiophanate-methyl (Topsin-Methyl), carbendazim (Bavistin), benomyl, (Benlate)] while no effect is observed when other fungicides such as pyracarbolid (Sicarol) (effective against Basidiomycetes) are being used. Detailed studies should enable to determine which fungicide is most appropriate for a particular disease along with the optimum time of administration since the conditions prevailing in the tropics are different from those in the temperate zone.

Chairman: Yang, C.Y. (AVRDC): Are there any other questions?

Foulkes, D.M. (United Kingdom): Is it not possible that the time taken to assess the toxicity and residue data from many countries provided to the joint meeting on pesticide residues is too long? Indeed, some products may have been in use for many years before finalization of the views of the joint meeting and Codex Committee.

Knusli, E. (Switzerland): I would like to make a comment. There are limits to the introduction of new compounds to the developing countries only after registration in the producing countries. For instance, since the producing countries do not grow crops such as cocoa, coffee, cotton, etc., in such cases, first use in the developing countries with due documentation is inevitable.

Yorinori, T. (Brazil): Although most of the researchers in the developing countries are aware of the problems involved in the use of pesticides, such as residues, it is often difficult for them to convince the authorities concerned in the respective governments of the need for promoting research to secure the safe use of pesticides through the enactment or enforcement of regulations. Would it be possible for FAO/WHO and the Codex Committee to emphasize the importance for the governments to tackle this serious problem?

Greve, P.A. (The Netherlands): It would be extremely important to increase the role of the Codex Committee for international trade of food. There is a need for harmonizing the level of pesticide residue limits, particularly in the case of the developing countries which should endeavor to participate more actively in the meetings of the Codex Committee.

Johnen, B.G. (United Kingdom): Regarding the registration and control of chemicals, I would like to draw the attention of the symposium to the Second FAO Ad Hoc Government Consultation on Harmonization of Registration Requirements which is going to be held from 11-10-1982 to 15-10-1982 in Rome. FAO member governments have been invited. The main points to be discussed are: (1) Data requirements for registration; (2) Model scheme for registration and control of pesticides; (3) Harmonization of labelling and classification by hazards; (4) Packaging and storage; (5) Disposal of surplus pesticides and containers; (6) Control of availability of pesticides in relation to their hazard classification and restriction in use; (7) Problems in registration (including commodity registration, stepwise registration, property rights of registration data). Whilst the consultation will not solve the question of financial support needed by developing countries to establish effective pesticide registration and control, all technical information needed and ways of implementing internationally harmonized procedures will be discussed. I would therefore like to urge participants to influence as far as possible their governments to send to the meeting in Rome the current or future regulatory personnel of the respective countries. Extensive documentation has been prepared for the consultation and this should be received by governments from FAO. In order to further the development of national procedures of pesticide control, FAO has also sent a questionnaire to governments to establish the current situation regarding such procedures.

Chairman: Yang, C.Y. (AVRDC): I would like to ask Dr. Kajiwara whether mungbean scab is restricted to the Bogor area. Is it true that the disease has since spread a little farther from the region?

Kajiwara, T. (Japan): The spread of the disease depends on the weather conditions and the most important factor is represented by the amount of precipitation: the higher the precipitation, the more extensive the spread.

Chairman: Yamamoto, I. (Japan): I would like to ask Dr. Mochida to present some data on insecticides.

Chairman: Mochida, O. (IRRI): Five aspects will be considered:

- (1) The share of insecticides within the total amount of pesticides used in different countries: In Brazil, the Philippines, Indonesia, insecticides account for more or about 50% of the total amount of pesticides used due to the importance of insect pest outbreaks in these countries.
- (2) Pesticide use in relation to the crops: In the case of South and Southeast Asia, rice which is the most important food crop accounts for most of the insecticides applied. However, insecticides are also used to control pests of vegetables and estate crops which in some countries play a major

role as cash crops, such as banana and sugarcane in the Philippines and oil palm and rubber in Malaysia.

(3) Trend of pesticide use: In most of the countries both the amount and price of pesticides are on the increase. However, in Brazil, it was mentioned that the consumption of insecticides for soybean pests was decreasing due to the adoption of good agronomic practices by the farmers and the advice given to them on how to use properly pesticides by extension workers.

(4) Present and future problems of chemical control: a) Development of insect populations resistant to insecticides. To prevent this phenomenon from occurring, it is recommended to use mixtures or combinations of insecticides, to apply different insecticides alternatively and to develop new chemicals such as the insectistatics. b) Problem of pest resurgence induced by the use of pesticides. The phenomenon of resurgence has been recorded in the case of fruit tree pests, the brown planthopper (IRRI) and other rice insect pests. The mechanism of resurgence remains unknown. Resurgence may depend on the kind of insecticide used and the type of formulation of a given insecticide (foliar sprays may induce resurgence unlike granular application). The natural enemies may also play a significant role in the manifestation of the resurgence phenomenon as well as the presence of insect populations resistant to insecticides.

(5) Integrated pest control: The profit/cost ratio of the use of chemicals should be considered. In the case of rice, the problem is difficult. The use of an insecticide may be recommended to the farmers but if there are no outbreaks, they are likely to experience a financial loss. On the other hand, in case of severe outbreaks, the application of insecticides is often ineffective. Monitoring or forecasting of insect pest outbreaks is of paramount importance. As regards integrated pest control for rice insect pests such as the brown planthopper and the white backed planthopper, the cultivation of resistant rice varieties may be a suitable method of control unlike in the case of the stem borers, the green rice leafhopper, the leaf folder, gall midge, pentatomidae for which insecticides are still needed. IRRI has developed varieties with multiple resistance to several insect pests while some of the varieties are resistant to virus diseases such as tungro, grassy stunt, etc.

Ishikura, H. (Japan): At the early stages of IRRI research, control of rice insects had been centered on the use of chemicals. In your presentation you indicate that IRRI has already conducted a very comprehensive screening on rice resistance to insects. What is the future strategy of IRRI with regard to the development of insect control technology? To what extent will the resistant varieties recently developed be introduced in the rice breeding programs? In other words, how much emphasis is placed on the utilization of plant resistance?

Chairman: Mochida, O. (IRRI): The strategy adopted by IRRI is that if highly resistant varieties can be developed, they will be incorporated in the rice breeding programs. If such varieties are not available for a certain pest, such as the stem borer, insecticides will be used.

Inoue, K. (Japan): The development of combinations of insecticides is very important for the chemical companies because the cost of development of new safe and effective pesticides is very high due to the need for providing toxicological data. Presently the insecticides used have a narrow spectrum, are quite selective and have a low mammalian toxicity whereas the broad-spectrum insecticides are highly toxic.

The development of combinations could enable to prolong the life of safe chemicals used individually. The use of combinations could result in delaying outbreaks of hopper strains resistant to the chemicals as well as broadening the spectrum of action of the chemicals. For example, combinations of carbamate and organophosphorus insecticides would enable to control hoppers as well as lepidopterous insects such as the stem borer at the same time with only 2 or 3 applications of the chemical, which is most convenient for the farmers.

Yorinori, T. (Brazil): I hope I did not give the impression that Brazil is not going to use any more insecticides on soybeans. We all know that developed agriculture depends on chemicals but we should be sensible enough to use them properly. Given the high cost of pesticide development which affects the farmers and the world community as a whole, the pesticide factor should be considered and discussed in a forum where the industry, the agricultural researcher, the farmer and

consumer points of view would be jointly represented.

Mansour, N.A. (Egypt): I believe that combinations of insecticides should be used only if extensive studies have been carried out with regard to their safety to the environment. In Egypt, we are suffering a great deal from the excessive use of insecticide combinations and fertilizers which is associated with undesirable side-effects on the environment. In the developing countries in particular, there should be some form of regulation affecting the relationship between the producers of chemicals and the consumers. When the producers introduce a new compound in a country, they should provide enough technical information on the possible side-effects of the chemicals in relation to the residual activity in edible crops. The producers should help establish the level of tolerance of a pesticide under the conditions prevailing in the respective countries. Also the developing countries cannot afford to carry out detailed studies on the metabolism and mode of action of a new chemical. Effort should rather be directed to information relating to the proper timing of application of a pesticide or on how to minimize the hazards of a chemical.

Magallona, E.D. (The Philippines): With regard to the use of combinations of insecticides, I wonder whether it is more advantageous to have a mixture cleared toxicologically by the government or a mixture which is not authorized but used by the farmers. Indeed, farmers who have to contend with difficult pests are often tempted to use mixtures and the government cannot stop them just by issuing laws. If governments could evaluate data on a mixture, it would be safer for the users.

David, B.V. (India): I would like to offer my comments on combination product status in India. So far, only one combination, Sevidol (carbaryl+lindane) has been approved. The government of India are very careful and ask for complete data on bioefficacy, persistence of residues, storage stability and toxicology. It is necessary to determine how the individual components behave as opposed to the combination and also to analyse the economics of such combination. Data on safety aspects are needed, particularly acute and subacute studies and supplementary toxicological tests. The total cost for generating data amounts to US\$ 75,000 and requires about 2.5 years. Data are also needed on analytical methods and antidotes for combination formulations. There is indiscriminate mixing of pesticides by tank-mix practice and it would be desirable to have a proper combination at right dosage.

Chairman: Mochida, O. (IRRI): I would like to ask Dr. Sundaru to discuss some aspects relating to the use of herbicides in the developing countries.

Sundaru, M. (Indonesia): From some of the presentations made in the last two days it appears that the use of herbicides is increasing in such countries as the Philippines. In some of the developing countries 2-4D and MCPA (EC formulation) are still used as sprays which the farmers cannot usually afford to buy since they are too expensive. Moreover farmers often use herbicides mixed with insecticides, which is dangerous. It would be desirable to use bottle sprinklers for the application of herbicides which is cheaper and more convenient than the use of granules which creates problems of transportation and storage.

It seems that the application of 2-4D exerts an adverse effect on the growth and yield of crops and also promotes a shift from broadleaved weeds and sedges to grasses such as barnyard grass, *Echinochloa crusgalli*, etc. As a result, more selective herbicides are being used, particularly for rice, such as thiobencarb, oxadiazon, etc.

Research should emphasize socio-economic aspects of the use of herbicides, in relation to the possible effect on the environment and the welfare of the farmers should be taken into consideration.

In this regard, it would be desirable to organize meetings of the registration bodies from various countries so as to harmonize regulations and to limit the use of toxic herbicides.

The problem of toxic residues in food crops should be tackled and I would like to suggest that the companies which manufacture the chemicals be responsible for research on the effectiveness of herbicides as well as on residual effects on the environment.

Obien, S.R. (The Philippines): I believe that weed research in the future in the developing

countries should also involve crops such as sorghum, corn, legumes, vegetables, sugarcane and plantation crops in addition to rice. Major areas of concern will be the perennial weeds which are difficult to control by available compounds approved by governments. To improve the application rates, better sprayers (with controlled delivery) should be developed so that farmers could apply the recommended rates of herbicides. It may even become necessary to promote work on biological agents to complement herbicide use. Other non herbicidal methods (alternative methods) must be explored also to reduce the cost of chemical weed control and to minimize the developments of resistant species and/or weed shift from annuals to perennials. We should also continue to study how we could still use "old compounds" as these may be cheaper than newer materials.

Finally, I would like to take this opportunity to inform you that in November 1983 the 9th meeting of the Asian Pacific Weed Science Society will be held in Manila. I look forward to having some of the participants in this conference attend the meeting.

Chairman: Pieters, A.J. (FAO/WHO): The next subject on the agenda is a discussion on the methods relating to the safety of pesticide use, including problems of registration and residues, fate of pesticides, etc.

From the reports presented by the various speakers at the meeting, it appears that in the developing countries there is a tendency presently to use modern pesticides with less unfavorable effects and properties than those of the older. Regulations and legislation on the chemicals and inspection of the use of the pesticides have improved and efforts are directed to instruct the farmers on how to use the pesticides in a safer way. The pesticide market is certainly growing in quantity but also the quality of the products used is improving.

On the other hand, when I read the publications and what has been said at the UNEP Conference in Nairobi, the picture is as follows: there are two major problems in the world nowadays: the devastation of the tropical forests and the misuse of pesticides. Recently a publication entitled "The Circle of Poisoning" highlights the following aspects: (1) Every minute one person is poisoned by pesticides in the developing countries (500,000 persons are poisoned each year and more than 5,000 of them actually die); (2) Death and poisoning are caused by pesticides banned in the industrialized countries and exported to the developing countries; (3) Food products treated with pesticides are re-exported to the developed countries which thus receive the residues they wanted to avoid; (4) Pesticides are mostly used on crops that are exported and do not contribute to feed the hungry in the developing countries; (5) Since seed production is entrusted to multi-national organizations, genetic diversity is gradually substituted for uniformity which makes the use of the seeds more dependent on pesticide applications.

I should only like to add that in the developing countries the responsibility of the producers of chemicals does not end at the moment they sell the pesticides and the responsibility of the governments does not end at the moment they have bought the pesticides. I believe that the difficulties in developing a good legislation and registration procedures can be alleviated by the use of the facilities made available by the UN agencies such as FAO. The same applies to the various problems with regard to residues in food products. The Codex Committee on Pesticide Residues has recently published a list of analytical procedures acceptable for the determination of pesticide residues in crops and an inventory of the facilities where analysis of residue levels can be performed in the developing countries. Arrangements have been made by the industrialized countries for extending assistance to make laboratory methods and personnel available to the developing countries. Also the researchers should urge the authorities concerned in their governments to participate in the meetings organized by FAO such as the Ad Hoc Consultation to be held in October in Rome or the Codex Committee during which problems pertaining to the regulations on pesticide use are being discussed.

I should now like to ask Dr. Ishikura to present some data on the regulation of pesticides in Japan.

Ishikura, H. (Japan): In Japan, paddy fields account for half of the total area of cultivated land which amounts to 5.6 million hectares. Because of the very heavy use of pesticides in

Japanese agriculture (in 1979 each hectare of cultivated land received 20kg of pesticides in terms of active ingredient), regulations on the safety of pesticides which involve several ministries and agencies are stringent, particularly after the Agricultural Chemicals Control Act was amended in 1971. During the period 1970–1980 a large number of pesticide compounds were withdrawn from the market since the data on chronic toxicity showed that they were not safe enough. Presently safety of pesticides has definitely increased and for every 10,000 tons of pesticides used there are 10 cases of poisoning with 1 death. For the assessment of toxicity, submission of data on acute and chronic toxicity, reproduction, mutagenicity and metabolism studies as well as data on pharmacological effects are requested. To increase the safety for farmers, in addition to the requirements for pesticide registration listed above, the submission of data on inhalation and irritation effects (skin, eye), acute delayed neuro-toxicity, skin sensitivity is now under consideration. Also in Japan there are guidelines with regard to residues and toxicity of pesticides (1972) as well as food additives, pharmaceuticals, feed additives and labor safety. Effort is made to set up standards of good laboratory practices controlling the activity of the laboratories concerned with the establishment of safety data on chemicals, pharmaceuticals and pesticides.

Magallona, E.D. (The Philippines): During the discussions which took place in the last two days, there seemed to be an inordinate desire to simplify matters which in reality are much more complex. For example:

- (1) Dr. El Sebae referred to the use of a) leptophos in Egypt. I wonder why the USA is not forbidding the manufacturers of pesticides to produce such a toxic compound which is no longer used in the USA but is still applied in the developing countries. b) With regard to toxaphene, what is the basis for establishing that this chemical is carcinogenic? Mouse studies only?
- (2) Could Dr. Yorinori establish unequivocally that fish toxicity was attributable to the use of pesticides? Weren't there other pollutants?
- (3) How did Dr. Jeong identify the pesticides in the market-basket samples? By gas chromatography?
- (4) With regard to research in the developing countries, a) The pesticide industry does not give adequate support especially in the case of residue research. Often the industry refuses to submit pesticide standards. b) The regulatory authorities generally do not support the researchers but expect the researchers to support them with data.
- (5) Harmonization of registration. a) The status of expertise in the developing countries is very inadequate. Who will evaluate the data presented by the industry? b) Response of industry. In the Philippines, GIFAP suggested a list of requirements but the member companies refused to honor this as a commitment and do not submit complete data. c) FAO and WHO operate only in an advisory capacity and are not in the position to force people to follow what they recommend.
- (6) Codex Committee on Pesticide Residues. a) There is a limit in the pesticides under consideration since only those included in international trade or those for which the manufacturers agree to submit data are being evaluated. b) The Committee does not deal with occupational hazards resulting from pesticide use and the maximum residue limits are administrative limits and are not necessarily related to safety.
- (7) Countries. The developing countries should develop their own standards and the regulations should be designed to suit individual cultures and capabilities. Also national leadership has to consider several other development priorities.
- (8) Research on pesticide use should place emphasis on the improvement of the application systems to prolong the use of a compound.

Chairman: Yamamoto, I. (Japan): We have already identified many problems and tried to propose a solution to some of them. To be able to promote the safe and effective use of pesticides, we should determine what has to be done at the governmental level, what are the responsibilities of the chemical industry and what are the research priorities. Therefore I would like to ask you what are the requirements of the developing countries to the developed countries in this regard.

Yorinori, T. (Brazil): Since in many of the developing countries the researchers find it

sometimes difficult to convince the authorities concerned in the government of the need to enforce regulations to prevent the misuse of pesticides, particularly with regard to the residue problems, the chemical industry will face a challenge in having to understand that there will be a decrease in the use of pesticides with the progress made in integrated pest management studies. Research on pest management will then have to focus on the development of pesticides which are effective against the target pests and are not associated with undesirable side-effects on the environment.

Ishikura, H. (Japan): When I listen to the comments made in the last two days, I realize that the problems most of the developing countries are faced with due the increase in the use of pesticides were the problems encountered by the developed countries one or two decades ago. I believe that the information on how these problems were overcome in the developed countries should be beneficial to the researchers, administrators and regulatory authorities of the developing countries. Honest disclosure of the experience in pesticides, including data on the hazards is of paramount importance if the safe use of pesticides is to be promoted in the developing countries.

Johnen, B.G. (United Kingdom): It has to be recognized that some of the demands made on pesticides are more or less incompatible with each other. For example, the demand for more effective chemicals cannot always be integrated with the demand for reduced toxicity to operator, consumer or the environment. There are cases where this is at least very difficult, but in hazard terms, should not prove detrimental. The demand for more specific chemicals for IPC systems can be incompatible with the demand for reduction in use of pesticides. More specific pesticides means that several chemicals for individual pests will have to be used which is more than in the case of a single broader-spectrum pesticide.

There were several calls during the discussion for more safety, residue, etc. data on pesticides. I would submit that such data exist already in sufficient quantity and quality but are not publicly accessible or sometimes not submitted even to regulatory authorities in all countries because the problem of safeguarding the property rights of the company who owns the data and has developed these at great expense (pesticide development cost is now far in excess of US\$ 20 million) has not been solved. It is hoped that the FAO consultation in Rome in October 1982 will show a way to the solution of this problem. Industry will be prepared to present its idea in this respect.

Magallona, E.D. (The Philippines): We should set limits to what administrators and regulatory authorities can actually do. I believe that the education of the farmers is the most important problem, which requires time.

Chairman: Yang, C.Y. (AVRDC): I should like to conclude that what the developing countries most need is that the developed countries or chemical companies carry out more research on application technology in the developing countries.