특강 I : Current Status and Future Prospects of Pesticide Research in Japan

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ABSTRACT

Distinguished guests, Ladies and Gentlemen ;

It is my great pleasure and honour to be invited to the inauguration ceremony of the korean society of Pesticide Science. On behalf of the Pesticide Science Society of Japan, I offer my sincere congratulations on the launching of the new society.

As the closest neighbouring country, we have for many years maintained good contact with Korean scientists in universities and governmental institutes, and with those in pesticide industrial circles through research and development. I feel the establishment of the Pesticide Science Society of Korea at this time is actually rather late as university laboratories, government bureaus and enterprises have all actively engaged for some time in research and development, the practical application, transactions, registrations and regulations of pesticides. By establishing this Society you can now bring all your subjects of interest and your activities together for discussion with scientists of different disciplines at meetings organized by the Society.

It is needless to emphasize on this occasion the importance of pesticide application in agricultural production and the protection of public health. Before reaching the present level of quality of pesticides, we went through a period of using persistent insecticides which caused environmental problems. Also the repeated use of pesticides caused resistance to develope in strains of insects, pathogenic microorganisms and weeds.

To overcome these worldwide problems requires international collaboration. Better pesticide production and application means selective and non-residual pesticides and their safe use.

However, there will inevitable be many barriers to surmount in obtaining registrations of new pesticides by the international patent systems, to comply with restrictions by the WTO system and pesticide regulation laws to be observed in each country. At the same time, we have common social problems in Korea and Japan. They are a decrease in farm lands and farm

householes, adequate domestic production only of rice for our citizens, and the high price of agricultural products. We have also experienced abnormal climate in Asian countries and a temporary shortage of rice as a result. We need a proper use of pesticides to assure as much harvest as possible even under poor cultivation conditions.

The Pesticide Science Society of Japan was established in 1975 and presently has about 1,750 members. The Society publishes a quarterly Journal of Pesticide Science and organizes annual meetings the last week in March each year which

inclued a business program on annual activities and the budget report, conferment of the Society Award, scientific reports and symposia.

Research topics recognized by the Society during the last five years(March, 1993 — March, 1997) are the following :

1. Awards for High Prospectiveness for Young Scientists

1993 Synthesis and Insecticidal Activity of Silicon-containing Pyrethroids with Low Fish Toxicity

1994 (i) Mode of Action of Diethofencarb to Benzimidazole-Resistant Strains in Neurospora crassa
(ii) Structure-Activity Relationships of Nicotinoids and the Related Compounds

1995 (i) Studies on the Mechanism of Action of Insecticides Using Electrophysiological and Molecular Biological Techniques
(ii) Mechanism of Action of N-Phenylimide Photobleaching Herbicides

1996 (i) Studies on Disappearance of Recombinant JH Esterase in Insects and Significance of the Studies.
(ii) Quantitative Structure-Activity Relationships of Molting Inhibitors
(iii) Application of Toxicokinetic Approaches to Insecticide Resistance Studies

1997 (i) Structure-activity and Mode of Action Studies of Pyrethroids
(ii) Action Mechanism of Pyrimidinyl Carboxy Herbicides

2. Awards for Prominent Research Achievement

1993 Study on the Behavior and Fate of Pesticides in Aquatic Environments

1994 (i) Studies on the Absolute Stereochemistry in Metabolism and Activity Development of Insecticides
(ii) Toxicological Studies of Pesticides by Using Protoplast and Cell Culture Systems

1995 Studies on the Synthesis and Pesticidal Activity of Organophosphorous Compounds

1996 (i) Studies on the Synthesis and Insecticidal Activity of Neonicotinoid Compounds
(ii) Cytochrome P450 Monooxygenase-Mediated Resistance to Insecticides

1997 (i) Studies on the Synthesis and Biological Activity of Imadazole Compounds
(ii) Approaches to the Primary Mode of Action of Chloroacetamides

3. Awards for Prominent Technological Achievement

1993 (i) Development of a Systemic Fungicide, Flutolanil
(ii) Development of a New Fungicide, Diethofencarb

1994 (i) Development of a New Acaricide, Milbemectin
(ii) Development of a New Fungicide, Ferimzone
(iii) Development of a Chloronicotinyl Insecticide, Imidacloprid

1995 (i) Development of a New Acaricide, Fenpyroximate Current Status and Future Prospects of Pesticide Research in

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(ii) Development of a New Acaricide, Pyridaben

1996 (i) Development of a New Herbicide, Imazosulfuron

(ii) Development of a New Rice Herbicide, Pyrazosulfuron-ethyl

1997 (i) Development of a New Fungicide, Mepanipyrim

(ii) Development of Flusulfamide

The subjects of these awards indicate the research trend of Japanese pesticide science. Awards for young scientists(1) include studies on the mode of action of insecticides(4 papers), herbicides(3 papers), insect growth regulators (1GRs)(1 paper), fungicides(1 paper) and assessment of insecticide resistance(1 paper).

Prominent research achievement(2) includes fundamental research on finding of new type of IGR compounds(1 paper), new analytical method of fungicide activity(1 paper), influence of pesticides to aquamethod of fungicide activity(1 paper), influence of pesticides to aquatic environment(1 paper) and insecticide resistance (1 paper).

Awards for prominent technological achievement(3) are for commercial products developed and marketed by an industry. They include development of fungicides(5 papers). acaricides(3 papers), herbicides(2 papers) and insecticides(1 paper). Development of these new products reflects the needs of the domestic and international markets and farmers' demands.

Japanese agriculture is now facing serious difficulties in decreasing farm lands and farm households, adverse effects of abnormal climates, a short supply of crops other than rice and high prices of agricultural products. These circumstances have caused the import of many agricultural products including vegetables, fruits, grains and dairy products to increase.

According to a recent poll, however, 46% of japanese surveryed concern about low domestic agricultural production.A stable food supply requires the optimal use of pesticides.

Table 1. Properties required for Idealistic Pesticides

a. Strong activity to target organisms
b. Low mammalian toxicity
c. High selective toxicity
d. Environmentally friendly
e. No residual effect
f. No development of resistance among pests
g. Low price
h. Easy application

The table shows the properties required for idealistic pesticdes and scientists are struggling to these. Some new products are being produced which meet these requirements and further investigations will be conducted to this end.

Recent research and development of fungicides in Japan has been successful in coping with the rapid development of resistance of various plant pathogens. There is a possibility that designs can be developed from naturally occurring antifungal compounds produced by fungi and bacteria for a broad spectrum systemic fungicide for use in agriculture.

Many sulfonylurea herbicides have been investigated since the 1970's and subsequently commercialized for use on turf, paddy rice and wheat fields : these are usually high performance with low dose applications.

A group of nitromethylene compounds, collectively called neonicotinoids, have systemic activity and excellent field efficacy for Hemiptera, Thysanoptera, Lepidoptera and Coleoptera on rice, vegetables and fruit trees. They are not cross resistant to organ-ophosphorous, carbamate of pyrethroid insecticides and are low in mammalian and fish toxicity.

Most of the IGR compounds have been developed from JH analogs, dibenzohydrazin compounds and ecdysone agonists. IGRs disturbing the normal hormonal activity are specifically related with the metamorphosis, growth and life cycle of insects. Research on identifying new types of compounds depending on bioassays of their action are still eneretically poceeding and efforts toward com-mercialization will continue.

Studies on transgenic crops resistant to insect pests, viral diseases, low temperature and herbicides will be continued to clear them for comercial production. Transgenic maize, rapeseed, and soybean varieties have authorized for human consumption by the health authorities in Japan.

Production of a stable and constant supply of food while stil protecting public health is an essential and urgent issues to meet the requirements of the world's growing population. The safe and effective use of pesticides with careful selection of those most appropriate will be necessary in future agricultural production.

Finally I would like to summarize the properties required for the future pesticides. Toxicology studies of agricultural chemicals are required for the registration and the toxicity data must be obtained in screening process. Toxic substances are excluded at the early stage of screening. However, animal protection groups call off to stop sacrificing many animals at the drug and pesticide experimentations. Instead of using intact animals for the tests, replacement to other methods like cell culture methods must be considered. We hardly face in our everyday life to pesticide poisoning unless we take them accidentally. Operators of pesticides application need to take cautios measures. Sometimes people around the farming area complains drifting of pesticide spray from nearby paddy fields of spray by helicopters. Radio-controlled model airplane ap-plications or application from outside field are being devises and PDS(pesticide delivery system) is conducted for effective formulations such as microcapsuls. flowables, driftless powders and slow release formulations. Plant-scale crop protection is also in progress to spraynly to necessary crops and not to other part of the field.

Environmental risk assessment is a difficult and time consuming process as residue influence to ecology and estimation of recovery period from the influence take long time.In our modern life many kinds of chemicals and chemical products are affluent in our environment. As the risk assessment, animal toxicology and residue analyses on pesticides are carring out, there has been found various advers effect of many chemicals to wild life. Last year NAS, EPA, CMA began investigation program to survey endocrine-desrupting substances. Chemical Industry Association of US promised to cooperate to this

program. In a book titled 『Our Stolen Future』was published and in that book more than 51 materials are listed as the endocrine-desrupting substances including medicines, pesticides, plasticizers of PVC and other plastics, dioxines, PCB and so on. Japanese Chemical Industry Association also estalished a co-ordination committee to investigate measures to deal with the proposed problems. Green peace, WWF and governments of European countries are calling off to phase out production of PVC as the plasticizer, phthalates desrupt endocrine function.

As a conclusion of my talk today, my interests at present are summarized in the following three articles :

1. More involvement of biological pesticides will increase as an important component of IPM. Biotechnological research on production of new cropcultivars will increase.
2. Effective use of pesticide in PDS will go on. Better formulation and application devises will be developed.
3. Measures must be found to answer the demand of phasing out of some pesticide use and their relations with endocrine-desrupting substances.