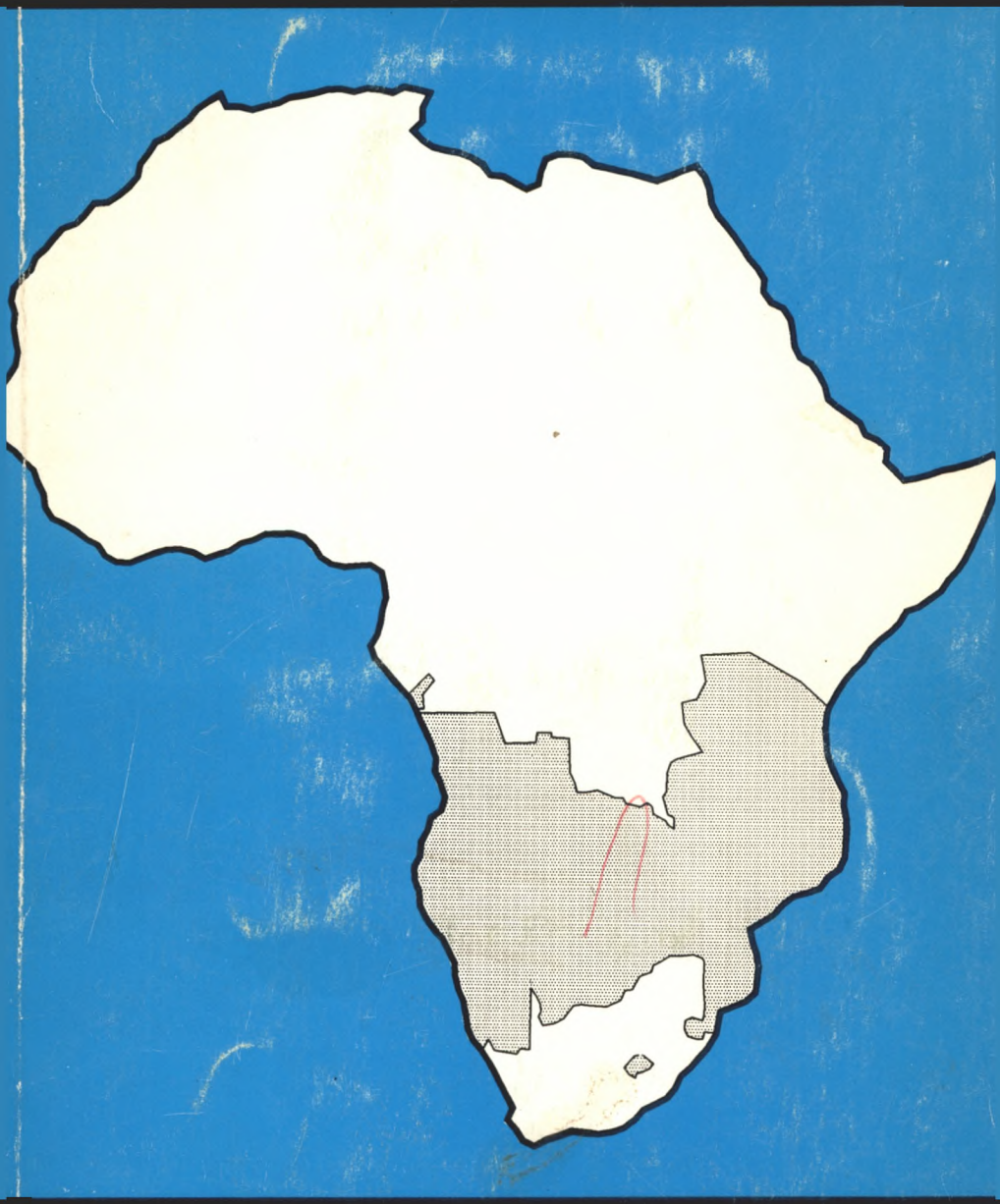
Market Reforms, Research Policies And SADCC Food Security



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University of Zimbabwe UZ/MSU Food Security Research in Southern Africa Project

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SECTION V: AGRICULTURAL RESEARCH PRIORITY SETTING AND HOUSEHOLD FOOD SECURITY

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The Experiences of SADCC/ICRISAT In Setting Priorities For Sorghum And Millet Research For Household Food Security

Leland R. House and David D. Rohrbach[1]

The persistence of food insecurity in the SADCC region, despite regional and some national food surpluses, results from a historical failure to develop improved technologies for smallholder production systems based in semi-arid areas. These low rainfall zones encompass many of the most food insecure households in the region. Frequent droughts cause a persistent need for food relief programmes. But even in years of average rainfall, many of these farm families still cannot produce their annual grain requirements. Such households badly need improved cropping technologies in order to increase the level and stability of their grain production. Improved technologies are also necessary to generate a sustainable income base.

The SADCC/ICRISAT Sorghum and Millet Improvement Programme (SMIP) was established in 1983 to help fill this gap. Decades of research on maize had provided a backbone for the development of the regional maize economy. In contrast, research on sorghum and millet, crops of key, historical importance to the regional agro-economy, was practically non-existent. Technological gains had allowed maize to broadly replace sorghum and millet as the region's principal cereal staple. The lack of technologies for the small grains left these characterised as traditional or subsistence crops.

Periodic droughts have stimulated intermittent interest in the promotion of sorghum and millet. Small farmers have been advised by extension workers to reallocate land from maize to these more drought tolerant crops. Yet improved maize production technologies offer higher returns than unimproved sorghum or millet, even in many drier zones. In Zimbabwe, for example, hybrid maize yields more than traditional sorghum or millet in all but the worst drought years (Hedden-Dunkhorst, 1989).

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Advice to grow unimproved sorghum and millet has threatened the credibility of extension workers.

Several SADCC governments have raised producer prices for sorghum and millet as an additional means to encourage production. But high producer prices have left sorghum and millet uncompetitive on the industrial market. Maize offers a cheaper industrial input because it is more productive. The uncompetitive prices caused the parastatal marketing boards to build unsaleable small grains stocks. Meanwhile, most households residing in low rainfall regions remained food insecure.

The SMIP helps construct the technological base upon which to rebuild the regional sorghum and millet economy. The choice of ICRISAT as the initial implementing agency offered direct access to world germplasm collections and top scientific expertise for sorghum and millet. This decision also facilitated the immediate establishment of an intensive regional research programme. Major complementary investments in the training of national programme staff and the improvement of national programme research facilities offered the basis for developing country-specific research capabilities for these crops. Over time, it is envisioned that these national programmes will take over many of the responsibilities of the regional programme. The development of a strong and sustainable set of national research programmes for sorghum and millet was originally expected to take 20 to 25 years.

This paper reviews the development of the SMIP, highlighting the establishment and evolution of priorities relating to crop productivity and utilisation that ultimately contribute to household food security. Within this context, the paper examines the role of the regional research institute and its response to the varying needs of the ten SADCC countries.

SMIP PROGRAMME ESTABLISHMENT

The primary objective of the SMIP is the strengthening of national capabilities to improve sorghum and millets. To achieve this, the programme was established with three major areas of activity: collaborative research, education and training, and support for the development and management of experimental facilities.

Collaborative Research

The objective of crop improvement was placed at the center of the programme. This decision placed an emphasis on technology generation rather than such broader efforts as the development of new farming systems. In 1983, virtually no breeding for sorghum and millet was being conducted in the SADCC region. Germplasm supplies were limited and national programmes were forced to rely on the testing of improved varieties developed elsewhere. Most national programmes had only limited means to even identify, much less make use of, externally generated technologies.

The initial SMIP priorities also accounted for the dynamic biological circumstances underlying varietal development and dissemination. Changes in cultivar or crop management are often coupled with changes in the disease, insect and weed pest incidence. Environmental changes such as prolonged dry spells and soil degradation also bring these sorts of changes. Correspondingly, the breeding programme needed a complementary input from an agronomist, entomologist and pathologist.

The semi-arid tropics are characterised by high variability in rainfall around the expected mean. The dry extreme is of particular concern. Sorghum and millet are widely known as drought tolerant crops. But plant response to drought is a trait with low heritability limiting gains that can be made by breeding. Large additional gains may be available through improvements in water management techniques. Thus, the development of crop management technologies designed to maximise moisture available to plants is another priority concern.

It was felt important to bring together a critical mass of scientific talent at one location. This would encourage interactions in the crop improvement process and facilitate the analysis of crop development interactions such as the relations between varietal response and moisture availability, soil fertility, moisture utilisation and cultivar, or plant luxuriance and susceptibility to stalk rots. Selection must be seen as a joint effort of breeder, pathologist, entomologist, and agronomist.

An economics input was not originally viewed as necessary until improved technologies had been developed. A production economist would then facilitate identification of technology adoption constraints and impact assessment.

Education and Training

The regional need for manpower development is well known. Correspondingly, a programme for degree education and non-degree training was given high priority. The degree education programme was subcontracted with the United States based Collaborative Research Support Programme in Sorghum and Millet (INTSORMIL). The non-degree training is carried out within the SADCC region and in conjunction with the ICRISAT training programmes in India.

Each national programme holds responsibility for the establishment of its training priorities relating to sorghum and millet and for the identification of candidates for overseas training. During the first ten years of the SMIP (1983-1993) over 100 individuals will have received scholarship support for B.Sc., M.Sc. or Ph.D degrees.

Regional training workshops are being run in crossing and crossing block management, nursery management, pest identification and scoring, economic policy analysis and research station management. The SMIP is supporting the post-graduate research of a small number of students. In addition, the SMIP offers research internships. Annually, 10-12 students from the University of Zimbabwe spend their three month summer vacation period with the SMIP.

Perhaps most importantly, the scientific expertise of the regionally based programme is being extended through collaborative research studies with national programmes and scientists. The strengths of academic training are then broadly complemented by on-going interaction with experienced scientific peers. In practice, such interaction stimulates improvement of the skills of national scientists in setting research priorities, planning investigations, analysing data and reporting research results. Such collaborative research helps educated disciplinarians become experienced scientists.

Station Development and Management

The early contributions of a station development and management officer were viewed as essential for both the establishment of a regional experiment station and the strengthening of several national stations. This position was premised on the assumption that efforts to build national facilities need to be complemented by efforts to run these efficiently. Further, the value of the results of crop experiments is directly linked with the efficient management of the experimental plots and the control of non-experimental sources of variability. Special efforts have been directed toward improving the quality of the management of station facilities and experimental trials.

EARLY SCIENTIFIC PRIORITIES

The establishment of a regional research programme in sorghum and millet was initially requested by the SADCC Heads of State in 1980. A regional needs survey was conducted by the programme Planning Mission in November of that year. This Mission consulted with each of the SADCC countries and outlined the priority each national programme attached to problems of breeding, agronomy, physiology, pest and disease control and food quality for sorghum and pearl millet. This offered the basis for the initial setting of each scientist's research priorities.

Problems of drought stress and the need for varietal and hybrid improvement were identified as particularly critical. Selection, to improve cultivars, depends on variability in the crop for the traits of concern. These encompass yield, disease and pest resistance and crop utilisation characteristics. An early priority was to undertake massive introduction to expand variability. For example, 5 500 accessions of sorghum, were received from 25 stations around the world. Another 2 400 accessions of pearl millet were received from 16 world locations.

Environments were immediately a matter of concern. The programme was centered at Matopos in Zimbabwe -- a representative semi-arid environment in the region. But the SMIP sought a broader series of environments to test cultivar adaptation, to identify racial considerations for diseases, and to screen for pest and disease resistance. Correspondingly, the above collection of sorghums was initially evaluated at five locations in four SADCC countries. The millet collection was initially evaluated in seven locations in five countries.

ENSURING CONTINUING RELEVANCE

Great importance has been attached to the objective of promoting on-going communication about sorghum and millet research in the region. This includes efforts to sponsor frequent reassessments of the value and orientation of SMIP contributions.

A number of steps have been taken to facilitate communication and information flows:

1. *Collaborative Science* - Roughly 30 to 40 percent of the time of SMIP scientists is spent traveling in the SADCC region and working with national scientists. Trials are administered collaboratively, SMIP scientists participate in national research planning workshops and disciplinary conferences, and SMIP scientists provide direct advisory assistance to individual scientists in the national programmes.

2. *Annual Regional Conference* - An annual workshop is held to review the results of sorghum and millet research in each SADCC country and plan the coming year's work. The national programme scientists are offering an increasingly important contribution to these discussions and to the planning of regional trials and nurseries.

3. *Monitoring Tours* - The SMIP organises biennial tours for SADCC scientists working with sorghum or millet to review each other's field research programmes. Every two years the progress of several national programmes is reviewed. Participating scientists not only interact on matters of scientific interest, but request seeds of varieties and hybrids of interest to their own programmes.

4. *Technical Advisory Panel* - A Technical Advisory Panel (TAP) meets annually with the SMIP to review the progress of the regional programme and suggest adjustments in priorities. The TAP is made up of the Director of SACCAR as chairman, three scientists from the region (frequently Directors of Research) and three eminent sorghum or millet scientists from elsewhere in the world.

5. *SACCAR Board* - The SMIP Director provides the Board of SACCAR with an annual update of programme activities. Suggestions are also received from this Board about programme priorities.

6. *Project Evaluations* - The SMIP receives periodic project evaluations from the programme donors. These often seek additional comment from SACCAR and the national programmes.

Few scientific programmes have sought such extensive interaction with other researchers in the region. In effect, the SMIP provides the foundation of a regional

scientific programme encouraging both a consistent interchange of ideas and a high quality of disciplinary work. Few programmes also face the extensive scrutiny of programme and scientific priorities experienced by the SMIP. This almost constant communication and evaluation has ensured the relevance of the SMIP to regional needs and expanded support for programme implementation.

THE EVOLUTION OF PROGRAMME PRIORITIES

The SMIP programme began in May 1984 and the first Regional Workshop was held in October of that year. Two important consequences of that meeting were the addition of finger millet to the SMIP crop improvement programme and the identification of stations in the region in different environmental zones that would be appropriate for screening of introductions and early generation materials.

The existence of sorghum and millet surpluses held by the Grain Marketing Board (GMB) in Zimbabwe strengthened an initial concern for crop utilisation. While it was recognised that sorghum and millet could be employed for virtually hundreds of products, considerable thought was required to identify utilisation priorities for research. Several study papers were locally commissioned in 1987. International and regional meetings on sorghum and millet utilisation priorities were held in 1988. With the support of the Technical Advisory Panel and SACCAR, a food technologist was hired in July 1988. The decision was also taken to revise the terms of reference of the economist from production to market economics.

Also at this time, the agenda of the pearl and finger millet breeder was extended to encompass the development of sorghum and millet as forage crops. A regional pearl millet breeder was then employed to take charge of the pearl millet breeding efforts.

The Experiment Station Development and Operations Officer was originally planned for the first three years of the programme. Recognising the need to improve the quality of field research, and as part of the objective of strengthening national programme capabilities, this position was made permanent. Attention to the need for substantial improvement in the strength of experiment station operations in many national programmes brought the employment of a Regional Station Development and Management Officer.

Though some funds have been allocated to the improvement of the facilities of national sorghum and millet research programmes, station management needs remain extensive. Accordingly, the SMIP is in the process of developing a project for SADCC, to be independently funded and managed, that will direct greater resources toward experiment station improvement in the Region.

More recently, concerns have been raised about the lack of availability of improved sorghum and millet seed. As varieties and hybrids reach release, seed is needed for advanced testing, farmer verification trials, extension and preliminary farmer use. One to five tonnes of grain are also needed by food industries to evaluate the

processing characteristics of new cultivars. This need for quantities of seeds up to five tonnes is more than a crop improvement programme is organised to manage, but often not enough to interest a country's seed industry.

This problem affects several crop development efforts in the SADCC region. The SMIP has accordingly taken the initiative of working with SACCAR and the SADCC Food Security Project to see if a DENAGRO recommended project can be modified to include this production.

1990 REASSESSMENT OF PRIORITIES

At the latest Annual Conference reviewing the progress of sorghum and millet research in the SADCC region, a survey was conducted asking each of 45 national scientists in attendance to specify the strengths and weakness of their programmes and to reassess their priorities for SMIP assistance. This survey is also being offered to regional scientists unable to attend the Regional Conference including 16 economists participating in a SMIP (and CIMMYT) sponsored training programme in economic policy analysis.

The SMIP seeks ultimately to work its way out of existence. Conceptually, it works to strengthen national programme capabilities to the point that outside assistance is no longer required. Such surveys help us gauge progress toward this goal.

The SMIP assumes that, early on, its own scientific staff takes greater responsibility for conducting regional research. Emphasis is placed on the education and training of national scientists. Over time, the SMIP functions are evolving toward the backstopping of national programmes with advisory assistance, the stimulation of communication flows and facilitation of the introduction and movement of germplasm, and the improvement of breeding stock containing particular traits valuable for incorporation into national research programmes.

SMIP'S REGIONAL ROLE

The maintenance of a strong regional research capability is viewed essential for supporting national programmes at various stages of development. Early on, this regional research effort has emphasised the introduction and distribution of genetic variability. The programme promotes the exploitation of this variability. The SMIP scientists bring new technologies and new ideas into the region. Collaborative research promotes the enhancement of scientific skills as much as the development of technology.

The regional programme is expected to evolve toward a role as generator of variability. The programme will then be less involved in technology development and more involved in the development of breeding material with genetic traits of particular value to national programmes. The scientific thrust of the regional programme would move upstream. The regional research will also concentrate on

the analysis of crop improvement problems which have limited priority for any particular national programme but high priority for the region.

The SMIP cannot be viewed as a simple research network. The regional programme promotes scientific interaction among disciplinary peers. But it also strengthens the technology base available to the region. Further, it generates institutional and technological support uniquely geared to the differing needs of each national programme. Clearly, assistance in the development of sorghum and millet improvement programmes must differ for countries as diverse as Tanzania and Lesotho.

The regional programme has not routinely provided support for the regular operational needs of national sorghum and millet programmes. Some national programmes have requested money for capital items and even for operational expenses. But national investments in such costs are viewed as essential signs of national commitment to the development of a capability for sorghum and millet research. The SMIP is increasingly contributing to land surveys and experiment station planning, but the relevant Department of Agriculture must pay for earth moving and other construction costs.

Donors supporting the regional sorghum and millet programme frequently ask whether SMIP generated cultivars are being adopted by farmers. But the SMIP itself does not release new cultivars in the region. This is the responsibility of national programmes. The SMIP offers improved materials to the national programmes for further testing and possible distribution.

This relationship sparks concerns about the capabilities of national programmes to effectively evaluate, multiply and distribute new cultivars. The SMIP is concerned about whether new varieties and hybrids reach the farmer. Correspondingly, the SMIP is increasingly interested in the multiplication of seed for advanced national testing, the introduction and management of farmer verification trials and the strengthening of extension efforts relating to sorghum and millet. SMIP is interacting with seed companies in the region and may increasingly interact with national extension programmes.

SUSTAINABILITY

The SMIP views the objective of sustainability in both environmental and institutional terms. The limited technology base available to farmers situated in low rainfall regions encourages environmental degradation. Indeed, the incentives facing these farmers are to rapidly exploit available resources in order to meet essential family needs while seeking opportunities to move out of agriculture. Improved sorghum and millet technologies should reduce incentives to simply mine soil resources. These also prompt the more efficient utilisation of water. The consideration of the quantity and quality of grain stover offers a feed resource which can contribute to a more sustainable livestock system. The forage research programme directly works toward this objective.

The long term sustainability of the sorghum and millet agro-economy further requires the establishment of a set of price and market policies that facilitate the adoption of improved technologies and trade of a production surplus. The SMIP has correspondingly emphasised shifting the orientation of economics work in national agricultural research programmes from a concern with describing farming systems and technology adoption constraints toward a concern for market efficiency and the competitive position of sorghum and millet in the economy.

The SMIP also seeks the establishment of a set of self-sustaining national capabilities for the improvement of sorghum and millet. This objective is promoted through the reinforcement of disciplinary training with a set of on-going collaborative research ties. Initially these may be viewed as links between a young professional and an experienced scientist. Overtime, these links are evolving into a community of peers.

Such scientific efforts are reinforced by the generation of farm management capabilities designed to provide continuing, cost-effective support for national research efforts. Better programme management and improved economic analysis, including the strengthened assessment of research priorities, offer a means to foster sustained budgetary support from Ministries of Agriculture.

HOUSEHOLD FOOD SECURITY

The objective of household food security marks an important justification for the existence of the SMIP (and for ICRISAT more generally). Sorghum and millet are essentially food security crops. These are grown in regions most subject to production and consumption shortfalls. They are produced by many of the poorest farm households in the SADCC region.

The SMIP recognises that food security can be attained through food purchases (or gifts) as well as food production. Most sorghum and millet producers participate in the national market as grain buyers rather than as grain sellers. But most of these farmers have little money with which to purchase food. The income required to purchase grain comes from cash remittances earned from relatives working off the farm. The cash allocated to purchase grain draws money away from school fees, clothing, housing and agricultural investment. Thus, efforts to improve the capacity of food insecure households to produce their basic grain requirements are essential.

These relations are not changed by programmes of 'structural adjustment' or market liberalisation. Incentives to invest in agriculture will always remain limited without significant improvements in cropping technologies. Currently, the returns to labor allocated to unimproved sorghum and millet enterprises are only ten to twenty percent of the daily wages for casual off-farm labor. As long as this remains true, most households residing in semi-arid areas of the SADCC region are better off migrating out of agriculture.

Improved seed has proven a key low cost means to expand household food production. Hybrid maize seed has been almost universally adopted in Zimbabwe because of its yield advantages. Improved sorghum and millet seed should offer even greater advantages to drought prone areas of the SADCC region. Correspondingly, the principal objective of the sorghum and millet breeding programmes is the attainment of high yields under low rainfall conditions.

The entomology and pathology programmes each have placed emphasis on identifying pest and disease resistance mechanisms either inherent in the seed or in the crop management. These programmes seek to limit the need for expensive pesticides. Concerns for the impact of pesticides on the environment are matched with concerns for their impact on the small farmer's budget.

The agronomy programme has placed great stress on the testing and evaluation of water harvesting technologies. Again, this emphasises the search for opportunities for increasing both yield level and yield stability across different environments with the use of limited amounts of purchased inputs. This programme has also identified an inexpensive means to improve sorghum stand establishment.

The food technology programme places greater priority on resolving constraints to expanding industrial utilisation of sorghum and millet. One major reason for the historical neglect of these crops has been their lack of importance as industrial inputs. In several SADCC countries, parastatal stocks of sorghum and millet have been accumulated and left to rot because of a basic misreading of the competitive position of these crops in industrial markets. This has resulted, in part, from a lack of familiarity with the processing and utilisation characteristics of the small grains.

Expanded industrial demand should provoke expanded support for research and production of sorghum and millet. Though many food insecure households may not produce for the industrial market, the resulting improved technologies should benefit these farmers.

The economics programme examines constraints relating to both the industrial and household utilisation of sorghum and millet. Studies of national market policies suggest the need to revise support prices to more industrially competitive levels. These analyses also highlight the need to support intra-rural markets. Market liberalisation strategies commonly proposed from idealised models of perfect market behavior must be complemented by investments to offset logistical constraints to grain flows from surplus to deficit households. Many of the recent market subsidies applied in the SADCC region have been highest, per unit of grain, in low rainfall and food insecure regions. As these subsidies are withdrawn, the market services offered these farmers are severely limited. Food insecurity may worsen. Improved production technologies may offset part of this loss. Improved rural markets are more broadly necessary to commercialise the semi-arid production system.

Through collaboration, such priorities are reflected in both regional research and national investigations. The regional programme has the capability of comparing the results of varied national efforts and offering input into individual projects reflecting a synthesis of these conclusions. The multidisciplinary strengths of the regional programme also serve to facilitate interdisciplinary ties within the national agricultural research institutes.

CONCLUSION

In order to establish a sustainable foundation of economic growth and household food security, each SADCC country must develop a strong set of institutions for the development and use of agricultural technology. Drought relief programmes and adjustments in market policy may offer temporary and limited gains to impoverished households. But long term solutions can only be found through improving the level and stability of income sources. The productivity of agricultural labor must increase. Improved technologies for sorghum and millet directly carry the farmer toward this goal.

When the SMIP began, initial programme and research priorities were set by an international team of sorghum and millet scientists in consultation with national scientists throughout the SADCC region. These priorities have evolved with regional experience. Better appreciation of national needs has brought the addition of crops (finger millet and forages) to the research mandate, as well as greater emphasis on the improvement of experiment station facilities, the initiation of research on crop utilisation, an expansion in the programme's capability to provide education and training, and most recently, an effort to establish a regional programme in seed multiplication. Strong emphasis has been placed on the promotion of regional consultation and communication as a means to guide the priority setting process. Regional interaction is specifically designed to promote communication across national programmes as well as between national and the regional programmes.

The objective of household food security has been pursued both by means of technology development and through the strengthening of national scientific capabilities. The SMIP is guided by the belief that food security is not simply the improvement of access to food in a dry year. Nor is it simply the generation of technologies (or knowledge) relevant to food insecure households. Household food security requires the development of a sustainable system of agriculture and agricultural institutions for semi-arid farming regions. The evolving priorities and institutional orientation of the SMIP represent a continuing move toward this objective.

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