# Agriculture:

# A challenge for change

**David Spurgeon**

Photo: Neill McKee

*Threshing rice in Panay Island, Philippines. As much as one-quarter to one-third of the crop may be lost as a result of inefficiencies in handling and processing the crop after it has been harvested.*

How do you feed the two billion people in the world's less developed countries when their food grain deficit, already some 37 million tons in 1975, is expected to increase to between 120 and 145 million tons by 1990? And how do you do it without either destroying their own agricultural sector's incentive or introducing unwanted and deleterious side effects into their cultures?

That was the "Challenge for Change in Third World Agriculture" discussed at a September seminar in Edmonton, sponsored by the Alberta Institute of Agrologists and the IDRC. The seminar was held at the University of Alberta and attracted an audience of some 200 and a press corps numbering about 20.

"There can be no doubt at all that the long-term solution to this food deficit will be found only in increased productivity within the LDCs themselves", the Centre's president, Ivan L. Head, said in opening the seminar. "Indigenous production *must* become the primary source of supply. It is the recognition of that fact that has shaped the program for this seminar.

"It is equally obvious, however, that a deficit of the magnitude forecast cannot be met in that timespan without massive food transfers from the developed countries in order to prevent further deterioration in already inadequate diets."

The problem of how to supply such food aid without, as Mr Head put it, "unconsciously building in a series of deleterious aberrations" was the theme of one of the seminar's two panels.

One partial solution to the food problem was described by Dr K.F.S. King, director-general of the International Council for Research in Agroforestry (ICRAF), which was founded recently on the initiative of the IDRC. Dr King defined agroforestry as a land management system that increases productive yields by combining food crops, trees, forest plants, and animals on the same piece of land. He said the management practices used are compatible with local methods of culture.

Agroforestry should be employed on ecologically brittle lands that are only marginally useful for conventional agriculture, Dr King said. These included the arid and semi-arid regions on which deserts continually encroach, areas where shifting cultivation is practised, tropical pasture lands, and mountain areas where there is little vegetation.

Dr King underlined the need for agroforestry in these areas by noting that the developed countries now possess a larger amount of arable land per unit of population than developing countries despite the fact that their share is only 36 percent of the world's total. In the year 2000, the developing countries will be required to feed 79 percent of the world's population with 64 percent of the world's arable land.

"At the end of this century, the developing nations, even if they are able to afford to utilize all the best land in their countries, will have to support a larger *proportion* of the world's population than they now fail to do", he said. "Put in another way, a unit of land in the Third World would be required to support more than twice the number of people that a comparable unit of land in the developed world will be called upon to do."

There are also imbalances in resources between the developing countries themselves, Dr King said. Asia is the most densely populated developing area, yet it possesses the smallest area of potentially arable land. Fully 83 percent of its potentially arable lands are already being cultivated.

Agroforestry has been practised in one form or another for centuries, Dr King said, but the efforts to devise a coherent land management system out of the welter of sometimes conflicting information and opinion about various agroforestry practices are new. Much research remains to be done to identify and incorporate into agroforestry systems the various necessary elements: agricultural species tolerant of various degrees of shade; trees and plants that help prevent soil erosion; optimum spacing arrangements for trees and agricultural crops; and multipurpose trees that yield not only wood but other products. Agroforestry must not be viewed as a return to primitive methods but as a modern adaptation of traditional farming and forestry technologies that have proved effective in resource management, environmental conservation, and food production.

Peter Walton, plant breeding specialist and chairman of the plant science department of the University of Alberta, noted some of the contributions his specialty could make to alleviate the world food crisis. "One of the most important tasks of the next 10 to 15 years will be to decrease dependence on the feed grain-animal-consumer food chain." The first thing the plant breeder can do is to help improve the nutritional quality of plants, for example, by improving the amino acid content and fitting it more closely to human needs.

"Our second objective is closely related: to improve our forage species in terms of quality and quantity so that the new varieties can make us less dependent on grainfed animals in stockyards in the production of meat and milk. This is going to reduce costs and free grain for human consumption.

"The IDRC has a program in Torreon, Mexico, which aims to reduce milk production costs by half by using pastures instead of by feeding animals in yards. And the last figures I heard from there indicated that rather than reducing them by half, the cost had been reduced by two-thirds. And this is but one example of something that could be repeated many times over throughout the world."

Finally, Dr Walton said, plant breeders can develop crop varieties with improved cold and drought tolerance and the ability to grow under acid and saline conditions in order to expand areas available

for production. "This kind of task is one that is very familiar to Canadian plant breeders, because in many ways the whole history of agriculture in Canada is that of moving ever further northward into more difficult environments. And this has often been achieved by plant breeding methods."

Dante de Padua, an agricultural engineer from the Philippines, proposed that food supplies in Asia could be increased by improving postharvest practices and thus cutting down on waste. Some estimates suggest that as much as one-quarter to one-third of a total food crop may be lost in less developed countries as a result of inefficiencies in the postharvest system. (The postharvest system can be described as all the components of the industry that deals with food crops from the time they are ready for harvest until they reach the consumer's table.)

The major mistake that has been made in the past in trying to improve postharvest practices in Asia has been to assume that industrial-type hardware, of the scale used in developed countries in temperate climates and designed for crops like wheat or corn, would work just as well in hot humid countries for rice, Dr de Padua said.

"The requirements in the Asian region are unique and complex in a way that makes the introduction of innovations and of the necessary hardware a much more difficult undertaking than it has generally been thought", he said. Postharvest technology requires considerable adaptation for application in Asia, and the hardware must make use of indigenous resources as much as possible.

He described several simple, inexpensive grain dryers that are being developed in Asia to cope with the area's special problems. One, made of 3/4-inch plywood and a simple fan, was designed by the University of the Philippines at Los Banos, where Dr de Padua works on the Southeast Asia Postharvest Program. Thailand's Royal Ministry of Agriculture has developed its own version of this dryer with a grant from the IDRC, and it has been exported to Malaysia and Indonesia under an Australian-ASEAN (Association of Southeast Asian Nations) program for introduction on farms. A massive extension-type demonstration and training course is being conducted to instruct ASEAN country farmers in the dryer's use.

One reason these dryers are needed is that commercial machines are simply out of the question because they are too expensive: "An installed three-ton-per-hour dryer from Denmark costs US$288,000", Dr de Padua said. "An installed two-ton-per-hour Japanese rice mill costs about $200,000."

The new, high yielding varieties of rice have made possible a second crop, which is harvested during the rainy months of September to November. The wet straw clogs harvesting machines, and if the rice is not dried it soon suffers from fermentation, mold, rot, or sprouting. Many rice millers who traditionally have depended on sun-dried crops will simply stop purchasing during bad weather because they do not get a good enough price for wet rice, and this leaves the farmers without a market for it.

The antiquated milling system also contributes to rice yields lower than is possible in Southeast Asia, Dr de Padua said. Rubber-roller huskers are far more efficient than conventional disks coated with emery, but the rollers wear out quickly and are expensive. Dr de Padua said the replacement cost could be reduced by licensing local manufacturers to produce them.

Much of the discussion during the first of two panels centred on the need to concentrate efforts on helping the small farmer to increase food production, as these farmers comprise the vast majority of the population in developing countries and generally subsist on their own produce. Coupled with this was the need to avoid producing unwanted cultural effects by the changes introduced into traditional agricultural societies.

Most panelists seemed to agree that technical developments are necessary to solve the food problem, but, as Howard Steppler, chairman of the plant science department at McGill University put it, "How can we assure that technical developments do more good than harm?"

Jose Valle-Riestra, a program officer in the Centre's agriculture, food and nutrition sciences division at the Latin American regional office in Bogota said: "New technical developments are like antibiotics. They save a lot of lives but they have side effects." For example, he noted that new rice varieties have been so efficient in irrigated areas of Colombia that they have put upland rice growers out of business. Upland farmers simply cannot compete with growers in the irrigated areas. Such side effects are a consequence of forgetting the needs of the small farmers and concentrating on productivity: those working in development must respond to small farmers' needs, Dr Valle-Riestra said.

A member of the audience (who did not identify himself) raised a question often heard: Why insist on using agricultural chemicals in the Third World, and why all the emphasis on efficiency? Hadn't small farmers survived for centuries by using their own technology?

The panel's chairman, Dr C. Fred Bently, professor of soil science at the University of Alberta and one of the Centre's first governors, replied that an increase in food production is necessary if we aspire to some improvement in the human condition. Dr Steppler noted that, by coincidence, he had received a letter the previous day from Colombia, which gave the following results on the farms of *campesinos*:

- using the *campesinos'* own technology and local strains of cassava, their yield was two tons per hectare;
- using their technology and improved strains of cassava, the yield was five tons per hectare; but
- using improved technology *and* improved strains of cassava the yield was 15 tons per hectare.

Both later explained that there were many reasons why agricultural chemicals and improved technology were needed on small farms in the Third World today. In former times, farmers did not have to feed the enormous present-day populations of the cities, only themselves. They and their families lived on their land in what constituted a closed system: they did not ship food beyond their land's borders, and their own wastes remained on their land. When the land's fertility was exhausted, they moved somewhere else.

Once it became necessary to grow large amounts of food for populations in the cities who no longer grow their own food, farmers had to take more nutrients out of the soil than they put into it. The lost nutrients subsequently had to be replaced by chemicals.

Dr Bentley said some Third World soils are so low in phosphorous that there are eight pounds or less in a single acre to a depth of one foot. Yet more than eight pounds of phosphorous are required to produce simply the grain in a 50-bushel crop, leaving aside the amounts required for the straw and roots. Thus if three successive crops were grown on such soil, all the phosphorous would be removed to a depth of three feet (the normal depth of crop roots). There is no way that the yield could be increased on such land under those conditions without adding phosphorous — actually, the yield would decrease over time.

The first panel discussion centred on the question, "Do technical developments in agriculture do more harm than good to the small farmers?" Although the panelists found it difficult to answer this in a categorical fashion, a remark by Dr Steppler perhaps expressed the opinion of the majority.

"There is an implication in the question that there is a 'yes' or 'no' answer and that we can live with either", Dr Steppler said. "The question we *should* address is, 'Do we need technical development to solve the world food problem?' — and the answer to that is an unqualified 'yes' ". □

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