Strategic Assessments and Development Pathways for Agriculture in the Semi-Arid Tropics

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# New Priorities for Agricultural Research in Africa

**H Ade Freeman, David D Rohrbach, and Chris Ackello-Ogutu**

## Change, diversification, and livelihoods

The agricultural economies of Africa have witnessed three major changes during the past 10 to 15 years that justify a reassessment of agricultural research priorities. First, liberalization of macroeconomic and trade policies has increased the relative importance of tradeables in the commodity mix. Second, agricultural input and product markets have expanded, broadening the range of livelihood strategies available to rural households. Finally, broader partnerships for technology development and dissemination are creating new opportunities.

Many of Africa's poorest and most food-insecure farmers live in semi-arid areas. To survive in a harsh and variable environment, they pursue a range of livelihood strategies. Different households pursue different development paths. But almost all seek to diversify their income sources and investment strategies as a means to reduce risk and respond to changing market conditions.

How can R&D agencies improve the payoffs to farmers' investments? There are trade-offs between different alternatives – should the farmer spend her limited money looking for an off-farm job, or on livestock, or on a bag of fertilizer? It is hard to evaluate these trade-offs. But recent investment trends offer some clues on the trade-offs involved, and on how farmers' investment decisions are influenced by changes in policy, technologies, and market conditions.

In July 2002, ICRISAT sponsored a conference on *Targeting agricultural research for development in the semi-arid tropics of sub-Saharan Africa* to discuss how best to link technology development, market expansion, and agricultural growth in Africa's semi-arid tropics (SAT). This meeting

- Examined and compared alternative growth paths for poverty alleviation and development of smallholder agriculture
- Reviewed the market and institutional factors influencing technology adoption
- Assessed the current stock of available technologies
- Discussed institutional arrangements linking national and international research programs and the public and private sectors.

*HIV/AIDS must be factored into agricultural development programs. Interventions must address labor shortages, nutritional constraints, and the loss of farming expertise.*

The meeting concluded with a series of recommendations for better targeting of agricultural research to achieve faster development. This policy brief summarizes the discussions and outputs from the meeting.

## Rural household decision making and technology change

Decisions to invest – or not to invest – in new technology are made in the context of the household's livelihood strategies. Case studies from Burkina Faso, Kenya, and Zimbabwe showed how these strategies have evolved, and the trade-offs underlying farmers' investment decisions. There were significant differences between countries in the relative shares and trends of agricultural income; but in all countries there is substantial – and growing – diversification of income sources. This diversification occurs because

farmers pursue alternative growth paths out of poverty, and also seek to reduce farming risks.

In many wealthier households, the largest share of income comes from non-farm sources – contradicting the common perception (even among policy makers) that rural households are simply crop or livestock producers. This raises the question: will non-farm income be invested back into farming? The evidence is mixed. Non-farm income is sometimes invested in expanding cash crop and livestock enterprises, but in other cases it is used to facilitate the movement of family members off the farm.

Small-scale farmers are commonly viewed as subsistence producers. In fact, most rural households are heavily involved in market activity. Poorer households sell labor to buy food; or sell vegetables, beer, or crafts to meet cash expenses. Wealthier households are more likely to sell cash crops and livestock products. In either case, national policies can have significant, but differential, effects on rural households. For example, higher grain prices may help the few households who produce cash crops, but hurt the majority who are net grain buyers.

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Given the importance of non-farm activities, households are likely to value labor-saving technologies even in perceived labor-surplus areas. Ultimately, we must facilitate the reallocation of labor from low-return to higher-return enterprises, and reduce entry barriers into remunerative non-farm activities. Thus, technologies and institutional arrangements that increase labor mobility may contribute more than technologies simply targeting investment gains in a single crop.

## The environment influencing technology choice

Factors such as agribusiness and market linkages, food security, gender, and HIV/AIDS condition the environment of technology choice.

Smallholder farmers producing for the commercial market need to become increasingly sophisticated in responding to the demands of end users. They must be able to offer not just competitive prices but also high quality products. That means they will have to grow the right varieties, using improved crop management practices, with proper attention to post-harvest handling and storage.

Researchers also need to respond to competitive grades and standards. Plant breeders traditionally focused on yield; now they must consider product quality as well. Scientists may also need to participate more fully in establishing workable grades and standards on quality and food safety. Agricultural economists may need to shift some of their time from studying farm management to analyzing market opportunities.

One continuing problem is that the market – specifically the grain assembly stage – does not adequately differentiate between products of different grades. Traders and grain processors incur high costs for cleaning grain to market standards; and "recover" these costs by paying farmers lower prices. A more effective solution would be to pay price premiums for better quality grain. This would encourage the establishment of farm- or community-level operations for grain assembly, cleaning, and sorting, and increase farmgate prices.

Commercialization of agriculture will not necessarily ensure food security, particularly in areas where drought is endemic and market linkages are poor. Many households lack the resources needed for market-oriented production. Typically, commercialization benefits only the top 10 to 30 percent of households. Poorer households may benefit indirectly, for example through an increase in the demand for wage labor, but many will remain at the margins of subsistence. Thus, technologies will still need to be specially targeted at ensuring food security for this segment of the population.

Technology development and dissemination programs continue to be biased against women. Women have limited access to credit and extension advice, and limited rights to, or control of, land. This severely undermines their production potential. The proportion of female-headed households is increasing. These households are perceived to be generally poorer than male-headed ones, but it is important to differentiate between different types of female-headed households. Those with good access to remittances and other off-farm income may have an entirely different investment profile than those without such income. Research and extension agencies must take these factors into account, and improve their capacity to identify and dismantle gender-related adoption barriers.

HIV/AIDS continues to have a devastating impact on rural livelihoods. The number of directly and indirectly affected households is growing. They are becoming poorer; livelihood options are narrowing as they lose income earners and take on more dependents. More research is needed to clarify the diverse nature of these impacts and how farmers are responding. But at a minimum, we need to design interventions that address labor shortages and nutritional constraints. We also need to account for the fact that farm expertise is being lost as older and more experienced farmers die earlier.

## Technology trends and prospects

Two broad questions are important in assessing technology trends and prospects in the African SAT. Are technologies currently available that can improve incomes and welfare among the rural poor? What new technology issues are emerging, and how can they be addressed?

A review of recent research confirms that a wide range of appropriate technologies is available, and more breakthroughs can be expected through the judicious application of biotechnology. However, adoption of available technologies has been slow. Scientists can no longer afford to restrict their activities to developing new technologies; they must help ensure that these technologies are widely used. They must pursue *science for development*.

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Plant breeders need to be more responsive to the demands of different end users. Farmers need varieties that will improve household subsistence; grain processors need varieties targeted for the market. Biotechnology can help improve this targeting, but biotech work needs to be carefully prioritized, after considering the probabilities of scientific success as well as consumer concerns. Similarly, natural resource management scientists must integrate their work with efforts to improve market institutions. They need to be more responsive to market forces in designing and adapting technologies, and more flexible in adapting to market opportunities.

In semi-arid areas in particular, there is need for a "Blue Revolution" in order to increase productivity per unit of water – *more crop per drop.* Productivity can also be substantially increased through relatively small improvements in soil fertility management. In either case, however, researchers need to focus not on maximum yields, or even maximum profits, but on increasing the returns to small quantities of better-targeted inputs.

All this will require wider partnerships between scientists and traders, crop and livestock scientists, agronomists and water management specialists, and between the public and private sectors. These partnerships should aim at developing not complex technological solutions but a wide range of technology options, including smaller packages, from which farmers can choose.

## Institutional arrangements for agricultural research

Technological change takes place through institutions, whether for development and dissemination (research, extension, policy) or for adoption (markets, credit, input supply). In order to speed change, it is critical to understand the nature and functioning of institutions and how they could be strengthened.

One aspect is broader partnerships with both conventional and new partners including NGOs and especially the private sector. Another and more fundamental aspect is a new paradigm for institutional arrangements. More adaptive institutional frameworks are needed that support institutional learning and innovation. Rather than pursuing a single "ideal" model of research or market structure and management, institutions need to be constantly evolving, searching out new alliances and partners as new opportunities arise.

Institutional learning processes have to be made more explicit. This implies that institutions will have to learn to acknowledge and diagnose their problems. They will also have to allocate greater resources to monitoring and evaluation – not to justify past work, but to identify future opportunities.

## Implications for research priorities

The agenda for agricultural research and development, or research *for* development, has become broader than

in the past. Technologies need to be matched not only with the crop or livestock enterprise and the biophysical environment, but also with the market and investment environment. Broader partnerships are necessary, involving agencies with a wider range of skills; but care must be taken to ensure that priorities are well set.

The institutional environment for agricultural research will include a range of national and international, as well as public and private organizations. Institutions such as ASARECA, CORAF, and SACCAR, which coordinate regional research and help guide development investment, will need to include these various stakeholders.

Finally, while the value of more strategic research is acknowledged, a problem-solving focus is also important. This will require better indicators of research impact, and better systems for setting – and changing – research priorities.

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The workshop offered the following recommendations.

### Research for Development

The Research for Development agenda should be driven by the priorities of African stakeholders and the specific requirements of end users, ie farmers, processors, and traders. Given the complexity of issues involved, research must shift from a narrow agricultural perspective to a broader perspective that encompasses the rural economy, including the non-farm sector. The agenda must consider market, policy, and institutional factors that influence water management and utilization; as well as factors that limit diversification and commercialization of SAT agriculture. We need to better understand the changes in the biophysical and socio-economic environment (climate change, drought, globalization, policy reforms, etc), and how they impact on poverty, food security, and the natural resource base.

### Market versus subsistence production

Many SAT farmers concentrate on subsistence production because they are poor, and live in areas with poor agricultural potential, undeveloped markets and poor infrastructure. Commercial agriculture may be too ambitious for this group – we need at least a subset of technologies that specifically target food security in the poorest households. In areas with better farming conditions and market access, research programs could focus on market-oriented production and value addition; but technologies must offer competitive returns to labor and capital compared with alternative income-earning opportunities.

### A new paradigm for technology development

Traditionally, plant breeders focused mainly on genetic and environmental (biophysical) parameters. We need a new paradigm that will also take into account the market, institutions, and household livelihood strategies. Similarly, resource management research must focus on better matching of natural resource-based enterprises with biophysical, economic, and social conditions.

### Economics and social science research

R&D programs need to strengthen their economics and social science programs, in order to better understand markets and institutional factors, and provide analytical advice to policy makers.

### HIV/AIDS

HIV/AIDS is an increasingly significant issue, and must be factored into agricultural development programs.

### Capacity building

New and more sustainable strategies are needed for building R&D capacity of the full range of stakeholders. These could include rationalization of the curriculum in training institutions. We must clearly identify the content of training programs, the modalities, and the responsibilities of different partner institutions.

About the authors: ***Ade Freeman*** *is Head, Impact Assessment Office, ICRISAT, PO Box 39063, Nairobi, Kenya.*
***David Rohrbach*** *is Principal Scientist (Economics), ICRISAT, PO Box 776, Bulawayo, Zimbabwe.*
***Chris Ackello-Ogutu*** *is Director, Resource Management and Policy Analysis Institute, PO Box 63086, Nairobi, Kenya.*

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**International Crops Research Institute for the Semi-Arid Tropics**
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**www.icrisat.org**