

Food Security in Africa: The Challenges of Researchers in the 21st Century.

James B. Kung'u

Department of Environmental Science, Kenyatta University, P.O. Box 43844 Nairobi, Kenya. Email: kungu_james@yahoo.com

Abstract

Food production in most of Sub-Saharan Africa (SSA) has not kept pace with the population increase over the past three decades. In many countries, food security remains a serious problem. It contributes both to high rates of under- and malnutrition, poorer learning in school, and lack of development in general. In Africa as a whole, food consumption exceeded domestic production by 50% in the mid-1980s and more than 30% in the mid-1990s. Food aid constitutes a major proportion of net food trade and in many countries it constitutes more than half of net imports. Despite food imports, per capita dietary energy supply (DES) remains relatively low; with about one-third of the countries having per capita DES of less than 2,000 kcal day⁻¹ which is lower than the minimum recommended intake.

Food imports to Sub-Saharan Africa rose from US\$ 1.1 billion in 1970 to US\$5.3 billion in 1985 contributing to increased external debt from US\$5.4 billion to US\$58.8 billion during the same period. In 1998, external debt stood at US\$230 billion. Since the 1980's global recession and introduction of Structural Adjustment Programs (SAPs), Africa's debt burden has grown from 30% of GNP to over 100% at present

Agriculture in Africa is not only a vital source of food but also the prevailing way of life. An average of 70% of the population lives by farming, and 40% of all exports are earned from agricultural products. One-third of the national income in Africa is generated by agriculture. Crop production and livestock husbandry account for about half of household income. The poorest members of society are those who are most dependent on agriculture for jobs and income. On average, the poor in SSA spend 60-80% of their total income on food.

Agricultural and economic growth must rise in Africa to realise basic development goals in the 21st century. Only a few countries are currently recording a positive growth in agricultural production while the majority of countries are seeing an increase in the area under agriculture. One consequence of the growth in agricultural area could be a doubling by the year 2050 of cultivated land area which will be great cost to the natural environment unless there is greater investment in agricultural management and technology on existing cropland. The scale of food imports in Africa has fostered dependence on food production in the rest of the world. Many Sub-Saharan African countries face the risk that supplies will fluctuate drastically with the rise and fall of grain reserves and prices on international markets. This paper tries to identify major challenges the African scientists must overcome in order for the African farmers to increase their agricultural production and achieve food security and sustainable economic growth in the 21st century.

Key words: Food security, land degradation, Research

Introduction

The number of hungry people in Sub-Saharan Africa (SSA) is reported to be increasing. Food security

is one of the most complex political, economic and moral problems of our times. Yet, food security in a nation is one of the most important indicators of development, particularly in low-income countries

(FAO/WHO, 1992). There can be no development without the creation of sustainable and regenerative food systems for all people. Despite the concerted efforts of governments and non-governmental organisations (NGOs), many countries are faced with food security crisis which arises from growing inequality in the distribution of resources, food and income. The situation is further aggravated by accelerating population growth, severe drought and intensification of commercial market-oriented agriculture, which is accompanied by monetization of rural economies. The threats of famine, mass starvation, civil strife and poverty are looming and persistent in most countries. Many governments are unable to provide for the needed infrastructure, better marketing and storage facilities and/or agricultural policies that could encourage subsistence production. Farmers are overwhelmed by unfavourable conditions and many households are unable to afford food. Hence, food security is a continuing challenge. There are about 800 million hungry people in the world today. Out of these, 232 million (29%) are found in India, 200 million (25%) in SSA, 152 million (19%) in Latin America, 112 million (14%) in Asia other than India, 56 million (7%) in the Caribbean and 40 million (5%) in the Near East and North Africa.

Africa has gone from being a key exporter of agricultural commodities into being a net importer, and is currently receiving most food aid, with some 30 million people requiring emergency food aid in any one year. Sixty per cent of the World Food Program's work now takes place in Africa. Despite food imports, per capita dietary energy supply (DES) remains relatively low with about one-third of the countries having per capita DES of less than 2,000 kcal day⁻¹ in the 1990s which is lower than the minimum recommended intake. Agricultural and economic growth must rise by 4% yr⁻¹ to realise basic development goals. One consequence of agricultural growth could be a doubling by the year 2050 of cultivated land area at great cost to the natural environment unless there is greater investment in agricultural management and technology on existing cropland (Anon., 1999). The scale of food imports has fostered dependence on food production in the rest of the world. Africa faces the risk that supplies will fluctuate drastically with the rise and fall of grain reserves and prices on international markets.

In SSA measures to secure a stable and sustainable flow of food supply, at affordable prices, are imperative for preventing malnutrition, famine and food insecurity. Government interventions in food markets, especially those that are triggered by the instability inherent

in food production and prices, are common in practically all countries. All too often, however, the design and analysis of these measures focus narrowly on the financial-budgetary aspects of the neglect of several other food security aspects that are equally essential for their successful implementation.

The big question is how scientists in Africa can ensure that every citizen in the continent enjoys access to adequate nutritious food. This paper draws attention to the role scientists can play on food security and point out some strategies for food security related research.

Role of agriculture in Africa

Agriculture is not only a vital source of food in Africa; it is also the prevailing way of life. An average of 70% of the population lives by farming, and 40% of all exports are earned from agricultural products (WRI, 1996). One-third of the national income in Africa is generated by agriculture. Crop production and livestock husbandry account for about half of household income. On average, the poor from developing countries of SSA spend 60-80% of their total income on food (WRI, 1998). Although industry is significant in a few countries, it is still in an early stage of development. In many countries, the level of mechanisation, including irrigation, processing, and storage facilities, is particularly low. Population pressure has been seen as a cause of world hunger, which is hardly the case although it is an aggravating factor. Climatic conditions and change have also been convenient scapegoats, yet an abundance of food can and does exist alongside famine even in natural hazards.

Africa is facing declining per capita agricultural output. Food imports to SSA rose from US\$ 1.1 billion in 1970 to US\$ 5.3 billion in 1985 contributing to increased external debt from US\$5.4 billion to US\$58.8 billion during the same period. In 1998, external debt stood at US\$230 billion. Since the 1980's global recession and introduction of Structural Adjustment Programs (SAPs), Africa's debt burden has grown from 30% to over 100% of GNP. The links between international/national economic policies and the natural resource base of implementing countries have not sufficiently been made in past policy formulation.

Africa is facing declining per capita agricultural output (Delgado and Mellor, 1984). As demand for food increases, so does demand for land. This has led to declining fallow periods and increased mono cropping

(ICIHI, 1986). Pastoral livestock agriculture has suffered from a combination of denuded range lands and pressure from agriculture as marginal lands come under cultivation (Dixon et al., 1989). All these factors have contributed to food insecurity.

Agriculture employs a greater share of the labor force than in any other region (apart from East Asia and the Pacific). Over 96% of farmers operate on a small-scale, farming less than five hectares. The sector is, however, characterized by weak linkages to markets and little or no access to external inputs. Many small-scale farmers farm degraded land and most are far from services and roads and consequently from extension programs.

Food security in Africa

The 1975 UN definition of food security reflected the thinking of the day, which focused on adequate production at the global and national level. This was also a conventional view of food as a primary need. Food security is, however, a matter of both limited food availability and restricted access to food. Food insecurity is no longer seen simply as a failure of agriculture to produce sufficient food at the national level, but instead as a failure of livelihoods to guarantee access to sufficient food at the household level. Today, most common definitions begin with individual entitlement, though recognizing the complex inter-linkages between the individual, the household, the community, the nation and the international community. In the 1996 Rome Declaration on World Food Security, food security is defined as:

Food that is available at all times, to which all persons have means of access, that is nutritionally adequate in terms of quantity, quality and variety, and is acceptable within the given culture (World Food Summit, 2002)

As mentioned above availability, access and affordability are all elements of food security. These are complex issues that encompass a wide range of interrelated economic, social and political factors both internal and external. All these factors challenge Africa's ability to address food security. Analysts generally believe that Africa's current food emergencies are the result of a combination of problems that range from drought and adverse weather patterns and civil conflict, to political-economic crises, HIV/AIDS and poor policy decisions. What is undeniable is that "Africa's persistent vulnerability is arguably due as much to a failure of understanding as to a failure of interventions". High-quality land

resources per household have shrunk in Africa over the past two decades, often dramatically.

Current scenario of the food security situation in Africa

No human right has been so frequently and spectacularly violated in recent times as the right to food, despite the fact that it is one of the most consistently enshrined rights in international human rights law and constantly reaffirmed by governments. Concerns generated by the food crisis of the mid-1970s led to world leaders accepting the common responsibility of the international community to abolish hunger and malnutrition. Targets set by the World Food Summit in 1996 for the reduction of hunger have largely failed, despite food production having grown faster than world population. Global, national and human security issues are increasingly converging, and in some regions overlapping.

Throughout the 1970s, the population in SSA expanded more rapidly than food production. The estimated number of people who were undernourished increased from 60 million in 1969/1970 to nearly 80 million by the end of the decade. Africa's nutrition situation became worse in the early 1980s with the onset of severe droughts and reduced food production. At the height of the crisis, the undernourished population rose to 100 million people. Sub-Saharan Africa is projected to have a per capita food supply of 2,170 calories per-day, which is the lowest among all regions by 2010. In contrast, the industrialised countries are projected to have a per capita food supply of 3,470 calories per day (Hazell, 1995). International Food Policy Research Institute's (IFPRI) model, which projects ahead to the year 2020, also envisages little improvement in food security in SSA, even under a variety of alternative projections of growth, investment, and trade liberalisation (Hazell, 1995).

The World Bank projects that developing countries will be importing about 15 percent of their grain consumption by 2010. FAO estimates that net imports by developing countries may increase from 90 million metric tons in 1988–90 to about 160 million metric tons by 2010. Most of the imports are said to be wheat and coarse grains (World Resources Institute, 1996).

Worldwide the trends on food security are alarming as progress in reducing hunger in the developing world has slowed to a crawl and in most regions the

number of undernourished people is actually growing, despite the fact that world food production has grown faster than world population in the past three decades. The latest estimates indicate that some 840 million people were undernourished in 1998–2000—11 million in the industrialized countries, 30 million in countries in transition, and 799 million in the developing world. The consequences of worldwide hunger are only now being appreciated. At the 2002 World Food Summit (WFS) the chairperson stated: “Together with terrorism, hunger is one of the greatest problems the international community is facing” (World Food Summit, 2002).

The reasons why action plans to address food security have continued to fail in Africa can be attributed to faulty problems analysis leading to faulty research actions. What is needed is an understanding that goes beyond conventional, orthodox wisdom to work more strategically in developing and implementing effective, national and regional research policies. Availability, access and affordability are all elements of food security

Major causes of food insecurity in Africa

Land degradation

Regular droughts are a fundamental part of the climate in Africa where there is normally an exceptionally high variability in rainfall and temperatures. Environmental factors impact heavily on agriculture, and agriculture in turn has a substantial impact on the environment. There are increasing reports of land degradation, deforestation, water logging and salinisation contributing to the declining ability of Africa to feed itself. Lesotho is a good example. Agriculture in this small country faces a catastrophic future, with average farm yields having declined by more than two-thirds since the 1970s. Soil erosion is spreading fast, and soil fertility is deteriorating even further. During the last months of 2002, it was reported that Lesotho experienced unseasonal weather conditions in the form of frost, cyclones and hail. While the issue of food security is directly linked to climate change and variability, weather is not the single determinant of yield, nor is the physical environment the only decisive factor in shaping food security. Scientists in Africa must come up with ways and means of overcoming climate related problems.

Fallow periods have declined, in all but some land rich countries in south-central Africa (Binswanger and Pingali, 1988), as African agriculture pushes into, and meets the land frontier. Population and other factors have put considerable pressure on land resources. Farmers have tended to survive by adopting extensification measures (by bringing pastoral or forested lands under cultivation) instead of sustainably intensifying by employing a higher level of labor and capital intensive techniques.

In SSA, soil mining is coupled with low agricultural yields. FAO data (FAO, 1986) indicate that the average yield for sorghum in Niger is 300 kg ha⁻¹ compared to 4000 kg ha⁻¹ in the US. In Sudan maize yields are 800 kg ha⁻¹ while the US is able to produce 7,500 kg ha⁻¹. While these comparisons arise out of diverse farming systems and varied ecological and economic conditions that exist between North America and Africa, they display the relative inefficiency of African agriculture, and may be indicative of a landscape with an inherent potential for degradation.

Ahmed et al. (2000) reported that higher yield for improved varieties of dryland crops, sorghum and millet, can only be realized when complimented with fertilizer use and improved irrigation. They reported that use of these complimentary inputs have been the exception in Africa and not the rule, thus yields are below potential. Low crop yields in SSA are forcing the region to continue importing large quantities of grain.

An endogenous factor affecting production is the poor quality of soil. African soils are relatively nutrient deficient and prone to degradation because they are geologically mature and highly weathered. The Green Revolution of the mid-1960s in Asia occurred because of the use of improved varieties and often with irrigation on fertile land. In comparison most African soils are marginal uplands. Improving yields on marginal uplands requires appropriate resource management strategies (Lal, 1990).

In Africa little research and development on food crops to improve low yields in drylands is occurring. Research funds tend to favor crops that are consumed outside the region. The implication for drylands is lack of improved yields in millet and sorghum, which are staples in 13, mostly dryland countries, with a population of 200 million. There has been no significant breakthrough in the genetic improvement of rainfed crops like millet and sorghum, which are grown in low rainfall areas, including 80% of the cultivated land in the Sahel (World Bank, 1984).

Most of the populations living in SSA are poor and lack sufficient housing, infrastructure and services that can mitigate the impact of a disaster. Some live in flood-prone or geologically unstable areas or they farm marginal lands. Demographic changes, environmental degradation, changes of river, dam and land management and other factors increase vulnerability. Susceptibility to natural hazards aggravate the adverse effects of these natural events, particularly in the least developed and conflict-ridden countries.

Lack of resources

There is a perception that Africa has under performed in macro-economic terms, but in fact according to World Bank statistics, Africa has not lagged behind the world as a whole: its growth rate in the period 1990–96 was 2.1% as against Latin America's 2.5%, East Asia's 4.0%, South Asia's 3.0%, and 0.8% for high income economies. Food production has in fact increased by over 25% in the last two decades, but not fast enough in terms of per capita production. Some countries in SSA has been having a negative per capita GDP growth rate of –1.0% between 1975 and 1999, compared with 6.0% for East Asia and the Pacific and 2.3% for South Asia.

Food insecurity and hunger are closely related to poverty and an inability to purchase food. Tackling hunger cannot be solved by simply producing more food for famines have occurred even with plenty of food. Most people buy food rather than produce it and in fact very few people, including small-scale farmers are entirely self-sufficient in food production. It has been reported that as harvests fails, people resort to selling of their livestock and assets to finance food purchases leading to higher food prices and lower livestock prices.

Security of land tenure is not only a determinant of food production for land is an essential resource for many people if they are to escape poverty, but it also influences conservation of that particular land. Traditional, political, social, and legal factors have been responsible for unequal access to land in Africa. This, in turn has increased the risk of resource degradation. Lack of security in land tenure in many African societies has reduced the motivation to invest in conservation of resources leading to further land degradation and low agriculture productivity. The distribution of land especially the eastern and southern Africa is so unequal that land reform and land redistribution is essential if there is to be a major reduction in poverty.

Land reform programs have enormous potential to increase agricultural production especially if they can be accompanied by comprehensive programs of access to credit, savings and markets. There is need for scientists in Africa to carry out more studies on land distribution and come out with research findings that can influence land policies on the continent.

Public investment in African agriculture has been falling for many years. Aid to agriculture and rural development in the late 1970s accounted for more than a third of total aid. In the late 1980s, that figure dropped to 24%. It is now closer to 10%. World Bank lending has fallen from around 31% of its total lending in 1979–81 to less than 10% in 1999–2000 (World Bank, 2000). Poverty strategies of many African countries make little mention of agricultural and rural development as sources of poverty reduction. No wonder, many African government budgets for agriculture have declined.

African scientists should not ignore traditional crops (which are more drought-resistant e.g. root crops, millet and sorghum) at the expense of cash crops. In Africa, small-holder agriculture has proved to be at least as efficient as large farms when farmers receive similar support services in inputs like seeds, fertilizer and credit. An FAO study revealed that small farms tend to be more productive and offer more employment to surrounding populations than large estates (reference). The International Food Policy Research Institute (IFPRI, 2001) estimated that for 1% rise in agricultural productivity, poverty would be reduced by 0.6%. The African countries must have additional public investment into on-farm improvements such as irrigation, better seeds, conservation of the natural-resource base for food production, improvement in research and extension collaboration, upgrading of rural infrastructure and improved market access.

New challenges and opportunities

Most recent attempts to develop hypothetical models of the world's potential to increase food production over the next decades conclude that the potential is sufficient to meet the growth of effective demand as world population and incomes increases. However, there is a substantial gap between the world's hypothetical production potential and short-term realities in certain regions, particularly in SSA (IFPRI, 1995)

In this millennium, food and agricultural production have to be promoted with viable livelihoods and improved human well-being, while at the same time

ensuring enhanced natural resources and environment at the local, national, and global levels. The fundamental challenge facing scientists in Africa in the 21st Century is to assist African farmers in increasing their food production in a sustainable way to be able to feed the expanding populations. Such an increase has to come primarily through the intensification of current agricultural production, as potential for bringing new land under cultivation in most countries is very limited. If hunger and poverty are to be reduced, this agricultural intensification must be both ecologically, socially, and economically sustainable.

New challenges and opportunities in Africa must be recognized and incorporated in research and development. Success will depend on the effective functioning of the whole continuum of actors and processes, including research, technology, infrastructure, good governance and policies on marketing and extension, combined with commitment to the plight of the Africans. The weakest link will determine the impact of the entire system; hence, it is imperative that all researchers must encourage all partners to play their effective and efficient role.

Sub-Saharan Africa's share of the world's food insecurity is projected to rise to nearly 40 percent of the total SSA population by 2010. At that time, every third person in the region is likely to be food insecure, with some 300 million people chronically undernourished.

The ability of researchers in Africa to incorporate all the scientific and technological capacity necessary to create performing varieties is very important. The involvement of stakeholders holds the key for the success of solving food insecurity in Africa. There is a need for focusing agriculture research on a number of indigenous plant species / or on traits of interest of high economic importance. Researchers in Africa must play a major role in exploiting the rich biodiversity in the continent for the benefit of the continent. Partnerships must be developed with entities that are capable of solving the problems in the continent. The researchers must accept the role of biotechnology in solving some of the continent food related problems but must patent plants and genes for the benefit of the African people.

Research approach:

The various challenges to sustainable management of natural resources for agricultural development, including water scarcity, soil degradation, biodiversity conservation are largely eco-regional in nature

and require eco-regional solutions. An eco-regional research approach will require increased collaboration within regions and a stronger emphasis on incorporating indigenous and farmer knowledge and innovation systems. While there is a need to concentrate on national researches that have international dimensions, it is important to compare notes with other researchers in a particular region. While carrying out research to solve the problems of food insecurity, the researchers must ensure the following: Efficiency, relevance, and collaboration

Food safety and the environment have to become topics of major importance for research in Africa. Researchers must have a considerable amount of research that focuses on finding solutions to protect the environment and human welfare from the negative fallout of agricultural practices. Another major area of research should be on policy, with concerns such as how to make the best use of the water available and what incentives might lead to a sustainable use of resources. These aspects should be particularly noticeable in countries in Sub-Sahara Africa.

Food security, sustainability and poverty alleviation can only be achieved if appropriate policies and investments are in place. From the farm level to the national level, many policies affect food production systems, including trade and macroeconomic policies, water management and allocation, property rights, agricultural input and output markets, and rural infrastructure and financial markets. Policy research should remain an important part of research strategies in the coming decades.

In response to new scientific developments that cannot be categorized within traditional sectors, collaborative research needs to be encouraged. Certain new research techniques can be used for many different purposes; for example, geographical information systems (GIS) can be applied in agricultural research as well as in rural or transport planning. The same is true of molecular biology, which has many biological, medical, and agricultural applications. The interest in collaborative research can be explained as a function of the need to combine new specialization. Because of the high costs involved, many research institutes in Africa cannot maintain all of the new specialization available. There is therefore a need for scientists to seek alliances through collaborative projects.

For Africa to develop and be self-sufficient in food production, mechanisms, programs or institutes need to be established to carry out combined research, which interact with the agro-industrial sector and

the producers. The collaborative mechanisms should emphasize the joint generation of knowledge and new technologies (Rutten, 1999).

Focus on basic research in universities

Traditionally universities in Africa have played a major role in agricultural research and their participation in public agricultural research need to grow more. This is because universities have greater flexibility in adapting their research agendas than research institutions, and they are more concerned with basic research, which continues to be considered as a public responsibility.

Concern has been expressed on many occasions about the low impact of the scientific system on societal development. Basic research in agriculture can lead to the following benefits:

- new information;
- new instruments and technologies;
- skills among researchers and especially among post-graduate students who later move on to other activities;
- access to information and networks of experts;
- ability to resolve complex technological problems;
- creation of new companies based on new discoveries.

This list shows that technological results form only a small part of research benefits and that, to obtain maximum benefits, it can be useful to have a link with the university environment (Persley, 1998).

To ensure more appropriate responses to the new research demands and new financial mechanisms, there has to be an attempt to make use of human resources more creatively. This can most commonly be achieved through short-term contracts, for example, for Ph.D. projects. Though the effect is ambiguous, however, on the one hand, there is greater mobility of researchers between professions, and a wider diffusion of knowledge, which leads to the creation of a broader knowledge cloud. Short-term contracts provide organizations with a mechanism to select the best researchers from the temporary personnel. On the other hand, reduced employment security limits the possibilities to carry out long-term research.

There is a need for integrating research findings into education systems if problems of food security are to be solved in SSA. Such integration has always been strong in many developed countries. Not only does integration of research into the education system

lead to budget cuts, but it also reflects the importance attached to knowledge and the concern to ensure adequate diffusion of research results. In addition, the use of scientists who also have educational responsibilities leads to greater flexibility and facilitates the development of a critical mass. Another element that needs to be done is to integrate nonagricultural disciplines into agricultural research.

Co-financing modalities

Co-financing between producers and governments in Africa need to be encouraged. Researchers in Africa should establish a co-financing formula where the producers decide what research is of interest to them, and pay for it. In situations where the technological impacts of research are barely noticeable to national consumers, while producers benefit through increased economic returns, it makes sense that the producers pay for research. Just like the small-scale farmers have been paying for road maintenance in some countries in Africa, they should also be encouraged to pay for research.

Researchers in Africa should encourage this type of financing which should focus on inputs, machinery, equipment, and processing industries. Private expenditures on research in Africa should be higher than public expenditures. The growth in private research could be influenced by three factors namely: (1) the rapid development of the sector; (2) the legal framework in which they operate and the clarity that exists with regard to legal property rights; and (3) the density of the knowledge cloud. Industry invests in research when it finds itself in a conducive environment (Klotz et al., 1995).

Conclusions

Food and nutrition security for Africa can and must be achieved because it is a human rights issue as well as a moral and socio-economic imperative. Food and nutrition security in Africa must receive renewed attention and commitment from researchers in Africa and we must recognize that with business as usual the goals will not be achieved.

The highest priority actions of researchers in Africa should be to raise agricultural productivity, fostering

Table 1. Land management and crop yield in some African regions as compared to Europe and South East Asia.

	Population Density pop Km ²	Crop land % of total	Irrigated % of total	Average yield Cereals kg ha ⁻¹	Fertilizer use Kg/ha ⁻¹
Northern	226	5	27	1,973	94
G. of Guinea	891	21	2	892	15
Central	145	4	1	923	2
Eastern	451	10	2	1,363	12
Southern	208	6	7	929	27
Thailand	1141	45	19	2,052	39
U.K	2,404	28	2	6,332	350

Table 2. Percent increase in food production between 1961 and 1963 and 1989 to 1990 both in areas and yield per hectare.

Region	Increased area %	Increased yields %
SSA	42	52
Latin America	30	71
South Asia	14	86
East Asia	6	94
High Income Countries	2	98
World	8	92

Source: Rojanasoonthon et al., 2002.

Table 3. Average changes of the forest areas in the world.

Continent	Annual change (Thousand ha)	Annual change rate (%)
Africa	-5,262	-0.78
Asia	-364	-0.07
Oceanic	-365	-0.18
Europe	+881	+0.08
North and Central America	-570	-0.10
South America	-3,711	-0.41
Total world	-9391	-0.22

Source: Urushadze Tengiz, 2002.

pro-poor economic growth through improved markets, better infrastructure, and greater trade competitiveness, building institutional and human capacity, improving nutrition and health with due attention to HIV/AIDS, and strengthening governance. All of these require added resources, but the benefits of food and nutrition security outweigh the resource needs.

The rights of all who have a stake in achieving food security, especially food-insecure people must be respected, protected, facilitated, and fulfilled. Without mechanisms for generating improved incentives for good governance and accountability of all actors, no sustainable progress can be expected.

Sound decision-making and implementation of needed action is constrained by lack of capacity and by governance and institutional weakness. All three constraints must be addressed simultaneously. Implementation must focus on strong government capacity, strong farmers' organizations, strong incentives for the business sector to engage in agriculture and the food industry, strong consumers' associations, media, and strong health systems serving the needs of the poor.

References

- Ahmed M.M., Sanders J.H. and Nell W.T. 2000. New Sorghum and Millet Cultivar Introduction in Sub-Saharan Africa: Impacts and Research Agenda. *Agricultural Systems* 64 pp. 55–56.
- Annon. 1999. UNIDO Workshop on Alternatives to MB in the People's Republic of China. Beijing, 8–9 November 1999, 131 pp.
- Binswanger H. and Pingali P. 1988. Technology Priorities for Farming in Sub-Saharan Africa. *Research Observer* 3 (1) pp. 81–98.
- Delgado C. and Mellor W. 1984. A Structural View of Policy Issues in African Agricultural Development. *American Journal of Agricultural Economics*. 66 pp. 665–670.
- Dixon A.J., James D.E. and Paul B. Sherman 1989. The economics of dryland Management. Earthscan, London UK. 302
- FAO. 1984. A Guide to Staple Foods of the World. Rome.
- FAO/WHO. 1992. Major Issues for Nutrition Strategies Summary, FAO, Rome.
- Hazell P. 1995 Managing Agricultural Intensification, IFPRI, 2020 Brief No. 11 (IFPRI, Washington, DC).
- ICHI (Independent Commission on International Humanitarian Issues). 1986. The Encroaching Desert: The Consequences of Human Failure. Zed Books. London.
- IFPRI 2001. A 2020 Vision for Food, Agriculture and the Environment. Washington DC.
- Indicators of regional vulnerability in Africa (WRI, 1996). WRI, 1996: World Resources: A Guide to Global Environment, 1996–1997. World Resources Institute, United Nations Environment Program, World Bank, Oxford University Press, New York, NY, USA, 342 pp.

- International Food Policy Research Institute (IFPRI). 1995. "A 2020 Vision for Food, Agriculture, and the Environment," draft paper (IFPRI, Washington, DC).
- Klotz, C.A., K.O. Fuglie and C.E. Pray. 1995. Private-Sector agricultural research expenditures in the United States, 1960–1992. US Department of Agriculture Economic Research Service. AGES, 9525.
- Lal R. 1990. Low-Resource Agriculture Alternatives in Sub-Saharan Africa. *Journal of Soil and Water Conservation*. 43 pp. 437–444.
- Persley G.J. (ed.) 1998. Investment strategies for agriculture and natural resources. Wallingford: CABI Publishing.
- Rojanasoonthon S. and Kheoruenromne I. 2002. Tropical soil science. Realities and challenges. In: Proceedings for the 17th World Congress of Soil Society, 14-21 August 2002.
- Rutten H. 1999. Development in the organization and finance of public and finance of public agricultural research in the Netherlands, 1988-1999. Personal communication.
- Urushadze Tengiz F. 2002. Soils in space and time: realities and challenge for the 21st century. In: Proceedings for the 17th World Congress of Soil Society, 14-21 August 2002.
- World Bank. 1984. Toward Sustainable Development in Sub-Saharan Africa: A Joint Program of Action. Washington DC.
- World Bank. 2000. World Development Report 2000/2001: Attacking Poverty. Washington DC.
- World Food Summit News. 2002. Five years later, 10-13 June.
- World Resources Institute (WRI), 1996/97: A Guide to the Global Environment. WRI, UNEP, UNDP. The World Bank. New York.
- WRI, 1998: 1998–99 World Resources Database: A Guide to the Global Environment. World Resources Institute, Washington, DC, USA.