International Agricultural Research - To Feed the Millions

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"The world food situation continues to be precarious. Over 450 million people live on the edge of starvation. Throughout the world, another thousand million people subsist on substandard diets. The state of affairs must and can be changed. The world can feed itself. The basic problems affecting food supply result from decisions made by governments and by individuals, not from uncontrollable or irresistible forces of nature. Solutions lie in new policies and new actions". So said Robert S. McNamara, Bradford Morse and Edouard Saouma in 1980*.

In the last three decades two revolutionary ideas have created an impact on world agriculture. One of them is the concept of international agricultural research, and the other of regionally and nationally coordinated agricultural research.

International agricultural research started with research programs aimed at improving the agronomy of wheat, maize and rice, and led to the development of International Centre for Research on Maize and Wheat (CIMMYT) in Mexico, and the International Rice Research Institute (IRRI) in the Philippines. These organizations created the green revolution in wheat and rice production with particular importance to developing countries.

As an example of coordinated research, policies of the Indian Council of of Agricultural Research have made it possible for the concepts, techniques and materials emerging from international agricultural research programs to be adapted for national requirements. The green revolution of wheat and rice production in India would not have been possible without productive interactions between international agricultural research organizations and Indian coordinated research programs. The concept of coordinated research in fact originated in India, and played a significant role in fostering interdisciplinary team work in various product-oriented research programs concerning crops, animals, and fisheries, as well as problem-oriented activities such as the All India Coordinated Research Project for Dryland Agriculture, the All India Coordinated Program on Water Management, etc. The Coordinated Maize Research Program and Agronomic Program were the two

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* Consultative Group on International Agricultural Research, Washington, DC. 1980.

first coordinated research schemes and, over the last 30 years, there has been steady development of coordinated research programs under the aegis of the Indian Council of Agricultural Research. Today, any improved agricultural research project of national significance will normally take the form of a coordinated program and, therefore, will make its impact throughout the country within this administrative framework.

Equally important, and epic - making as a revolutionary idea in Indian agricultural research and education, has been the development of agricultural universities. These have become important instruments of agricultural change in each state of the country, in fact, the international agricultural research centers, the Indian Council of Agricultural Research's coordinated research projects, and the state agricultural universities, form an effective chain in the transformation of agriculture in India.

Even this chain would have failed to produce results in the fields of millions of farmers unless dedicated extension staffs and farmers were not effectively working together to make an equally strong chain. Also, government policies, particularly those relating to price incentives for produce, and the provision of inputs, have helped to make the green revolution effective in India.

The first phase of the green revolution, which principally affected the irrigated areas of the tropics, bypassed the dry farming areas of the world The second phase, it is expected, will favourably affect rainfed agriculture in the humid, subhumid, semi - arid and arid areas of the world. Achieving the agronomic improvements desired will require a massive effort, and take a period of many years, because of the complexity of the problems involved and the research neglect, in the past, of crops of value to dryland farmers. Pulses, oilseeds, sorghum, millets, roots and tubers have suffered from such neglect. To achieve success in this difficult area the improved management of rain water and of soils and crops becomes essential.

The main focusin international agricultral research is on food (as distinct from industrial) crops, and on animal production. Research programs are therefore directly concerned with increasing food production and its availability in developing countries, where the gap between production and demand is widening. The prediction of many demographers of mass-scale starvation have not yet come true. Some disasters have been averted through timely action by the national and international organizations. Nevertheless, there can be no case for complacency. Despite the most remarkable achievements in food production (as, for instance in India), the food demand and supply equation in the world still shows unsatisfactory trends. In fact, all the efforts of research are negated by alarming increase in population, and the position is worsening in the developing countries of Africa, Asia, and Latin America. In the Sahelian region of Africa food famine is a constant threat. Wortman and Cummings (1978) have concluded (Table 1) that judging from present trends, food deficits in some countries will be alarming. Statistics from the World Bank and from the UN's Food and Agriculture Organization (FAO) also indicate similar trends.

TABLE 1. Prospects for some Low Income Countries

Country	Deficit 1975 (mi. ltons)	Projected deficit 1990 (mil. tons)	Projected deficit Percentage of consumption
Afganistan	—	1.3 - 1.5	19 - 22
Bangladesh	1.0	6.4 - 8.0	30 - 35
Burma	0.4	1.9 - 2.4	21 - 25
India	1.4	17.6 -21.9	10 - 12
Indonesia	2.1	6.0 - 7.7	14 - 17
Egypt	3.7	4.9	32
Sahelian Group	0.4	3.2 - 3.5	44 - 46
Ethiopia	0.1	2.1 - 2.3	26 - 28
Philippines	0.3	1.4 - 1.7	11 - 13

Source : Sterling Wortman and Ralph W. Cummings. Jr., 1979, 'To Feed This World' (The Challenge and the Strategy), published by the Johns Hopkins University Press, Baltimore and London.

TABLE 2. International Centers of Agricultural Research.

Name & Place	Year of Inception	Commodity
Centro Internacional de Agricultura Tropical (CIAT) Columbia	1967	Cassava, Bean, Beef, Rice
Centro Internacional de la Papa (CIP), Peru	1971	Potato
Centro Internacional de Mejoramiento de Maizy Trigo (CIMMYT), Mexico	1966	Wheat, Maize
International Centre for Agricultural Research in the Dry Areas (ICARDA), Syria	1977	Barley, wheat, FABA beans, Lentils
International Crops Research Institute for the Semi-Arid Tropics, (ICRISAT), India	1972	Sorghum, pearl millet, pigeonpea, chickpea, groundnut
International Institute of Tropical Agricultute (IITA), Nigeria	1967	Cereals, roots, tubers, Legumes
International Laboratoty for Research on Animal Diseases (ILRAD), Kenya	1974	Two major livestock diseases specific to Africa
International Livestock Centre for Africa (ILCA), Ethiopia	1974	Livestock production
International Rice Research Institute (IRRI), Philippines	1960	Rice
West Africa Rice Development Association (WARDA), Liberia	1971	Rice
International Board for Plant Genetic Resources (IBPGR), Rome	1974	Board for Genetic Resources
International Food Policy Research Institute (IFPRI), Washington	1975	
International Service for National Agricultural Research (ISNAR), The Netherlands	1980	

Soon after the establishment of CIMMYT and IRRI the world community felt the necessity of establishing other international centers with research responsibilities for other food crops. It is interesting to note that the number of International Centers of Agricultural Research has now grown to 13 and that their main focus concerns food commodities (see Table 2). From this it can be observed that most of these centers specialize in research on cereals (rice, wheat, maize, sorghum. millets and barley), pulses and legumes (pigeonpea, chickpea.cowpea, groundnut and lentils), tubers and root crops (potato, cassava and yam) and the other are concerned with animal production. All the centers, except three (IFPRI, ISNAR and IBPGR) are located in developing countries.

They are nonpolitical, nonprofit making, autonomus research organization whose main objectives is to catalyse national agricultural research, particularly in developing countries. They all have interdisciplinary teams of scientists working together on a commodity, or on a problem, assessed to be of high priority in increasing world food production.

Some of these centers have a global mandate, but some have regional mandates. In the second category are IITA, CIAT, ILCA, ILRAD and WARDA. Besides a crop improvement program, that is prominent in many centers, there is a farming systems research program which is global in out look but confined to a geographic zone. For example, farming systems research relating to the semi - arid tropics figures prominently in ICRISAT's mandate. Similarly, the farming system research for arid areas figures in ICARDA's mandate, and for the humid tropics in IITA's mandate. Staff at IRRI, too have realized, unless the farming system technology for rainfed areas is developed, rice production in many developing countries cannot increase.

The International Board for Plant Genetic Resources is located in FAO, Rome for reasons of convenience and coordination. It supports international, regional and national agricultural research program.

The International Food Policy Research Institute (IFRSI) is unique in the sense that it is concerned solely with food policy research. It's headquarters are in Washington.

The latest addition to the group of international centers is the International Service for National Agricultural Research (ISNAR), whose main role is to help in the development of national research programs.

Thus, these three organizations-IBPGR, IFPRI and ISNAR-are backstopping the activities of the other international centers.

Starting from a meagre resource of less than US $ 10 million, and only two international centers, the number of these centers has now grown and their activities have become far-reaching. Their current annual budget is about US $ 150 million.

An essential contribution to this objective of international research is being made by the Consultative Group on International Agricultural Research (CGIAR). The Group is sponsored by FAO, the World Bank, and the United Nations Development Program (UNDP),

and comprises in all some 45 countries, international and regional organizations, and private foundations. The purpose of the Group is to bring the resources of biological and socio-economic research to bear on the long neglected possibilities of agricultural production in the tropics and subtropics where nearly all the less developed contries lie. The research and training programs undertaken by the centers, and sponsored by the Group, seek to arm the developing countries with superior varieties of essential crops and improved farming systems for the production of food plants and animals. FAO provides the Secretariat support in the form of a Technical Advisory Committee(TAC).

This International Agricultural Research Organization, though very young, has made a considerable impact in world agriculture. Recently the CGIAR was awarded the King Baudouin International Development Prize for having made a significant contribution to the development of the Third World, and to the solidarity and good relations between the industrialized countries and the countries in process of development.

The recent conference of agricultural research directors from developing countries held at Ballagio, Italy, foresaw an evolving role for the international centers. They reaffirmed the continuing essentiality of the internationally supported centers, with adequate support, continuity, and flexibility, and cited the following among their anticipated longer-term continuing functions (Cummings, 1979)* :

1. Collection, conservation, cataloging and distribution of germplasm
2. Organization of pathfinding research designed to raise the ceiling of yield, and to impact greater stability to yield (i. e., research which can lead to the development of high - yield and high - stability varieties with desired quality)
3. Development of improved research techniques
4. Organization of relevant training programs
5. Organization of information and bibliographic services
6. Organization of symposia, seminars, and monitoring tours.

It hardly needs to be emphasized that the benefit that a country can obtain from an international center depends on its own scientific strength and its determination to make use of new techniques and concepts. Such a country as India, that has a strong programme of coordinated research and a number of agricultural universities, can effectively and rapidly make use of the elite segregating material emerging from the international centres. The example of wheat and rice can be cited as classical examples. A similar development is happening in the case of sorghum, pearl millet. and other

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* Cummings, R. W., 1979. 'The role of International Institutes,' Proceedings of the Inaugural Symposium at ICRISAT on Development and Transfer of Technology for Rainfed Agriculture and the SAT Farmer.

crops. In some countries where national research programs are not strong, they need finished products that merely require testing, evaluation and popularization. In such cases the training of the locally available technical manpower assumes considerable significance. It may not be out of place to stress that an international agricultural research center can act as a catalyst only in the development of suitable technology or in creating a breakthrough in agricultural production, and results of such action can be synergestic only if the local material and regional programs interact harmoniously. Establishment of linkages for the transfer of technology, and the formation of appropriate government policies to encourage such transfer, are very important. It is common knowledge that seed-based technology is easy to transfer but that technology based on resource management poses many problems in its transfer. So far the international centers have gained much experience in the seed-oriented technology. Now they are beginning to test the concepts of resource-based technology. For example, ICRISAT has developed a technology that can convert millions of hectares of deep black soils, where rainfall is reliable, into double-cropped areas with a resulting potential increase in agricultural production of 3 to 5 times. But, unless it is evaluated and modified to suit local environments by national research and development staff, only a slow pace of technology tranfer can be expected.

To sum up, international agricultural research programs have introduced a concept of team work at international, regional, and national levels into problem-oriented research for increasing production in developing countries. There is no doubt that, if the national and the international systems work together well, the world has the capacity to feed itself and to improve the welfare of the human race.