Constraints on Agriculture Production in South Asia: Role of International Collaborative Research

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ABSTRACT

There are a number of developments in agriculture in South Asia that deserve attention as we move through the new millennium. These are influencing the direction, strategies, and priorities for development at national and international levels. This paper addresses important constraints faced in South Asian agricultural production (biotic and technological), relating to both supply- and demand-driven factors. These issues include the pervasiveness of poverty, continuing concerns about malnutrition, growing constraints on water, lack of technology uptake, and sources of cereal production growth, among others. First, regarding the pervasiveness of poverty, an estimated 560 million poor people now live in South Asia. Some 70% of these 560 million live in rural areas; and poverty will remain predominantly a rural phenomenon until 2030. Governments and international R & D agencies now place high priority on reducing poverty, with South Asia as a focal point. Second, there are continuing concerns about malnutrition in spite of improvements in overall food intakes per capita. Child malnutrition in South Asia is expected to remain a seemingly intractable problem towards 2020. Third, water has become an overarching concern in the region. The rate of expansion of irrigation in India, as in other South Asian countries, has slowed down in recent years due to the increased cost of large-scale canal schemes, reduction in groundwater availability, increased salinity, and the lack of suitable sites for further dams. Projections are that South Asia will be among the regions with the most severe water shortages towards 2025. The growing economic value of water will impose a strain not only within the agricultural sector, but also between agriculture, industry and the cities as competition for limited water supplies grows more intense. R & D will need to emphasize drought and improved water use efficiencies, including water harvesting, as a priority research area. An additional constraint is related to sources of future cereal production growth. Cereal production in South Asia is projected to grow by around 1.5 % per annum to 2020. This is much less than historical growth rates. Additional influencing factors include: changes in the consumption and production trends and the effect of further economic liberalization.

The opportunities for international collaborative research and the role of various research institutes in the global agricultural research system are summarized in three prime roles: the catalyst role of advanced research and international research institutes in basic and strategic research; the bridge and broker roles in the process of dissemination and adaptation of technologies and new research findings; and the adaptive and commercialization roles by developing countries with partnerships of both public and private sectors. The paper discusses examples whereby international centers are functioning as an extremely valuable bridge, broker and catalyst, taking the case of ICRISAT for agricultural research in drought-prone areas of the semi-arid tropics.

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CONSTRAINTS TO AGRICULTURAL PRODUCTION

The Green Revolution proved the power of modern technology. Yet, in keeping with its philosophy, this revolution concentrated on the better endowed areas with potential for more productivity. Marginal areas were bypassed, and the gap between the 'haves' and 'have-nots' widened as a result.

The overarching goal of halving poverty is yet to be established. In targeting poverty, the poor themselves and the conditions in which they live must be identified. Who are they, where do they live, and from what sources do they take their livelihood?

Poverty in the region of South Asia is concentrated in the rural areas, primarily in the countries of Bangladesh, India, Nepal, Pakistan, and Sri Lanka. In regions persistently stricken by poverty, hunger persists along with it as a natural consequence. With the exception of Southeast Asia and the Pacific, hunger and poverty are increasing together in many parts of the world, particularly in Africa, Latin America, and South Asia.

The battle against poverty is ridden with burning issues and unanswered questions. In South Asia in particular, issues include the pervasiveness of poverty, the ongoing concerns of malnutrition, population growth rates, water scarcity, production and consumption patterns, and the trends of globalization and liberalization.

Among the constraints to agriculture, key are those to land productivity, such as water scarcity and droughts, land degradation, and poor quality of soil. Production is also hindered by technological limitations resulting in inefficient levels of land and labor productivity, as well as the non-availability to procure HYV seeds and slow progress in adopting new technologies. These problems are gravest in the more marginal areas with higher risk, higher vulnerability, and higher concentrations of the poor.

INTERNATIONAL ALLIANCE

International collaboration to fight poverty and hunger takes many forms. Through the contributions of the CGIAR, for example, collaboration is activated as strategic partnerships, networks, strategic alliances with advanced laboratories and universities, the Challenge Program, and internship programs with universities. It is through these international collaborative partnerships that the products of research from strategic information, state-of-the-art knowledge, new technology, and technical expertise ultimately impact their objectives through the processes of capacity building, partnering, and the use of information

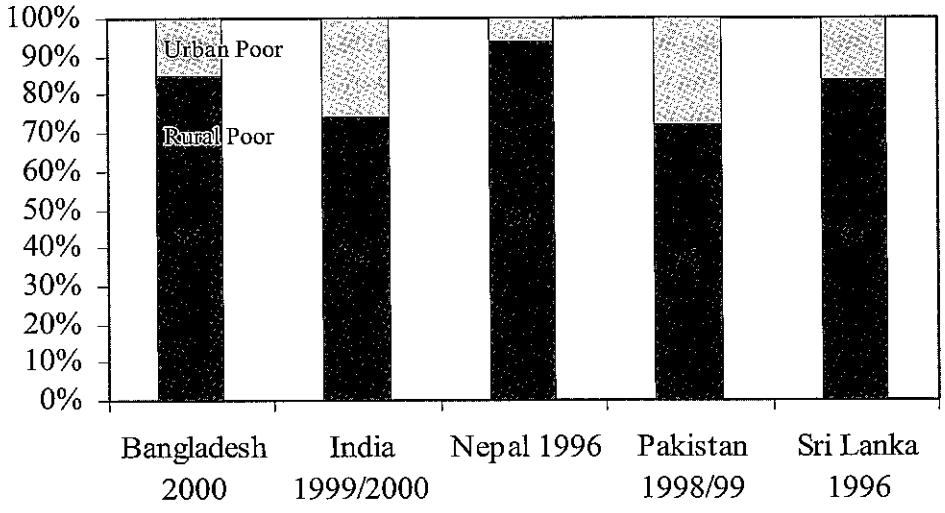

Fig. 1. Overarching goal: having poverty by 2015

communication technologies.

Successful international alliances have played three roles within collaborative international partnerships: the role of 'bridge,' the role of 'broker,' and the role 'catalyst.'

By bridge we mean a mechanism by which to apply the core competencies and comparative advantage to produce new technologies (the high science) in addressing the key constraints. When the key constraint is drought, for example, how can biotechnology, the new sciences, and the organizations with the capacity to use them bridge this mechanism of partnership? In answering this question, the current activities at ICRISAT provide good models for the bridge role. In the field of biotechnology, for example, ICRISAT is developing the transgenics of the groundnut and chickpea for tolerance to biotic stresses, and mapping the root traits of the drought-tolerant chickpea, a plant endowed with long roots that reach further down into the soil to draw out more water.

As an example of the second role of international collaborative partnerships, that of broker, the CGIAR is joining with partners and stakeholders in national programs to develop a platform for the exchange of a very important resource, that is, the research data on germplasms and other technologies. Out of the half million germplasms now known, 113,000 are in accession at ICRISAT in Pantacheru, India. Collaboration with JIRCAS has been especially fruitful in the mission to save germplasms and the biodiversity of food crops.

The third role is that of a catalyst, namely, taking advantage of unique combinations of skills and the modern infrastructures of science in various advanced research organizations and global partnerships to catalyze new trust. As examples here we can cite efforts undertaken from the natural resource science base to address the issue of land and water productivity by evaluating agro-environmental changes using remote sensing for fertility management in Asia and in Africa, and nutrient dynamics in crop livestock systems.

Many lessons can be gleaned from the experience of ICRISAT, a ground-based institute in Asia and Sub-Saharan Africa that has been successful in realizing the potential for partnership, institutional arrangement, and bringing about more effective and relevant solutions. Though headquartered in India, six sites of focus lie a continent away in the semi-arid tropics of Africa.

The strength of ICRISAT in the continents of Africa and Asia brings the world very good potential by showing the productivity of the global flow of the ICRISAT technologies in the foregoing fields of germplasm research, information exchange, and natural resource science. The technologies targeted for Africa have spillover effects throughout the entire African continent and across the rest of the world, as do

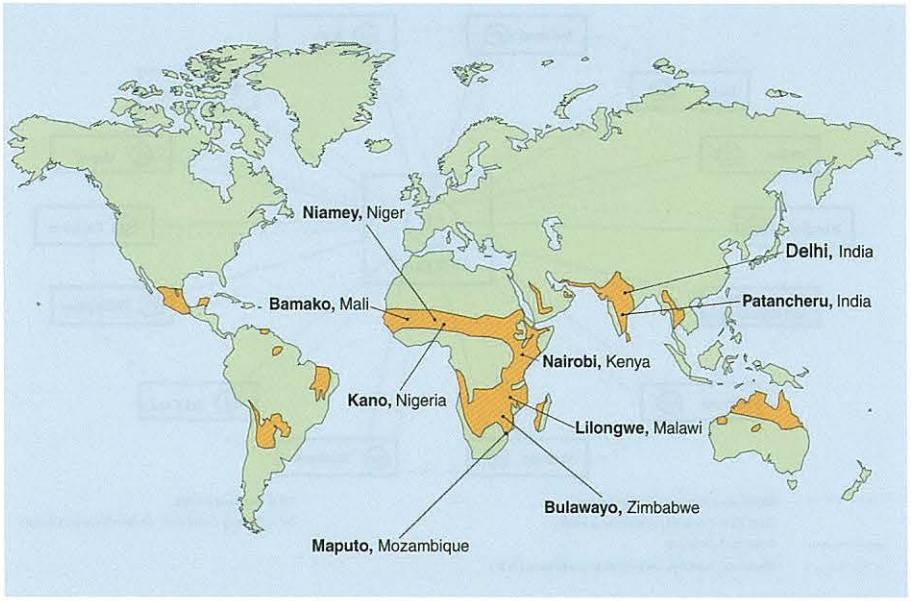

Fig. 2. Strength of ICRISAT in two continents: Asia and Africa

the successes in the semi-arid tropics of India and other parts of Asia. These spillover effects maximizing the multiplier effect of the resources invested.

The Cereal Legumes Asian Network (CLAN) is an ideal partnership at work within the ICRISAT framework. CLAN has aggregated the networking for both cereals and legumes to support, coordinate, and enhance technology exchange among scientists. This is a very successful example of networking comprising 14 countries around Asia, now emulated in programs in Western, Southern, and Eastern Africa. CLAN and many partnerships like it have successfully achieved the 'greening of the gray,' engendering a veritable Green Revolution in the more marginal areas of the semi-arid tropics.

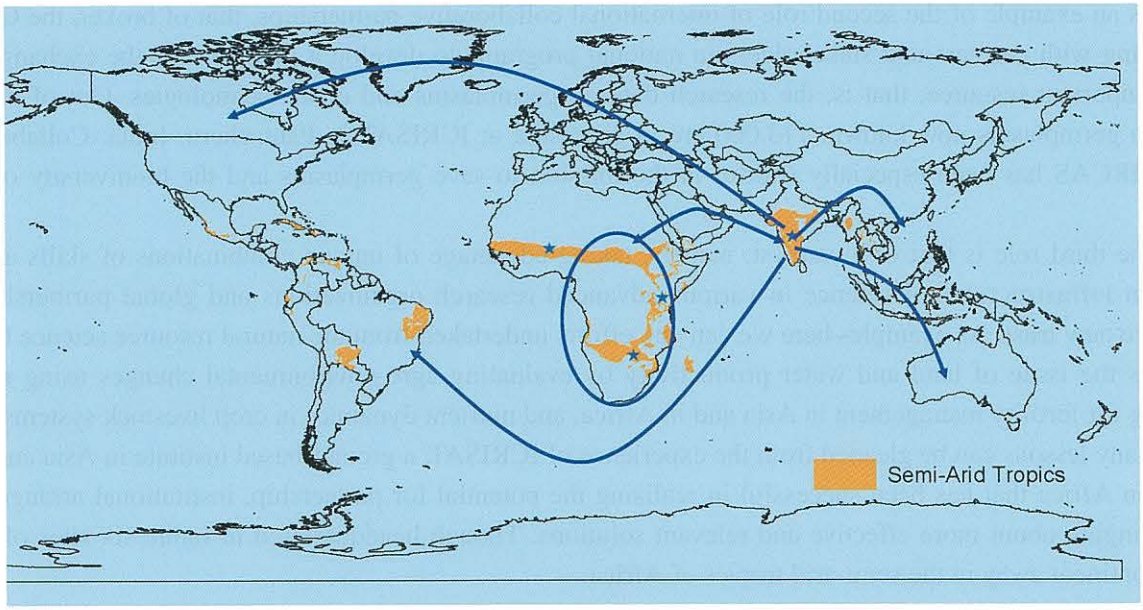

Fig. 3. Global flow of ICRISAT technologies

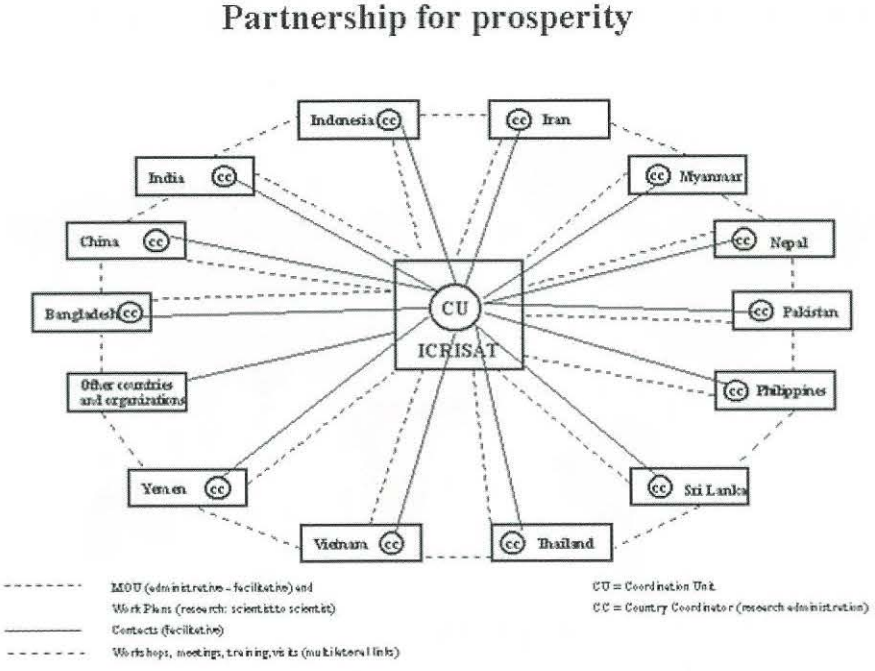

Fig. 4. The Cereal Legumes Asian Network (CLAN)

In an assessment of the impact of these networks, the number of cultivar releases, the number of exchanges, the level of adoption, and the impacts have all been found to be higher in the networks whose partnership and coordination are broader and stronger.

INNOVATIVE STRATEGIC PARTNERSHIPS

Among the innovative strategic partnerships serving as technology exchange enablers, GFAR and NEPAD under NARS and the molecular breeding alliances in Bangladesh, China, India, Pakistan, and Vietnam are all being emulated in Western Central Africa, Southern Africa, and Eastern Africa.

Innovative strategic partnerships are what CGIAR needs and what CGIAR has been pursuing. This global partnership is now coalescing in the form of Challenge Programs, innovative strategic partnerships that find solutions to very specific problems within a framework both time bound and targeted towards high impact. The CGIAR is embarking into the Challenge Programs.

Strategic partnerships need tools far more extensive than technologies based on the biological sciences. In addition to tools such as germplasm databases and natural resource management technologies, partnerships rely on the use of information and communication technology to achieve their high impacts.

In a pilot project launched in India and now introduced in Western Central Africa, the Virtual Academy of the Semi-Arid Tropics (VASAT) relays information via satellite for climate data management and operates a distance education coalition in the semi-arid tropics. The system works so well that the World Bank is now supporting it, and the CGIAR is adopting it as a model for future projects of its own. The success of VASAT underlines the value of blending information technology with successful models of open and distance learning in collaborations designed ultimately to help vulnerable rural families cope better with the impacts of drought and other constraints like it.

APPLYING THE ASIAN EXPERIENCE TO AFRICAN PROBLEMS

In its successes in Asia, ICRISAT has identified both constraints and avenues for success in individual countries. The experience of the Green Revolution in South Asia, particularly in India and Pakistan, helps ICRISAT identify ways to solve the challenging problems facing Africa.

ICRISAT has learned, for example, that high-impact technologies such as germplasms are widely adaptable and flow readily from region to region. The chickpea, a material developed in India, found its way from North India to South India (where now it is cultivated in massive quantities), then across an ocean to Ethiopia, and ultimately to developed countries such as Australia and Canada. A population of sorghum parental materials followed a similar course, spreading from its birthplace in India to Western Central Africa and Southeastern Africa. Millet has propagated even further afield.

Moreover, germplasm research in a single region is but one of many types of investment to reap spillover effects in other parts of the world. Similar phenomena have been witnessed with resource management technologies, for example. Water shed management uses the concepts of community-based catchment and collective action in community watersheds. This technology is already being introduced in Africa to emulate the successes achieved in India and parts of Southeast Asia.

The ICRISAT successes through priority alliances will provide models for future action in Africa, provided that ICRISAT can identify why Africa has been lagging behind. The success of the global germplasm exchange, the confirmed effectiveness of the bridge, broker, and catalyst roles, the capacities built from region to region, and the successes of partnerships in activating collaborations, both South-South and North-South, must all be emulated in Africa to a far greater extent in the future.

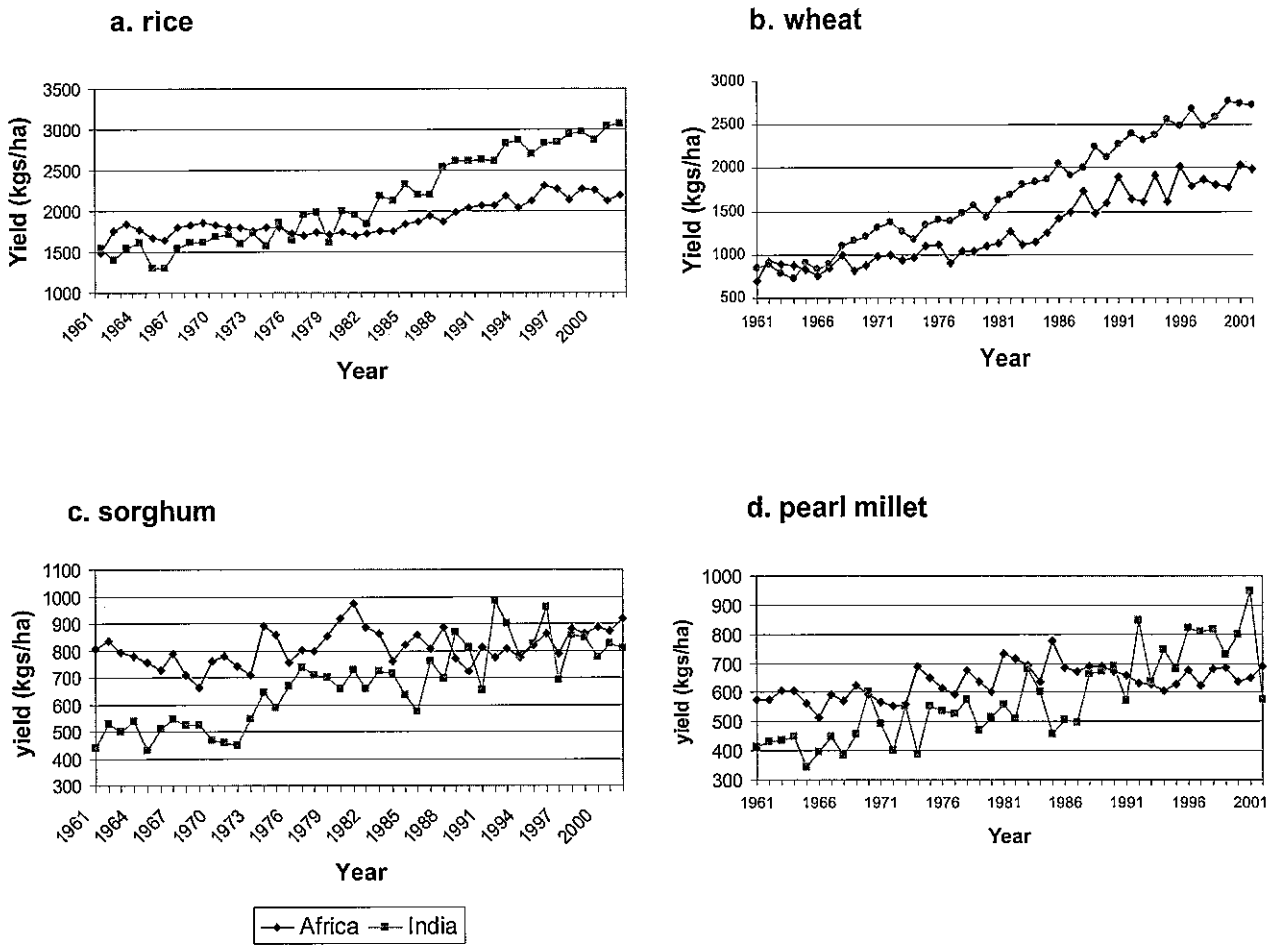

Fig. 5a, 5b, 5c and 5d. Trends in major cereal yields in Africa and India

In the early 1960s, rice and wheat yields in India were about the same as those in Africa. Now, after the Green Revolution and four decades, India is growing much, much more. Similar patterns have been seen with sorghum and pearl millet, crops that before were cultivated in larger quantities in Africa.

Much can be learned by reviewing the Green Revolution experience, provided that we can identify the priorities in the enabling environment necessary to get Africa growing as well. Once the roles of technology, infrastructure, markets, and stable governance in achieving the Green Revolution are known, priorities must be identified to ensure that investment in Africa and aid to install yield-increasing technologies will reap the desired effects. The drivers of transformation and growth from the Green Revolution will have to be tweaked if they are to succeed in Africa.

This is where the regional aspects of priority analysis come into play. Would it be appropriate to set the investment and research priorities on maize in Southern Africa, far from the food-insecure regions in Central and Western Africa that grow more wheat and sorghum millet, and actually depend on the latter as a main staple? And what of Eastern Africa, that grows more sorghum and millet than the coarse grains? In looking back to the lessons learned from Asia, the priorities must be focused at the regional level rather than on Africa as a continent.

As members of a global coalition addressing constraints to productivity and sustainable livelihoods, ICRISAT and its many allies will have to recognize the importance of the bridge-broker-catalyst role, platforms for South-South and North-South collaboration, and the global sharing of technological solutions such as germplasm and natural resource management. In striving to build partnerships with great synergies, they must recognize the comparative advantages of the players and the comparative advantages and needs of

the target groups.

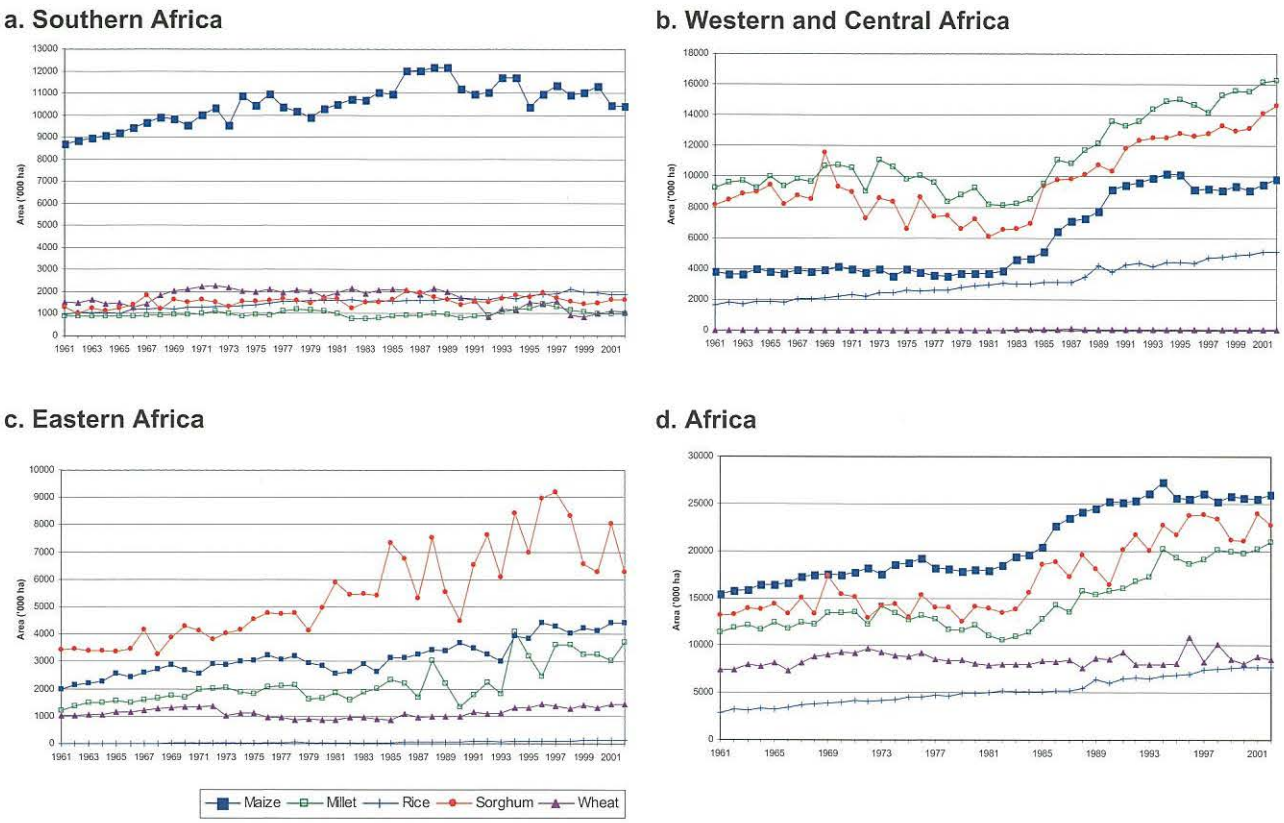

Fig. 6a, 6b, 6c and 6d. Trends in major cereal production in major African regions