

## FINAL DISCUSSION

Chairmen: Dr. Kunio Toriyama and Dr. Cleudaldo B. Perez

### ORGANIC PRODUCE

Organically grown food is often thought of as healthier than food grown using chemicals. Participants at the meeting discussed whether this is actually the case. Dr. Hsieh was concerned with the overuse of chemical fertilizer, especially for vegetables, and discussed recent research carried out in Taiwan on the fate of applied N. These results suggest that excessive nitrogen fertilizer not only pollutes the soil and water, but also pollutes the plant itself. If applied ammonia changes into nitrite and nitrate before it can be absorbed by the roots, the nitrate will be absorbed by the plant. Nitrate in food is known to be very damaging to human health, and a potential cause of cancer. Especially under tropical conditions, the rate of nitrate accumulation in plants can be high, and analysis had found some cabbage grown in Taiwan to have very high nitrate levels in cabbage. He suggested that reducing the use of chemicals and increasing the use of organic fertilizer might help to solve this problem.

Dr. Hong agreed, but pointed out although people often refer to “too much fertilizer”, there is little quantitative evidence on how high a level this represents. There is great concern in Korea to reduce the level of chemical fertilizer applications and make use of organic by-products, including those produced outside the agricultural system. Agriculture in recent decades has been a burden to the environment, but the aim now is that agriculture should contribute to the health of the environment by absorbing potential pollutants. However, some farmers are using too much organic matter, and there can be a high nitrate content in vegetables produced by organic farmers. He suggested that when the term “excessive” is used, that it should be quantified. For example, what level of nitrates can be tolerated in vegetables?

He suggested that it may not be realistic to aim for a world completely free of all pollutants. Instead, we should establish what level of e.g. nitrates in vegetables can be tolerated, and then regulate the use of fertilizer to maintain nitrates below these limits. Any standards would probably be different according to climate and locality, but we need to find how to make best use of organic matter without damage to the environment and without endangering food quality. Dr. Hamblin suggested that both these statements were not very different to the quality controls which have always been necessary for food regulation. In most places, there are national and international standards on the permissible levels of toxic substances. She suggested that Dr. Hong’s wish to relate these to farm practices might be difficult to operate, since we cannot always relate a single farming practice to product composition. However, sampling and traceback patterns could be used to indicate patterns.

She suggested that the recent discussions on sustainable agricultural systems had indicated that these are more complex and need more elaborate training and management than the systems they are replacing. Perhaps there had not been enough emphasis in discussion on how this improved level of education and skill could be achieved. She recommended that one outcome of the meeting might be a search for methods of integrating. For example, one instrument that might be used is price controls to reflect different qualities of produce. She pointed out that price controls are very powerful, and farmers react strongly to them. There are also more complex mechanisms such as education. She suggested that FFTC might promote improved integration of such mechanisms to promote sustainable agricultural systems.

### SOURCE OF ORGANIC FERTILIZERS

Mr. Ariffin bin Tawang pointed out that one of the major components used for organic fertilizer is animal wastes. In many countries, livestock production areas are spatially separated from those with intensive cropping. He asked how, if organic farming proves successful, organic methods could be applied in parts of the country that did not have a large livestock base or some other source of organic materials. Would governments

have to promote livestock even if production is not competitive? He also suggested that discussion of sustainable agriculture should include biotechnology, including the manipulation of genes to create resistant varieties and remove the need for pesticides.

Dr. Saleem Ahmed pointed out that from the practical viewpoint of future food needs, it is likely that fertilizer use will increase, at least in the short term, and the problem is how to make it sustainable. He suggested that improved fertilizer technology should be considered, such as slow release fertilizers. In response to Dr. Hong's question as to what level of fertilizer use could be considered harmful, he pointed out that usually the recommended level is considered the ideal one. Different countries may set these levels differently to meet their particular soil needs, and he agreed that there is a need to define standardized criteria of what is a proper level of fertilizer use. Economists might feel that that price could be factored in, and if actual application rates are higher than the recommended ones, the price of fertilizer is probably too low. He felt that the concept of trying to determine the theoretical maximum fertilizer level is a useful one. In discussions of organic fertilizer, he suggested that not only animal manure should be considered as a nutrient source, but also leaf litter, rice straw and rice bran etc. Dr. Saleem Ahmed pointed out that when many countries refer to "food needs", they refer only to food grain needs. He proposed that this category be extended to include all food crops. Finally, rather than an opposition between organic and non-organic farming, he suggested that sustainable agriculture needs a middle course which uses the best features of both.

Dr. Mutert suggested that fertilizers should be viewed as a source of plant nutrients which can be organic or inorganic, mineral or chemical. Either type can cause problems from overuse. He referred to agriculture in the Netherlands, where some farmers are applying 500 kg N from inorganic sources, plus an additional 500 kg N from organic sources - a total of 1000 kg per hectare per year! Even in a highly intensive system this is too much fertilizer, and part of it is volatilized while some ends up polluting the groundwater.

Several participants had also discussed the diversification of rice-based systems into vegetables, root crops etc. Dr. Mutert pointed out that overuse

of both fertilizers and pesticides tends to be particularly marked with vegetable crops, and also in fruit production. Fruit and vegetables are attractive crops for farmers, because they are high-value cash crops, often export crops. Dr. Mutert said that the accumulation of organic wastes is reported from densely populated areas, while in other areas there is a demand for them. One problem is how to recycle organic wastes in such a way that the agricultural sector is making a positive contribution to the environment.

Dr. Hong expressed his admiration for the way in which organic resources are being put to agricultural use in Taiwan. Korea is now producing some bagged organic fertilizers, but these are very expensive compared to the nutrient content of the fertilizer in the bag. Dr. Hong asked, if the return of the organic wastes to the land is good for the environment, whether the government could take action that would allow farmers to use organic fertilizers at a more reasonable price. He asked whether such policies had been adopted in Taiwan. Dr. Hsieh replied that the ROC government gives a subsidy for organic fertilizer. One kilogram of organic manure has a subsidy of about NT\$3 (US\$0.12), compared to a purchase price of NT\$ 5-15 (US\$0.20-0.60) per kilogram, depending on the quality of the fertilizer. Subsidy reduces the price of organic fertilizer and encourages farmers to use more of it.

Dr. Hsieh emphasized that the soil organic matter content in most of Asia is low. Although in Japan and USA some farmers are using only organic fertilizer, plus green manure and crop rotation, with good results, in tropical countries the soil organic matter content tends to be low. Furthermore, organic fertilizer is not as efficient as chemical fertilizer. He suggested that Asian farmers should use the minimum amount of chemical fertilizer needed to stimulate plant growth and raise production, together with lots of organic manure. Dr. Hsieh suggested that in sustainable agriculture for most of Asia, there should not be an emphasis on organic materials alone, but the use of organic fertilizer combined with small amounts of chemicals.

## **SUSTAINABLE AGRICULTURAL DEVELOPMENT**

Dr. Hamblin pointed out that the meeting had tended to focus on a relatively small number of high-input systems in Asia. In terms of sustainable agriculture

for the region, there is also a large group of Asian countries with a syndrome of quite different problems. They include such issues as deforestation, the management of degraded environments, and difficult social issues regarding the use of land. How can sustainable systems be established in such environments? She pointed out that scientists alone cannot provide the answer, because it requires more than technical solutions. Dr. Hong said that Dr. Librero's data from the Philippines showed average rice production of 1.9 mt/ha using improved varieties, although these varieties had a potential yield of 7 mt/ha. In Korea, the recommended level of N for rice is 100 kg/ha, but some farmers are applying double this amount. If fertilizer consumption could be rationalized, and the fertilizer saved be used in tropical areas, yields could easily be tripled. This would reduce the need to extend agriculture onto new land. He pointed out that chemicals are sometimes seen as a danger to the environment, but properly used they can bring environmental benefits. Dr. Perez said that the present public protest in the Philippines about the use of chemicals in crop production is mainly concerned with pesticides, rather than chemical fertilizers. Application rates for rice are low, although some plantation crops may already be receiving applications of chemical fertilizer which are too high. Dr. Perez added that in the Philippines, availability and price are what limit most small-scale farmers, which is why average rice production is still low, in spite of a 70% adoption of new rice varieties.

In summary, Dr. Perez emphasized that sustainable food production means sustainable profitability, ecological sustainability with proper management of natural resources, and social sustainability with justice and equity. These needs were common to all countries. The framework for development must address them, whether in the short or the long term. In view of the information provided by the meeting, he asked participants to consider what will be the critical problems faced by scientists, extension specialists and policy makers. There are also the specific concerns at a farm and community level. With regard to agroindustry, there is the problem of which commodities will be important for the industrial sector, or as a source of by-products for use as plant nutrients. These issues will have to be addressed by policy makers and research scientists, and Dr. Perez suggested that FFTC would play a major role in collecting and disseminating the information that will guide them. He pointed out that everyone agrees with the sustainable framework adopted in 1992 at the summit in Brazil, and the concept that we are only

custodians of the earth and must safeguard it for future generations. However, it is difficult to find a balance between sustainability and production, since all countries are struggling to achieve economic growth in a competitive economic environment. Dr. Toriyama thanked participants for their valuable contribution, and hoped they would continue their efforts to develop sustainable agriculture in the Asian and Pacific region.

### **SOME MAJOR CONCLUSIONS FROM THE MEETING.**

- Low-input high-productivity agriculture is probably a contradiction in terms. High productivity requires a high level of inputs, whether of organic materials or agricultural chemicals. Sustainable agriculture for most countries of the region will not consist of organic farming, but on minimum input of chemicals supplemented by organic materials. The overuse of chemical fertilizer is widespread in industrialized Asian countries, caused partly by low prices as the result of government intervention. Reduced use of chemicals is a basic strategy for sustainable agriculture in industrialized countries, but not in less developed ones where the use of chemical fertilizer generally needs to be increased. Overuse of organic matter should also be avoided, since heavy applications of organic matter are potentially as polluting as too much chemical fertilizer. The concept of overuse of fertilizers (or pesticides) needs to be quantified, preferably in terms of its environmental impact or the quality of the produce.
- One of the most important technical aspects of sustainable agriculture is increased fertilizer efficiency. This will enable farmers to reduce fertilizer applications (and their production costs), while the impact of fertilizer applications on yield will be increased. Soil and plant analysis are needed to inform farmers how much and what kind of fertilizer to apply, and improved application technology such as

slow release fertilizers.

- Technology for sustainable agriculture generally requires a higher level of training and management than the system it is replacing. Extension and education will play a key role.
- In particular need of improved technology and sustainable cropping systems are slopelands, often with acid soils, which have been used for forestry and annual cropping under non-sustainable systems.