

Africa's Green Revolution

By
Joy Asiema

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During the 1960s and 1970s, some Asian and Latin American countries experienced yield increases due to the adoption of highyielding varieties of wheat, rice and maize. Their good performance was due to extensive use of irrigation, fertilizers and pesticides. This so-called Green Revolution has, however, never gained the same importance in Africa.

Improved varieties of maize, wheat and rice have been adopted in agricultural heartlands in well-endowed areas of Asia and Latin America. By the early 1960s, highyielding varieties of wheat had already been taken up by Mexican farmers and planted on 90 per cent of the country's wheat area. In Pakistan, the Mexican wheat varieties were introduced in 1965 and six years later they covered 50 per cent of the wheat acreage. Attempts to introduce the Green Revolution on a large scale in Africa failed, but the Green Revolution crops nevertheless gained importance.

Although maize is not indigenous to Africa, it is the single most planted cereal on this continent. Particularly in Eastern and Southern Africa, it is the most important staple grain. In Zimbabwe, hybrid maize varieties were introduced in 1949. Kenya adopted highyielding maize varieties in the mid 1950s. It released its domestically produced hybrids in 1964, and these gave a 40 per cent yield increase. Kenya's hybrids are now exported to Tanzania, Uganda, Ethiopia and Zaire. The average maize yield in Africa is 1,160 kg per ha per year, but significant differences exist. Countries that do not use highyielding varieties have an average yield of 600 to 700 kg per ha per year. Exceptionally high is the yield of highyielding maize varieties in Zimbabwe, with an average of about 3,400 kg per ha, thus nearly three times higher. Some largescale farmers have even recorded annual harvests of up to 6,000 kg per ha.

The adoption rates for improved maize varieties are generally high. The proportion of maize area planted with hybrids in Kenya, Zimbabwe and Zambia is even exceptionally high ([see table](#)).

This can be attributed to the advanced infrastructure in Kenya and Zimbabwe, compared to other African nations with low adoption rates, as well as to incentives and inputs that favour the use of hybrid maize in all three countries.

Nigeria is making extensive use of diseaseresistant maize seeds developed by the *International Institute of Tropical Agriculture* (IITA). In addition, recently developed Tanzanian and Zambian hybrid varieties are streakvirus resistant and will be useful in large areas in neighbouring countries.

In terms of area, rice is the fourth most important crop in Africa, after maize, millet and

sorghum. Two species are grown in Africa: the introduced Asian rice (*Oryza sativa*), and African rice (*Oryza glaberrima*). It is grown throughout Africa, wherever water is adequate, including the river basins within the arid and semiarid zones. Highyielding varieties are used on approximately 5 per cent of the area planted with rice.

Finally, new wheat varieties have been introduced in Nigeria, Ethiopia and Sierra Leone.

The failure of Africa's Green Revolution

The failure to introduce the Green Revolution on a large scale in Africa in the 1960s and 1970s is due to a several factors.

Firstly, rice, maize and wheat were the predominant Green Revolution crops, of which only maize is a principal staple food in some African countries. In general, African diets are based primarily on grains such as millet and sorghum or on roots and tubers such as cassava, yams and sweet potatoes. These crops have never received much attention from scientists and were no part of the Green Revolution.

Secondly, much of the African continent has infertile soils, severe pest and disease problems and little water available for agriculture. The use of a narrow genetic base variety and practise of monoculture, all characteristics of the Green Revolution, increases the risks of large areas of crops being devastated by pests, diseases and crop failure. In West Africa, for example, disease and pest problems have hindered a successful introduction of improved Indian sorghum and millet varieties. Water control problems have prevented the introduction of highyielding dwarf rice varieties. Only 3 to 5 per cent of Africa's cultivated areas are irrigated, compared to 20 per cent of India's cropland. After 10 years of experimenting, only 2 imported rice varieties out of 2,000 tested performed as well as local varieties. Additionally, some of the newly introduced varieties were not easily accepted by local people who preferred the traditional varieties.

Thirdly, Africa's poor transportation and commercial infrastructure makes inputs not easily accessible by all farmers, and harvests can not get to the markets on time. Recent experiences from a project in Ghana, supported by the *Sasakawa Africa Association*, headed by Norman Borlaug, have shown that high increases in agricultural output can be achieved. According to Borlaug, the main problems are how to ensure that fertilizers reach the farmers and how to bring their produce to the urban markets.

In India and Mexico, unlike many African countries, appropriate investments in rural roads were undertaken by governments with assistance from international donor organizations. The assistance of the donor organizations, notably the *Rockefeller Foundation* and the *Ford Foundation*, was predominantly directed towards the areas which were important to the US interests. Africa, historically linked more to Europe than to the USA, therefore had no priority.

Fourthly, many African countries have a lower labour/land ratio, less human and institutional capacity, and have economic limitations. While many Latin American and Asian countries have large economies, the many African economies are small and even more dependent on the export of primary commodities. Besides, their open economies are more susceptible to fluctuations in international prices. Government revenues and, consequently, agricultural research budgets, depend mainly on export earnings and are highly unstable as a result. Prior investments in human capital and development of training and research institutions by the Green Revolution countries of Asia and Latin America contributed to their success in agricultural research. India, for example, began to build agricultural colleges in the 1920s under the British colonial government. By the 1960s Indian policy makers and scientists had acquired extensive knowledge about the nature of problems facing agriculture in that country, about where the biggest payoffs of research

would likely be, and about which parts of the country had the largest agricultural potential. In contrast, many African countries have, until recently, devoted little investment to the training of agricultural scientists or building research institutions. The lack of trained personnel and knowledge of local agricultural conditions severely limits the effectiveness of foreign assistance and places too much reliance on expatriates.

African countries have, compared to India, not such a strong agricultural policy. India's state advisory services have been much more geared to serve not only the largescale but also the smallscale farmers, who make up the majority of the rural population in many developing countries.

The spread of highyielding maize varieties in selected African countries (1990)

Country	Total maize area	% Maize area planted with Improved openpollinated varieties	% Maize area planted with hybrids
Burundi	124	20	0
Kenya	1500	8	62
Malawi	1334	3	11
Mozambique	1015	17	1
Senegal	117	100	0
Tanzania	1631	18	6
Zambia	763	5	72
Zimbabwe	1150	0	96

Prospects for a Green Revolution in Africa

The Asian and Latin American experience shows that agricultural technological development can contribute to overcoming food problems in developing countries. This is, however, a long-term process which not only depends on importing new technology but also on developing indigenous capacity in agricultural sciences and policy analysis through manpower training and institution building. These skills allow a country to adapt foreign technologies to local conditions as well as to locally develop new technologies.

Government policies need to give higher priority to agricultural research and development and to provide greater incentives for agricultural production. This could be done, for example, through proper pricing policies and the creation of credit facilities, particular for the poorer farmers. Besides, governments should invest more in rural roads to facilitate access to inputs and markets. In general, no single country in Africa can afford to finance and implement the detailed and extensive research that cereal crops such as rice, maize and wheat, require. Regional and international agricultural centres have been evolving to meet this need. Of the *International Agricultural Research Centres (IARCs)*, five are located in Africa: the *International Council for Research on Agroforestry (ICRAF, Kenya)*, the *International Institute for Tropical Agriculture (IITA, Nigeria)*, the *International Livestock Centre for Africa (ILCA, Ethiopia)*, the *International*

Laboratory for Research on Animal Diseases (ILRAD, Kenya), and the West African Rice Development Association (WARDA, Ivory Coast).

A condition for an African Green Revolution is an effective interaction between the work of the IARCs, from which the improved varieties have to originate, and research work in the individual African countries themselves, aimed at adapting the improved varieties to the local conditions. As the debate over the effectiveness of the Green Revolution continues, biotechnology is being praised for its potential to improve agriculture in developing countries. Many IARCs recognize the potential, and are using for example tissue culture techniques to provide diseasefree planting material and to supplement their germplasm conservation work. The IARCs are, however, heavily dependent on the free flow of scientific information and germplasm and this is under threat due to the private nature of biotechnologies.

Notwithstanding this limitation, the extensive collections of seed and plant materials which the IARCs have developed will be extremely important in developing appropriate (biotechnological) options for African agriculture. In addition to the activities of the IARCs, a number of United Nations and other research programmes deal with biotechnology or research training in this area. However, the extent to which all these programmes can help African nations to improve food production and offset the existing trading dependencies with developed nations, will depend heavily on the establishment of appropriate agricultural policies by African governments themselves.

Joy Asiema (ACTS)

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The Network University
Wibautstraat 224
1097 DN Amsterdam
The Netherlands

phone +31 20 5618 163
fax +31 20 5618 164
email monitor@biotech-monitor.nl