

Appropriate use of bio-fertilizers and bio-pesticides for small-scale farmers in Asia



AMONG THE MAJOR CONCERNS IN TODAY'S WORLD are the pollution and contamination of soil by excessive and injudicious use of agrochemicals, as well as their detrimental effects to humans — a burden borne, in particular, by agricultural workers and rural communities worldwide. Compelled to respond to concerns on both health and environmental grounds, governments all over the world are now switching from 'risk reduction' and 'safe use' procedures, to developing more environment-friendly alternatives of sustainable agricultural production such as the use of bio-fertilizers and bio-pesticides.

Excessive and inappropriate use of agrochemicals has undeniably resulted in negative and sometimes irreparable effects on the environment and on human health. Degraded soils and groundwater pollution caused by chemical leaching have resulted in nutritionally unbalanced and unproductive lands. In the same way, reliance on chemical pesticides to manage pest problems has aggravated environmental decline and caused serious health effects on agricultural workers and rural communities. Pesticide residues also raise food safety concerns among domestic consumers and pose trade impediments for export crops.

It is in this context that bio-agents, such as bio-fertilizers and bio-pesticides, have recently become the focus of research and resources in many countries. Scientists worldwide are now exploring suitable and effective bio-agents as among the strategies to achieved improved and sustainable crop production. In many Asian countries, bio-fertilizer and bio-pesticide technologies are now in various stages of development and utilization.

Under this premise, FFTC organized the international workshop on appropriate use of bio-fertilizers and bio-pesticides for small-scale farmers to bring together experts from all over the Asian region to share and exchange practical and technical information and enhance regional cooperation in the development of standards and regulations on bio-agents. During the workshop, 13 speakers representing 8 countries in Asia discussed and identified bio-agents that are suitable and effective to local conditions. They also deliberated on the enormous contributions of bio-fertilizers and bio-pesticides in improving crop production and agricultural ecosystems. Overall, the workshop provided a better understanding of the efficacy and safety of these technologies in small-scale farms, and gave a clear picture of the general status and prospects of bio-agents as promising strategies for environment-friendly and sustainable crop production.

Status and potential of bio-fertilizers and bio-pesticides in Asia

While the negative effects of agrochemical overuse are widely acknowledged by most countries in Asia, majority of small-scale farmers in the region continue to rely on inorganic fertilizers and pesticides. Bio-alternatives occupy only 1-2% of the total crop protection market, mostly concentrated on the sales of Bt products. Factors limiting the use of bio-alternatives include availability and accessibility, efficacy of the product, knowledge on their development and proper application, promotion and marketing, and policy aspects.

Despite this situation, however, efforts related to fertilizer and pesticide risk reduction and concerns for food safety, human health and the environment drive international communities to continue exploring alternatives that would abate the negative effects of inappropriate and intensive use of agrochemicals.

Opportunities for developing, using, and commercializing bio-pesticides and bio-fertilizers in Asia are vast. Research results indicate their effectiveness and cost efficiency. They can easily be mass-produced and are compatible with Good Agricultural Practice (GAP), food safety, and environmental concerns. With a growing public and private investment in this area, some countries in Asia have had significant technology breakthroughs and research findings establishing the effectiveness of bio-pesticides in managing pests and diseases and bio-fertilizers' efficiency in enhancing soil productivity.

With an established system of registration and a more advanced R&D, countries like Japan, Korea and Taiwan have made significant strides in terms of developing and commercializing bio-agents. However, for some developing countries in the region, successful cases of adoption of bio-agents by smallholder farmers largely depend on their level of education and training to lead them into rational decision-making given various farm production options. In addition, regulatory systems to ensure efficacy, safety, and cost effectiveness of bio-agents have yet to be established in most Asian countries.

Farmers' acceptance of bio-fertilizers and bio-pesticides

Some of the specific bio-fertilizer and bio-pesticide products that farmers are using in the ASPAC region, their effects and economic benefits, and some strategies used by organizations to further promote their acceptance and utilization are discussed below.

The Tokachi Federation of Agricultural Cooperative (TFAC) in Hokkaido, Japan produces and distributes rhizobium bio-fertilizers namely: mamezo for soybean, azuki bean, and phaseolus beans; R-processing seeds, in which leguminous seeds are inoculated with *rhizobia*; and the hypercoating seeds wherein leguminous grass seeds are coated with *rhizobia* within the capsule of calcium carbonate. Eighty-percent of farmers in Hokkaido use these bio-fertilizers.

In the same way, both central and local government agencies in Taiwan are supporting

extensive production and application of bio-fertilizers such as rhizobial and P-solubilizing microbial inoculants for vegetable soybeans and other crops, and AM-inoculants for melons and other horticultural crops. From 1987 to 2006, enough inoculants were produced to inoculate approximately 65,091 ha of farmland. Over the year, farmer's economic gain also increased significantly (US\$ 27 million) from using rhizobium inoculants. This resulted in savings on chemical fertilizer and reduction of groundwater pollution caused by N leaching. Among the strategies used to increase farmers' acceptance of bio-fertilizers are: holding of awareness meetings and visit to demonstration plots treated with bio-fertilizers.

In Vietnam, farmers in the Mekong River Delta have been using BioGro in rice and this resulted in fewer diseases, stronger stems, brighter and cleaner grains, better grain yields, less cost, and more benefits. In Namdinh, farmers' adoption of Biogro resulted in less chemical fertilizer costs, better growth, acceptable grain yield, better quality, and better profit.

In Thailand, model farmer groups practicing organic farming in U-Thong district of Suphan Buri Province in Bangkok demonstrated the application of indigenous knowledge in the development of bio-fertilizers. This classic utilization of indigenous knowledge was highly advocated by the country's agriculture department.



Bio-N is a microbial-based fertilizer developed in the Philippines intended to supply 30-50% of N-requirements of rice, corn, and other crops.

Participants visited: (top right) the Agricultural Park at the University of the Philippines Los Baños (UPLB) showcasing vegetable plots applied with compost and herbal gardens with plants used as natural pesticidal control; and (below) the Center for Rural Technology Development in Calauan, Laguna, Philippines promoting vermicomposting technology for small-scale farmers.



In the case of bio-pesticides, environmental concerns and insecticide resistance has recently led many farmers in Taiwan to consider use of microbial insecticides for the control of agricultural pests.

In Korea, bio-pesticides occupy only 2.8 % of the pesticide market valued at 35 million dollars. Egg yolk and cooking oil mixture (EYCO) is widely adopted by Korean farmers for various pest control and to increase plant health. In many field trials, EYCO was found effective in controlling powdery mildew and small insects such as mites. Korean farmers adopt it because it can easily be prepared. It is cheaper than the chemical pesticide. It is safe and environment-friendly.

Use of herbs and plants to repel insect pests was also widely practiced by small-scale farmers in Thailand. Examples of multipurpose repellent is a preparation that consists of 1 kg each of neem leaves or seeds, galinga tuber, and lemon grass chopped into small pieces or finely pounded mixed with 20 liters of water and left to ferment for three days.

Bio-pesticides in the Philippines are still unpopular to farmers. However, with the high cost of synthetic pesticides nowadays, coupled with their negative effects, bio-pesticide use can be a welcome alternative to chemical use. Such is the case of the Bantug Samahang Nayon MultiPurpose Cooperative (BSNMPC). Members are now mass-producing and using NPV as biopesticide in Barangay Bantug, Asingan, Pangasinan.

Many IPM programs on rice, vegetables, cotton, tea, soybean, and groundnuts have been implemented in different areas in Vietnam. A related



campaign launched by the agriculture ministry in Long An province has resulted in farmers' acceptance of technology. Nearly 550 farmers have applied the IPM approach on millions of hectares of rice. Moreover, farmers with IPM training achieved higher net profit than those without IPM training. IPM programs have also helped significantly reduce farmers' medical costs due to pesticide poisoning.

Issues, constraints and recommendations

Bio-fertilizers and bio-pesticides are still underdeveloped and underutilized in most developing countries in Asia due to technical, social, and institutional constraints. The effectiveness and efficacy of bio-agents have yet to be established to be comparable if not to exceed that of agrochemicals. Bio-fertilizers, for instance, are perceived by farmers to have slow positive effect compared to chemical fertilizers. Some other issues that need to be addressed include technological constraints and limitations, farmers' acceptability of the technology, lack of technology promotion and product marketing, financial limitations to pursue further research activities, inadequacy of modern research equipment and



Visit to the bio-fertilizer production section of the National Institute for Molecular Biology and Biotechnology (UPLB-BIOTECH), Philippines.

laboratory facilities, and inappropriateness of existing policies to the nature and characteristics of bio-agents.

Recommendations to address the problems include: conduct of further research activities to fine-tune the technology, multi-disciplinary effort in undertaking research and extension activities, provision of adequate financial support for R&D, and upgrading of research equipment and laboratory facilities. Extensive marketing, promotion and awareness program must also be implemented such as information campaigns on the disadvantages of overusing chemical fertilizers and toxic pesticides, field demonstrations to showcase the benefits of adopting bio-agents in crop production, training for farmers and researchers on the aspect of developing and using bio-agents, technology promotion and product marketing through partnership with local government units and private companies, and policy advocacy to create legislations and gain strong policy support from the government, especially in the area of standards and regulations.

In the development and adoption of bio-agents, basic principles of good agricultural practice must also be emphasized, such as use of resistant varieties, clean seeds, cropping systems, balanced ecosystems, etc.. Lastly, resource sharing and complementation among countries in the Asian region through information exchange and technical partnerships must be given due importance to facilitate the development, use and adoption of bio-agents.

International Workshop on Appropriate Use of Bio-fertilizers and Bio-pesticides for Small-scale Farmers in the Asian and Pacific Region

Held in Los Baños, Laguna, Philippines, November 19-23, 2007

No. of participating countries: 8 (Japan, Korea, Malaysia, Myanmar, Philippines, Taiwan ROC, Thailand, Vietnam)

No. of papers presented: 13

No. of participants: 13 speakers and 30 local participants/observers

Co-sponsor: Philippine Council for Agriculture, Forestry, and Natural Resources Research and Development (PCARRD)

List of papers

Resource papers

1. Status and challenges for the development and proper utilization of bio-fertilizers and bio-pesticides in the Asian and Pacific region
- Johannes W. Ketelaar, FAO Regional Office for Asia and the Pacific, Thailand
2. Management of relevant vegetable diseases by bio-pesticides in Japan
- Masataka Aino, Hyogo Prefectural Technology Center for Agriculture, Forestry and Fisheries, Japan
3. Utilization of biopesticides for crop pest management: the CLSU experience
- Marilyn G. Patricio, Central Luzon State University, Philippines
4. Biotech-fertilizer development of the Taiwan Fertilizer Co., Ltd.
- Ren-Che Shieh and Hui-Mar Huang, Taiwan Fertilizer Co., Ltd., Taiwan ROC

5. Current status of bio-pesticides development, farmer's acceptance and their utilization, and future perspective in Taiwan
- Suey-Sheng Kao, Taiwan Agricultural Chemicals and Toxic Substances Research Institute (TACTRI), Taiwan ROC
6. Current status and future direction on commercial production and use of bio-fertilizers in Japan
- Tadashi Yokoyama, Tokyo University of Agriculture and Technology, Japan
7. Current status of bio-fertilizers and bio-pesticides development, farmer's acceptance and their utilization in Korea
- Hyeong-Jin Jee, National Institute of Agricultural Science and Technology (NIAST), RDA, Korea
8. Current status of bio-fertilizers development, farmer's acceptance and their utilization in Malaysia
- Rosnani Abdul Ghani, Malaysian Agricultural Research and Development Institute (MARDI), Malaysia
9. Current status and future perspective on bio-fertilizers and bio-pesticides production, farmers' acceptance and their utilization in Myanmar
- Kyaw Nyein Aye, Myanmar Fruit and Vegetable Producers and Export Association, Myanmar
10. The status of bio-pesticides and bio-fertilizers in the Philippines
- Pio A. Javier, University of the Philippines Los Baños (UPLB)
11. Current status of bio-fertilizers development, farmer's acceptance and their utilization, and future perspective in Taiwan
- Shiu-an-Yuh Chien, Agricultural Research Institute, COA, Taiwan ROC
12. Current status and future perspective on bio-fertilizers and bio-pesticides production, farmer's acceptance and their utilization in Thailand
- Banpot Napompeth, Kasetsart University, Thailand
13. Current status of bio-fertilizers and bio-pesticides development, farmer's acceptance and their utilization in Vietnam
- Phan Phuoc Hien, Nong Lam University HCMC, Vietnam

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