Policy issues in the small grains sector of Southern Africa

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GASGA - GROUP FOR ASSISTANCE ON SYSTEMS RELATING TO GRAIN AFTER HARVEST
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Preface

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GASGA- the Group for Assistance on Systems Relating to Grain After Harvest- is a voluntary association of organizations primarily linked with donor operations.

These organizations all have major involvement in most, if not all, of the following:

- Provision of professional advice;
- Conduct of field projects;
- Training of developing country personnel; and
- Conduct of research and its application in relation to problems in the postharvest sector of grain and other major food commodities in developing countries.

The association is essentially technical; it is international in character, but informal and limited in membership so that its deliberations, aimed at the specific objectives indicated below, can take place readily.

GASGA consists of the following organizations:

- Australian Centre for International Agricultural Research (ACIAR), Canberra, Australia,
- Centre de Cooperation International en Recherche Agronomique pour le Dveloppement (CEEMAT/CIRAD), Montpellier, France,
- Deutsche Gesellschaft fur Technische Zusammenarbeit (GTZ) GmbH, Eschborn, Germany,
- Food and Agricultural Organization of the United Nations (FAO), Rome, Italy,
- Food and Feed Grain Institute, Kansas State University (KSU), Man-hattan, Kansas, USA,

- International Development Research Centre (IDRC), Ottawa, Canada,
- Natural Resources Institute (NRI), Chatham, England.

GASGA aims to stimulate improvement in the technical help given to developing countries in the postharvest handling, processing, storage, and transport of grain, and to harmonize activities so that the most effective use is made of members' resources. GASGA seeks to identify and suggest ways of meeting needs for research, development, training, and information in this field, in light of existing or planned operations by GASGA members and other organizations.

The Group is also prepared to answer requests for technical advice from developing countries.

GASGA also seeks to facilitate the appropriate dissemination of information about technical developments and activities in the postharvest sector to donors, developing countries, and other interested organizations. The last group includes, for example, the International Agricultural Research Centres whose commodity-oriented preharvest programs must be linked with postharvest activities and requirements.

The GASGA executive meets annually to review progress in its activities and discuss proposals for future work.

Since the 19th executive meeting, held at Feldafing, Germany, a technical seminar has been held in association with the annual meeting and the papers presented at the seminar published in the GASGA Executive Seminar Series.

This volume, the fifth in the series, contains the papers presented at a seminar held during the 23rd GASGA executive meeting, hosted by IDRC, in Bulawayo, Zimbabwe, from 10 to 14 June 1991.

Introduction

Edward J. Weber
Executive Chairman
GASGA

Sorghum, finger millet, and pearl millet have traditionally provided food, employment, and income for a substantial portion of the population, particularly smallholder producers, in the vast arid and semi-arid lands (ASAL) of sub-Saharan Africa.

Historical trends, however, show that these grains are declining in absolute and relative importance in terms of production and consumption, and thus also in terms of

income and employment in rural areas of sub-Saharan Africa. Such a decline cannot be explained solely in terms of constraints imposed by climate, soil, and production technology. For example, farmers have been successful in increasing production of maize, a less well-adapted crop, in the ASALs.

This situation has not yet been well explained nor addressed in policy decisions and is producing unease in many areas of government, among researchers working in this subsector, and among donors concerned with food security, income, and employment issues.

Many explanations, and probably indications about what should be done next, lie with the relatively low productivity of these crops. However, postharvest constraints also contribute to the situation. GASGA members believe that the potential and position of these crops in ASAL food systems should receive comprehensive analysis from the various perspectives of producers, processors, marketers, and consumers. Therefore, they organized a consultation that would begin to provide the information required by policy makers and others to make enlightened, productive decisions and policies related to the future of the crops. The strategy proposed was a workshop that would:

- Build on previous information obtained by GASGA and some of the main actors in

the development of the sub-sector, such as the Southern African Development Coordination Conference (SADCC)International Crops Research Institute for the Semi-And Tropics (ICRISAT) Regional Sorghum and Millet Improvement Programme (SMIP). (At its annual executive meeting in 1987, GASGA had a special session focusing on the cereal grains of the semi-arid areas. This was followed in October 1987 by a 3day workshop at the headquarters of SMIP to develop a logical framework analysis.)

- Consult representatives of other key groups that benefit from, or could influence, the performance of the sorghum and millet subsector.

Groups to be consulted included: those who make policies intended to benefit the inhabitants of the ASALs; those who allocate resources for research and development to the subsector and the ASALs; development and extension workers in the ASALs and the subsector; representatives of the food processing industry, marketing boards, etc.

The consultation was not meant to repeat the work of the technical and research workshops that have occurred at the country, regional, and international levels. Those workshops and symposia stressed the reporting of knowledge at the level of the component technology. The intention of this consultation was to consider the entire production-to-consumption system (PCS) for sorghum and millets in southern Africa. Treating the PCS as an integrated system and taking note of current research and

practices, the consultation was to generate suggestions for improving the performance of the subsector in the region.

Objectively, the PCS comprises production, storage, processing, marketing, and utilization, as well as the policies that encourage or inhibit the subsector. The system also comprises the human beings who obtain a livelihood from sorghum and millets: farmers who produce and store the grain and make use of the stems and leaves; suppliers of inputs and technical advice to the farmers; processors, at home, in small enterprises, and in large industry; people who market the grain as private traders or as employees of a parastatal organization; and consumers who eat or drink products made from the grains.

The consultation was cosponsored by SMIP. We warmly acknowledge the leadership of Dr Leland House, director of SMIP, Dr David Rohrbach's key contribution to the consultation in the form of his challenge paper, and the participation of SMIP senior staff in the workshop.

The aim of the workshop was to contribute to the quality of life of dwellers in the semi-arid areas, with the following specific objectives:

- To assess the importance of these crops to semi-arid area dwellers and in

national economies,
- To consider the total PCS,
- To identify gaps in existing programs relating to research, development, extension, and other support from institutions and government,
- To define options based on existing technical and policy knowledge and on mutual learning,
- To formulate realistic recommendations for policy,
- To recommend action to augment existing efforts at national and regional levels.

The consultation began with a keynote address by Dr David Rohrbach of SMIP, *Sorghum and millet food systems in southern Africa* Several additional speakers were invited to elaborate on specific aspects of the paper in brief presentations, which are summarized in this report. These presentations became the inputs and set the stage for subsequent discussions by three groups, formed to consider the issues and perspectives. The workshop concluded with a plenary session that included presentations from the three groups and discussion of the conclusions and recommendations.

Sorghum and millet food systems in southern Africa

David D. Rohrbach
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Sorghum and millet were the dominant cereal grains in southern Africa as recently as 100 years ago. With the expansion of the colonial agroeconomy, however, maize production spread rapidly. By 1915, 60 000 ha of maize had already been planted in Zimbabwe, for example; this doubled over the next 15 years. The spread of mines, mills, and grain markets encouraged the expansion of maize cultivation in commercial and smallholder cropping systems throughout the Southern African Development Coordination Conference (SADCC) region. Rapid growth in urban and industrial demand for maize stimulated the establishment of a framework of policy, institutions, and technology still guiding the cereal grain economies of these countries today.

Sorghum and millet are now generally viewed as secondary or traditional crops, although they are still grown on 25% of the coarse grain cropping areas of the SADCC region. However, most of these areas are in the outlying regions of the countries, where market infrastructure is limited and farm incomes remain low. The semi-arid agricultural systems are prone to mid-season dry spells and drought, production levels are highly variable, and most households suffer persistent food insecurity. Low productivity leads to a semisubsistence orientation in agricultural investment and

reliance on nonfarm and off-farm sources of income.

Except for small areas of commercial production for the premium opaque beer market, sorghum and millet have been marginalized in the region's agroeconomies. Even in Botswana, where sorghum and millet account for 90% of the total crop area, larger quantities of maize and wheat are consumed.

The historical decline in the production and use of sorghum and millet has prompted questions about the future of these crops. National consumption trends suggest a broad preference for the taste of maize and wheat. The sorghum and millet purchased by several parastatal marketing boards in the region has proven difficult to sell. Industrial demand for these grains appears limited. Further, the long-term viability of agricultural investments in crop production in semi-arid regions is questionable. Returns to labour are much higher in other sectors of the economy. Declining yields suggest that crop production in many semi-arid regions may not be environmentally sustainable; these systems may be better suited to extensive livestock production.

Yet the future of sorghum and millet in the SADCC region cannot be judged solely on the basis of historical trends. Improvements in production technology can dramatically change the comparative advantage of small grains production. Rising productivity could improve the competitive position of sorghum and millet in both rural and

industrial markets. Shifting market policies, changing regulations, and reducing subsidies favouring maize could also provide incentives to produce and consume these crops. The possibility of providing these incentives merits closer examination.

Reconsideration of the competitive position of sorghum and millet in southern Africa is also justified by the growing recognition of the need for new strategies for developing agriculture in semi-arid regions prone to drought. Budget deficits encourage efforts to reduce the fiscal demands of annual food distribution programs for drought relief. Foreign exchange constraints are stimulating a search for opportunities to reduce grain imports. Efforts to reduce the trade account deficits of marketing boards are resulting in the withdrawal of market support for sorghum and millet and a corresponding reduction in market services for outlying zones. Equity objectives necessitate new strategies to develop competitive private markets in these zones. Finally, public interest in the development of semi-arid regions is prompted by high unemployment and the need to stem the migration of farmers from rural to urban areas by increasing the productivity of many of the poorest rural households.

This paper provides a review of the structure of supply and demand for sorghum and millet in the SADCC region. The analysis highlights the determinants of the competitive position of these crops in the market. The paper begins with a review of the historical decline in sorghum and millet production and use with a summary of trends in their

production in the SADCC region. The relative position of sorghum and millet within the framework of national coarse grains policies is then examined. A brief assessment of the justification for supporting development of the small grains subsector introduces an outline of the competitive position of sorghum and millet in the national food systems. The food systems perspective allows a clearer view of the linkages between production and consumption decisions. This highlights the key determinants of the competitive position of the small grains in alternative end uses and helps identify adjustments in grain policies, market infrastructure, and technologies necessary to exploit the competitive advantages of these crops.

The analysis refers to the introduction of structural adjustment and grain market liberalization policies in the SADCC region. These changes illustrate the recent interest of the governments in alternative development strategies. New policies are being formulated that shift the structure of investment incentives facing the agroeconomy. The adjustments offer new opportunities for exploiting the potential of the small grains subsector.

The declining importance of sorghum and millet in southern Africa

It is difficult to trace the timing of the decline in the importance of sorghum and millet in southern Africa. It began at least 100 years ago, and the largest transition seems to have occurred well before a consistent set of production estimates became available. The Food and Agricultural Organization (FAO) has maintained time-series production data since 1960. The dominance of maize in most agroeconomies in southern Africa evolved before this.

Table 1. Pattern of land allocation to coarse grains in SADCC, 1961-88.

	Average growth in coarse grains area, 1961-88 (%/year)		Proportion planted to sorghum and millet (%)	
Country	**Sorghum and millet**	**Maize**	**1961-65**	**1986-88**
Angola	0.5	2.1	13.3	10.2
Botswana	-0.7	3.6	94.9	87.0
Lesotho	0.2	0.4	32.5	31.6
Malawi	-2.0	1.4	8.2	3.8
	-0.8		36.6	24.7

Mozambique		1.6		
Swaziland	-8.5	-0.6	17.1	3.0
Tanzania	3.7	2.6	28.5	34.1
Zambia	-3.2	-1.3	17.6	11.9
Zimbabwe	0.1	2.1	39.4	28.9

Source: FAO (1988a).

Table 2. Productivity and production of coarse grains in SADCC, 1961-88.

	Average growth in yield, 1961-88 (%/year)		Proportion of sorghum and millet (%)	
Country	**Sorghum and millet**	**Maize**	**1961-65**	**1986-88**
Angola	-1.2	-3.9	13.6	17.0
Botswana	1.7	-1.4	87.0	83.3

Lesotho	-1.6	0.7	33.3	28.0
Malawi	0.2	0.5	55	2.3
Mozambique	-0.6	-1.4	33.8	29.7
Swaziland	2.9	5.0	19.5	2.2
Tanzania	0.2	2.7	29.3	22.9
Zambia	0.6	3.4	13.0	4.7
Zimbabwe	-0.3	1.4	26.4	13.0

Source: FAO (1988a).

A review of coarse grain production trends over the past 25 years indicates, however, that the relative position of small grains is continuing to decline. Although the accuracy of these statistics is limited, particularly during the early period and particularly for such secondary crops, the data do offer a rough indication of land allocation and production trends.

Since 1961-65, the area planted to sorghum and millet has decreased in five of the nine SADCC countries for which data are available (Table 1). Production area has significantly increased in only one country, Tanzania, where a sorghum production promotion campaign was launched during the mid-1970s. In comparison, maize area increased in seven of the nine SADCC countries.

The area planted to sorghum and millet has declined from 27% to 24% of the total area planted to coarse grains during the past quarter century. In most countries, sorghum and millet have retained their position as critically important food security crops. Yet maize plantings are now ubiquitous. The largest shifts to maize production have occurred in countries with significant advances in maize technologies (e.g., the widespread adoption of hybrid maize in Zimbabwe and Zambia).

In general maize productivity has been improving relative to that of sorghum and millet. Average sorghum and millet yields have declined in four of the nine SADCC countries (Table 2). Average maize yields have also declined in three of these countries, but strong gains have occurred in three others. Investments in agricultural research largely oriented toward maize-based production systems seem to have paid off.

The gains in maize area and productivity led to an increase in the relative contribution

of this grain to national grain production. Absolute production of sorghum and millet increased in only two of the nine SADCC countries for which data were available. The contribution of sorghum and millet to total coarse grains production increased in only one country, Angola, where average yields for maize sharply declined. In contrast, maize production increased in absolute terms in eight of nine SADCC countries.

In most of the SADCC region, coarse grain production has not kept pace with population growth or demand for these crops. As a result, the region has shifted from being a net exporter of coarse grains to being a net importer; eight of the ten SADCC countries now tend to be maize importers. Imports are increasing in both absolute and per capita terms (Table 3). Wheat grain imports are also rapidly growing. In contrast, sorghum and millet trade remains limited.

	Net per capita cereal grain imports		Net per capita maize imports	
Country	**1961-65**	**1986-88**	**1961-65**	**1986-88**
Angola	-20.1	27.2	1.7	6.5
Botswana	98.4	117.7	27.1	40.3
Lesotho	8.9	71.3	0.0	28.8

Malawi	-1.4	1.8	-2.0	0.1
Mozambique	9.0	26.2	3.9	12.2
Swaziland	16.2	55.1	0.0	22.4
Tanzania	7.2	5.3	2.3	-0.8
Zambia	7.9	19.1	-1.2	9.6
Zimbabwe	-14.4	-31.5	-32.6	-38.4

Source: FAO (1988b).

A portion of the maize imports are needed to feed farm families in areas of sorghum and millet production, where low productivity of these grains has caused production deficits and persistent food insecurity. Rather than contributing to the national food supply, many farmers in the semi-arid regions of southern Africa are contributing to the demand for grain imports.

The low and declining productivity of small grains is partly a result of an historical preoccupation with maize production. Even areas that are not particulary suited to maize have been given over to its production. Investment needed to generate and disseminate improved technologies for the small grains has not been forthcoming. The largest growth in small grains area, in southern Africa, occurred as a result of a temporary program for the promotion of drought-tolerant crops in Tanzania. No country except South Africa has maintained a consistent small grains breeding program.

Maize currently accounts for over 50% of the area planted to coarse grains in eight of the ten SADCC countries. Only in Botswana does sorghum dominate the cropping system. The combination of maize production and imports makes maize the leading source of coarse grain calories in every SADCC country.

However, sorghum and millet remain critically important in many of the driest and most "food insecure" areas of the SADCC region. Although relegated to semisubsistence status, these crops remain essential food staples for many of the poorest farm households whose capacity to purchase imported maize is limited.

When sorghum and millet are viewed in terms of their suitability for production in drought-prone, semi-arid areas, their importance increases. At least half of the SADCC

region can be characterized as semiarid and drought prone. Other areas contain acidic soils suited to the production of finger millet. Regional economic growth will best be served by promoting the production and use of a diverse set of crops suited to these agroecological conditions, not by efforts to promote a limited set of dominant crops.

The structure of coarse grain policy

Coarse grain policies in the SADCC region have evolved in response to urban and industrial demand for alternative staples. The predominance of maize arose out of the importance attached to this crop as an urban foodstuff. This justified the creation of a market infrastructure designed to encourage surplus production and deliveries to a centralized system of grain storage and processing. National marketing authorities arose out of concerns to stabilize maize supplies and provide a consistently favourable incentive for market deliveries.

Prices were fixed, grain movements were restricted, and sales had to be made through parastatal marketing boards. In some countries, even the milling industry was parastatal. Agricultural research and extension institutes were correspondingly

charged with responsibility for increasing the level and quality of maize output.

Policies relating to sorghum and millet have been derived from concerns about equity rather than consideration of the value of these grains in competition with maize. In this context, regulations guiding small grains marketing and distribution have largely been established es appendages of those for maize. Sorghum and millet prices have commonly been maintained at consistent proportions of the price for maize. Movement restrictions and grade standards are similar across the coarse grains.

National grain policies have been based on the premise that all farmers are surplus producers, or at least capable of producing a surplus. Therefore, the policies have been largely extractive in design. Movement of grain within the rural areas has been discouraged (until recently, they were illegal in many SADCC countries). Grain could not legally move from farming areas with a grain surplus to areas facing deficits. The combination of pan-seasonal and pan-territorial pricing practices supported reliance on centralized, public grain stocks.

Equity was cited as justification for extending parastatal market infrastructure and associated regulations to the most distant reaches of each SADCC country. National grain policies did not discriminate between regions of high and low potential or between regions close to transportation and those more distant. In most countries,

subsidies were provided to build and meet the operational expenses of outlying marketing board depots. In some cases these subsidies were direct budgetary expenditures. In others, the cost of outlying infrastructure was cross-subsidized by profits from market operations along rail lines.

In some countries, subsidies on production inputs (seed and fertilizer) were established to encourage the use of improved varieties and methods. Subsidized credit linked the production of a maize surplus with grain deliveries to the marketing authorities. National maize promotion programs employed extension agents to encourage larger plantings of maize-virtually regardless of the agroecological zone. Agricultural development programs were primarily defined in terms of maize production initiatives designed to achieve food self sufficiency, and food security was defined in terms of the level of national grain stocks.

Concern for the poor consumer brought additional subsidies on the retail price of maize meal. These encompassed direct subsidies of milling costs and indirect subsidies on meal distribution. Pan-territorial consumer prices encouraged the spread of industrially milled maize to the most distant regions. As a result, maize milled by urban industry is often the cheapest source of cereal calories in many sorghum and millet growing zones. In some rural markets, industrially milled maize is the only grain available. Households experiencing production shortfalls due to the lack of improved

sorghum and millet technologies have been forced into reliance on the urban industrial output. National market policies, originally structured to provide a steady supply of maize to urban consumers, have also encouraged the movement of grain through urban industry back out to the rural areas that experience consistent food deficits.

Maize consumption has been further encouraged by the indiscriminant distribution of maize in drought-relief programs. Maize is viewed by many politicians as superior to sorghum and millet and food aid is a politically significant transaction.

Structural adjustment and market liberalization

In recent years, governments throughout the SADCC region have recognized that the budget deficits incurred through subsidization of grain production and market systems are unsustainable. The deficits have stimulated efforts to reduce market subsidies and, in some cases, eliminate them altogether. Trade restrictions are being lifted-initially on crops less important to the industrial economy (restrictions on trade in small grains have been lifted in virtually every SADCC country). Market liberalization has also

involved reducing support to the outlying areas. Parastatal depots in remote areas and in areas with low or inconsistent delivery levels are being closed down.

As markets are liberalized, both parastatal and new private-sector traders are concentrating their resources along the more profitable routes in high rainfall zones. These encompass the major transport routes for maize flow to urban markets. The access to markets of outlying sorghum and millet production zones will deteriorate. Over time, private-sector investments should support the movement of grain directly from surplus to deficit regions and the reliance of deficit regions on imported maize meal should decline. Intrarural movement of sorghum and millet should increase. Yet no country in the SADCC region has a clearly defined strategy to promote the development of this sort of competitive, private trading network in outlying regions.

Market liberalization will also shift the competitive position of sorghum and millet as industrial inputs. Several opaque brewing industries have already shown an interest in contracts with large-scale commercial farmers for a supply of high-quality sorghum. The milling industries may perceive similar incentives. But the participation of most sorghum and millet producers in commercial grain markets will be limited by the high cost of collecting grain from large numbers of small farmers in outlying areas. Trade ties with small farmers will also be discouraged by the quality requirements of particular industries.

The liberalization of national grain markets could broadly shift the terms of trade facing the majority of small farmers in the semi-arid regions of southern Africa. The ultimate impact of these adjustments will depend on both the phasing of deregulation and the changing structure of investment incentives facing the private market. The development of the sorghum and millet subsector critically depends on major improvements in technology. In addition, production and consumption incentives will be guided by the evolution of rural grain markets.

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Exploiting the competitive niche for small grains

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As structural adjustment programs are implemented, the objectives justifying the development of sorghum and millet production and utilization systems need more careful elaboration. Sorghum and millet are still widely viewed as minor, traditional

crops in SADCC food systems. They are recognized for their drought tolerance, but the value of these small grains is more commonly seen in their contribution to semisubsistence food supplies than in the commercial market. Even the high value of sorghum and millet in intrarural markets is generally unrecognized. Yet the small grains are essential components of sustainable agricultural systems in the region's extensive semi-arid areas. The development of these areas requires the development of the sorghum and millet economy.

Comparative advantage

The competitive position of sorghum and millet (pearl millet in particular) principally derives from their relative drought tolerance. Sorghum and millet are more suited to areas with high temperatures and low or unstable rainfall than maize. Yield levels ought to be both higher and more stable under conditions of drought. Finger millet also has a competitive advantage over maize in regions with acidic soils.

However the boundaries of the regions in which sorghum and millet perform favourably relative to maize depend on the technologies employed. Currently, maize out-yields sorghum and millet in many, if not most, years in drought-prone regions and it offers higher yields in many areas with acidic soils. This is a result of historical support for improvements in maize productivity. Maize has been favoured by the

development and dissemination of improved varieties, by efforts to promote fertilizer use, and by greater extension support designed to improve crop management. Improved technologies have not been widely available for sorghum and millet.

Investment in technology development for sorghum and millet is beginning to result in major improvements in productivity compared with both traditional methods and with maize. Once readily available, these technologies should extend the competitive domain of the small grains. Sorghum and millet currently account for one-guarter of the coarse grains production area in SADCC. With improved technologies, this could expand to 30-50% The economic contributions from the extensive semi-arid regions of southern Africa could significantly improve.

Food security

The most competitive niche for sorghum and millet is in the rural market. Most semiarid production zones where sorghum and millet are widely grown are consistently net food importers. Even in favourable rainfall years, only a small minority of households produce grain for market. Substantially more grain is purchased than is sold. Most households producing sorghum and millet experience frequent shortfalls in household grain production. Many never produce enough grain to meet their annual consumption requirements.

The immediate priority for improving the productivity of sorghum and millet and the use of these crops must be to improve the food security of rural households. In most semi-arid parts of the SADCC region, major production gains will first serve to improve the level and stability of food consumption among rural households. Productivity gains must also be backed by improvements in grain storage and in increasing grain transfers directly from surplus to deficit households.

Sustainability

The agricultural production systems currently used in most semi-arid areas of the SADCC region are not sustainable. Low incomes and food insecurity limit incentives to preserve the environment. Low productivity has resulted in loss of the most educated and skilled members of the agricultural work-force. Remittances are critical in sustaining these meagre production systems and supplementing household food supplies. Investment strategies are correspondingly geared toward attaining a semisubsistence level of production while children are educated enough to take advantage of employment opportunities off the farm. Farmers are much more likely to invest what little money they have in school fees than in fertilizer. Farming investments favouring future generations are simply not perceived as important.

The future of agriculture in SADCC's semiarid regions remains dependent on significant

improvements in the productivity of these zones. In the long run, these areas may best be left for extensive livestock production. In the short and medium term, however, the capacity of the SADCC economies to absorb population migration from semi-arid regions will remain limited. Zimbabwe has the largest and, arguably, the most dynamic industrial sector in SADCC. Yet the formal sector in this country can employ only 5-10% of the children leaving secondary school each year. The returns on scarce resources invested in agriculture must rise to attract greater investment in the semiarid production systems. These returns must remain adequate for at least as long as it takes to absorb the households into the larger industrial economy.

Market development

The costs of grain-market controls have proved unsustainable throughout the SADCC region. The existence of broad areas with continuing food deficits and the rising cost of moving grain over long distances justify emphasis on intrazonal grain marketing. Policy should encourage the establishment or strengthening of a broader private network of grain trade, storage, and processing. Policies favouring extraction, centralized storage, and industrial grain processing must be replaced with policies favouring development of competitive intrarural markets.

Efforts to supply grain to industry on a competitive basis should concentrate on

specialized crops for which industry is willing to pay a premium and on the more commercialized production zones along rail lines. In general, sorghum cannot compete with maize in industrial uses for which they are close substitutes. Sorghum and millet produced by a large number of small farmers located in outlying regions necessarily incur high assembly and transport costs. Maize tends to be drawn from regions with higher average rainfall and larger and consistent surpluses that are situated closer to major processing plants.

Economic growth

Efforts to promote sorghum and millet production should not be based simply on desire for equity or concern about the welfare of those producing insufficient food. The development of the small grains food (and feed) system should be viewed as a contribution to national economic growth. Policies and investment strategies should be designed to exploit the competitive advantages of these small grains-a basis for improving the productivity of the extensive semi-arid (and acidic soil) regions of the SADCC countries and of their rural labour force. Gains to the economy will also accrue from improving rural food security, reducing the need for drought relief, lowering the level of subsidies underlying grain markets, and, at least in the short run, stemming migration from rural to urban areas.

The current small grains food system

Strategies for development of the sorghum and millet subsector can be mapped, in part, from an understanding of the current position of these grains in the national food system. In comparison with the strength of the maize economy, the food system for sorghum and millet is primitive. Although supplies of cheap maize meal produced by urban industry are ubiquitous, little sorghum or millet enters the national market. The vast majority of sorghum and millet is consumed by farm households.

The structure of this system is illustrated by an analysis of sorghum grain flow in Zimbabwe, one of the more commercialized of the region's sorghum economies (Figure 1). Small farmers account for over 90% of sorghum production by area and 80% by production level. Only 7% of national sorghum crop is sold through formal sector markets (to the grain marketing board). Of the marketing board's portion, only 75% comes from large-scale commercial farms. Although small farmers produce the most grain, they deliver only a limited amount to the national market. Of the sorghum produced by small farmers, 98% is retained for household consumption and neighbourhood sales.

Figure 1. Production and use of sorghum in Zimbabwe, 1990-91. (GMB, grain marketing board.)

Figure 2. Grain movement in the food system of small farmers in semi-arid regions.

In 1990, sorghum markets were partially liberalized and red sorghum markets were deregulated. As a result, large-scale farmers now sell most of their crop directly to the opaque brewing industry. The principal brewer obtains his entire supply of sorghum for malt domestically. During the 1980s, this single source of demand accounted for over 90% of the sorghum used by Zimbabwe's industries.

During the 1990-91 marketing year (Figure 1), unusually large stocks of sorghum were held by the marketing board as a result of uncompetitive pricing policies. Following the 1982 84 drought, the large-scale commercial farm sector doubled the area of its sorghum plantings. Favourable rainfall during the following 2 years tripled production and market deliveries. The government refused to adjust the sorghum selling price downward and stocks simply accumulated. Five years later, the grain marketing board was finally disposing of the last of these stocks at large discounts (and trade account losses). The old stocks were purchased by the brewing and feed industries. Large discounts were also offered in export markets.

At market determined prices, the brewing industry purchases roughly 17 000 Mt of good malt-quality sorghum each year. This demand is forecast to remain steady. Small quantities of low-quality grain may be sold to the stockfeed industry, but most will continue to be retained for rural consumption.

This picture of the formal market can be extended with a closer look at the food system of small farmers in semi-arid regions of Zimbabwe (Figure 2). Roughly 90% of grain (sorghum, millet, and maize) production in these drought prone regions is retained for household consumption. Of the remainder, 23% may reach national markets through parastatal marketing authorities. The remaining 6-7% is sold through neighbourhood markets-primarily to neighbouring households. Market regulations (and subsidies) in most SADCC countries have prevented the development of private grain trading networks. As a result, virtually no grain flows over long distances through informal channels. Village grain markets are primitive or nonexistent.

Figure 3. Regional grain deficits in Zimbabwe, 1991-92. ME, Mashonaland East; MW, Mashonaland West; MC, Mashonaland Central; ML Manicaland; MD, Midlands; MV, Masvingo; MN, Matabeleland North; MS, Matabeleland South. (Source: National Early Warning Unit 1991.)

Because most semi-arid regions face persistent grain deficits, imports are always

needed. Rural households must purchase an average of 20% of their grain each year. This may rise as high as 60% during years of drought.

Virtually all of these purchases are of maize-mainly in the form of industrially produced maize meal. Even when sorghum stocks are large, direct sales back into regions of grain deficit have been limited.

Most marketing boards are simply not oriented toward redistributing grain to rural areas. Further, the private trading network necessary to extend grain distribution beyond marketing board depots is nonexistent. In many villages, industrially milled maize is the only grain available for purchase.

In Zimbabwe, the 20% annual deficit facing semi-arid regions implies a need for almost 100 000 Mt per year of imported grain. This deficit may be offset only by a 40% increase in total sorghum and millet production.

Zimbabwe maintains enough maize in stock to avoid grain imports. However, following the drought in 1990-91, grain deficits ranged from 50-80% of consumption requirements in the driest regions (Figure 3). This implies a need for up to 400 000 Mt of grain-roughly twice the average sorghum and millet production by small farmers.

These relations are similar across all the countries of the SADCC region. In countries with better developed wholesale and retail trading networks, much of the deficit may be offset by industrially milled maize. In regions where grain and meal markets are limited, consumption levels simply decline.

Sorghum and millet remain critically important food security crops for many of the poorest and most drought-prone areas of the SADCC countries. As markets are liberalized and maize meal subsidies are withdrawn the relative position of the alternative coarse grains will shift. As new varieties and hybrids become available, sorghum and millet should begin to play a more important role in the SADCC food system.

Prospects for the future

The priorities for developing the small grains food system must reflect both technological opportunities and utilization preferences. These forces of supply and demand must be viewed from a dynamic perspective that takes into account changes in the broader macroeconomic environment and in opportunities to exploit an

evolving set of production and consumption niches. This evolution can be shaped through:

- **Policies (e.g., grain production priorities, grain price policies, trade restrictions, and grain stockholding strategies),**
- **Infrastructure (e.g., availability of transport facilities, grain storage facilities, and the network of grain traders), and**
- **Technologies (e.g., for crop production, grain storage, and product development).**

The major functional components of the food system represent major decision points for investment or resource allocation. They include grain production, storage, processing, trade, and consumption. At many points on the continuum from grain production to consumption, decision-makers must judge the returns to competing investments. They must decide whether to allocate land to sorghum or maize, whether to store these grains for later sale or consumption, whether to process or trade these grains in the formal market. The environment of policy, infrastructure, and technology determines the structure of incentives guiding these decisions.

Investment in the sorghum and millet subsector can be guided by government support and broad agreement regarding development priorities. To date, few countries in the SADCC region have seriously considered what these priorities ought to be. None have

articulated strategies for developing semi-arid agricultural systems.

The production system

The dominance of maize in many semiarid cropping systems and in areas more suited to the production of sorghum and millet derives from strong national policies favouring the production of this key staple. Strategies designed to promote expanded grain production in zones of higher potential have simply been extended to the drier and acid-soil regions. Subsector strategies to support the production and use of sorghum and millet must first be distinguished from those underlying the larger cereal grain economy. Specialized development plans are particularly needed for each country's drought-prone regions.

Most households in the SADCC region growing sorghum or millet also grow some maize. Because of the availability of improved technologies, maize is commonly the more productive crop. Sorghum and millet are grown to offset the rinks of severe drought and for specialized use as beer malt, but due to the strength of historical public support and relative productivity, maize is viewed as the commercially important enterprise.

If sorghum and millet are to compete with maize in smallholder production systems

and in rural and industrial consumption systems, the productivity of these crops must significantly increase. Productivity gains must offer returns higher than those from maize and higher than the earnings of labour and capital resources off the farm. The value attached to increased productivity will not necessarily be simply grain yield. Farmers most concerned about food deficits may place a higher value on less variability in yields, greater minimum yields, and better storage properties. Returns to labour are also important and farmers have consistently shown their willingness to sacrifice yield for taste. Differing values may also be placed on the relative ease with which alterative varieties can be processed.

Initial productivity gains must be achievable with limited capital investment. Capital is an extremely scarce resource. Farmers in semiarid production systems display a common aversion to risky investment in fertilizer. If credit is available, purchases of livestock may be preferred to purchases of chemical inputs.

The greatest immediate potential for improving the competitive position of sorghum and millet is the development of improved varieties and hybrids. Small farmers in semiarid regions have shown a willingness to try new seeds. Hybrid maize has been adopted by more than 90% of Zimbabwe's small farmers, including many farming in highly drought-prone conditions. Sorghum and millet have a genetic potential to perform significantly better than maize in these regions. Recent experimental station

and on-farm trials are providing accumulating evidence of these gains. Further testing is now needed to judge whether the prospective yield gains are associated with the range of additional grain traits that farmers value.

A second major determinant of production decisions about alternative grains is the structure of extension support. Maize promotion programs have led to circumstances where extension workers based in semi-arid regions are much more likely to know the latest recommendations for maize than for sorghum or millet. Extension workers are also unlikely to understand the complexities of risk management strategies, e.g., planting a crop three or four times over several months. They are not taught how to respond to such behaviour. When farmers fail to attend meetings and ignore advice, the incentive to provide additional advice declines. Many extension workers are more likely to accuse farmers of not wanting to learn about new technologies than to adapt their recommendations to the constraints guiding farm decisions.

Finally, as new technologies become available, the physical distribution system is a constraint. Seed companies are less likely to invest in promotion of new varieties when the level and consistency of demand is unknown. Seed distribution is more difficult and costly in outlying regions. When seed prices are controlled, profit motives encourage the concentration of resources in areas along the rail lines. The introduction of open pollinated varieties implies a further risk to the companies.

Although an initial market may be significant, future demand may be limited.

Grain versus livestock feed

Many semi-arid areas in the SADCC region receive such low levels of rainfall that they are suited only for livestock. In general, these livestock production systems are also classed as subsistence. Cattle are not raised for commercial markets. They are maintained for draft power, milk, and income security. The value of the services provided by these animals and the value gained through reproduction (although low) tends to be higher than the value of crop production. It is also often higher than the value of the animals if they are sold on the commercial market.

Relatively little effort has been directed toward improving cattle raising methods in small-scale production areas. Farmers are encouraged to use crop residues, but crop breeding programs generally do not measure the relative value of these residues in terns of digestibility, protein content, etc. The importance of residues may be recognized, but the trade-offs between grain yield and residue value are unknown. The need to provide varieties with varying residue values to alternative farm populations is seldom considered.

Most small farmers living in semi-arid regions will continue to grow food crops

regardless of their limited productivity. But consideration of the economic future of semiarid production systems must take into account the importance of crop-livestock interactions. Efforts to maximize productivity should assess returns to investments in combined crop and livestock enterprises. Ultimately, these areas may best be viewed as subsistence production systems for crops and as commercial production systems for livestock.

Grain processing

The International Development Research Centre (IDRC) has promoted the introduction of small grain dehullers into the market systems of southern Africa. This strategy is based on the premise that a major disincentive to the production of sorghum and millet is the constraint to the use of these crops resulting from the laborious task of processing. Although some farmers process sorghum and millet through nearby hammer-mills, many persist in hand processing due to the poor quality of hammermilled meal. The difficulty of hand processing has led farmers to plant and consume more maize.

Farmers prefer hand processed sorghum or millet, but labour constraints (or the high value of labour in alternative occupations) discourage the practice. Preference for hammermilled maize over hammemlilled small grains promotes the use of less-

drought-tolerant crops. Once dehullers are introduced, mechanical processing of small grains should yield acceptable meal.

The validity of these assumptions needs further investigation. Although farmers appear interested in the use of dehullers, it remains unclear how much they are willing to pay for these services. In particular, will payments fully offset unsubsidized capitaland operational costs of the dehullers?

It is also unclear whether the availability of dehulling services will lead to a significant increase in the consumption of sorghum and millet. These services may easily bring a significant increase in the consumption of dehulled maize. Although evidence indicates a clear demand for the services of dehullers, their impact on production and consumption decisions must be evaluated.

Grain storage

National policies for grain storage tend to concentrate on efforts to maintain a central, publicly administered grain stock. Maintaining these stocks is sometimes used to justify trade controls over a principal grain staple such as maize, but in most southern African countries, the largest grain stock is held by farm households. Most farm households store sufficient grain to meet their consumption needs until the next

harvest. Small-farm households also usually keep small strategic stocks to be used if the next year's harvest is poor, particularly in regions with a high probability of drought. Most of these stocks are disposed of during the preharvest period if the crop season appears favourable, but small amounts of grains that can be readily stored may be held for 2-5 years.

Finger and bulrush millet can be stored for extended periods-sometimes up to 10 years. In some areas, there is a direct link between this storability and farmers' production strategy. A minimum stock is maintained over extended periods to offset the risks of severe drought. The area of land allocated to these crops depends on the quantity of grain left in stock. When multi-year stocks run low, more land is planted. When millet stocks are large, more land may be planted to the more risky crop, maize.

Knowledge of the importance of rural grain stockholding strategies is limited. Small programs in some countries are directed toward improving methods of household grain storage. Yet in no case has a national storage policy been established that considers household storage as a key component of the national grain stock. Estimates of grain storage losses in the rural areas are highly variable; although they are rarely less than 15% per year, they are sometimes as high as 50%. This represents a tremendous loss in national food supplies.

Revised national policies can be established that take into account the importance of farm household grain stocks for the national grain reserve. Pricing policies must then reflect the value of maintaining these stocks within the rural areas. Such policies can be viewed as a means of reducing the cost of holding the national stock and as a means of reducing the cost of distributing grain back to farms when rural supplies fall short. Part of the effort involved in maintaining central grain stocks should be redirected toward gathering better information about rural stocks, monitoring them, and encouraging more efficient practices.

Technological advances should be sought that extend the storage life of rural grain supplies. These include improving the quality of storage bins and improving storability of improved varieties. The latter may be a function of grain hardness as well as grain shape or size. In addition, further work is needed on the efficient use of chemicals to preserve grain, including traditional pesticides such as wood ash, eucalyptus bark, and certain grasses. Extension agents should be as prepared to provide training in the use of traditional storage practices as in the use of agrochemicals.

Particular emphasis should be placed on rural grain storage policies and practices relating to sorghum and millet. These grains are grown in regions where the value of improved storage may be highest, i.e., where households are most subject to food shortfalls. Sorghum and millet are commonly viewed as food security crops. Stocks are

maintained, particularly millets, as insurance against shortfalls. If the storage technologies and incentives relating to these crops can be improved, the payoff in terms of enhanced food security may be high-higher perhaps than the return to additional investment in a centralized strategic grain stock.

Grain trade

Virtually every SADCC country has initiated some form of grain market liberalization over the past few years. Sorghum and millet trade has been deregulated and commitments by public marketing authorities to act as buyers of last resort have ended. In some cases prices for these grains are still announced, but they are no longer enforced. In others, there are no longer official grain prices.

These adjustments have been stimulated primarily by the determination to reduce budget deficits of marketing boards and to reduce national subsidies for grain trade. Such changes have generally not been accompanied by clear strategies for promoting the development of a competitive private-sector marketing system to take the place of the public support.

New strategies are needed to facilitate the movement of grain from surplus to deficit households through private channels. National grain-trading strategies should be

designed to encourage the development of competitive grain trade, not simply along the rail lines, where private investments may have the highest payoff in the short term, but also in outlying areas most prone to exploitative pricing practices.

Major initiatives are being launched in several SADCC countries to improve rural roads. In addition, however, major initiatives are needed to improve transport. Extensive investment is needed in building a rural truck fleet, based in and oriented toward serving outlying areas. Special loans are needed for rural entrepreneurs willing to invest in such facilities. The elimination (or relaxation) of pan-territorial prices will also encourage these investments.

Improved investment incentives are also needed to induce traders to invest in commercial grain (and other goods) storage systems. Pan-seasonal prices eliminate the return on investment in grain storage. Again, such controls must be lifted and maize meal subsidies must be reduced or removed. Commercial loans could be targeted toward the construction of rural grain storage facilities. Small-scale traders should be advised on how such investments can be made most efficiently (e.g., the size and strength of commercial grain storage facilities).

Grain traders must also have access to trading capital. Currently, small-scale private grain traders in Zimbabwe (approved buyers acting as representatives of the grain

marketing board) are often criticized for buying grain using lines of credit meant for purchasing merchandise for their retail shops. This practice, however, is a resection of the capital constraints these traders face. Few small-scale rural traders have the capacity to tie up the ZWD 5400 required to purchase only 20 Mt of grain. Many even have difficulty obtaining enough money to purchase and hold 1 Mt of grain. There are no financial arrangements to support such investments.

Restrictions on grain movements and controls on grain prices have severely limited the number of traders with experience in buying and selling large quantities of grain. Trading networks must be built up. Removing market controls will stimulate only limited investment and this will tend to be concentrated along rail lines. Regulatory changes must be accompanied by the provision of access to capital, foreign exchange (for vehicles and spare parts), and advice on small-scale investment opportunities.

Industrial demand for sorghum and millet

Less than 5% of the sorghum and millet produced in the SADCC region is used by industry.[2] Virtually all of this is used in the opaque beer brewing industry as a flavouring ingredient or source of malt. Cheaper maize remains the principal input. Sorghum and millet are uncompetitive with maize in the range of other industrial uses for which these grains are close substitutes, e.g., stockfeed.

The small grains will remain uncompetitive as long as their productivity remains lower than that of maize and the assembly and transport costs associated with the collection and movement of grain to the milling or brewing plant are high. The brewing industries in Zimbabwe and Tanzania derive their sorghum largely from large-scale commercial farms close to their breweries. This practice allows a greater degree of control over the quality of the grain as well as low costs.

The likelihood of a significant increase in the use of sorghum (or millet) by the opaque beer industries in the region is limited. Large increases in productivity relative to maize would be needed to justify switching to these grains. If these productivity gains are achieved, this grain might be better used to resolve shortfalls in rural grain supply. The potential for expanding the use of sorghum (or millet) in beer making depends on the strength of the brewing industry in each country. Although there is a potential to increase the demand for opaque beer in some countries, in Zimbabwe demand seems more likely to decrease. As incomes rise, there is a rapid transition to clear beer consumption. Over the past 5 years, consumtion of opaque beer has remained stable, while that of clear beer has risen at an average annual rate of 20%.

Although there is some interest in the use of sorghum or millet in clear beer production, brewers remain concerned about consumer preference for barley-based beers. Inexperience with the use of sorghum and a ready supply of barley further limit

interest in the small grains. As in the case of opaque beer, maize is also a cheaper source of adjunct.

Work in Nigeria has shown the technical feasibility of using sorghum in the production of clear beer. However, this does not mean priority should be placed on this opportunity. There may be stronger justification for promoting expanded production of sorghum for alternative grain uses-such as food security of rural households.

A larger and politically important source of potential demand for sorghum is in the production of composite bread flours. Bread consumption is increasing rapidly throughout the SADCC region. None of the countries in the area is self-sufficient in wheat production. All except Zimbabwe import more than half of their wheat supplies; the SADCC countries imported an average of 550 000 Mt of wheat per year in 1986-88 at an annual cost of over USD 85 million. This compares with an average annual import bill for barley and malt of less than USD 9 million.

The substitution of high-quality white sorghum for wheat has been proven feasible and the economics of this substitution seem to be favourable. The principal constraint to the pursuit of this option is the lack of a consistently available amount of consistently high-quality grain. Although there will always be scope for improving the quality of grain available for composite milling, sorghum varieties are already available

that can be milled economically. However, the grain is not available in the quantities needed by industry. Where larger quantities of white sorghum have been available (only in Botswana), its quality has been poor or highly variable.

The milling-baking industry must contract with larger commercial producers for particular varieties of white sorghum with clearly specified characteristics. Grain traders should also be alerted about the market for white sorghum of good milling quality.

Little is known about the potential demand for industrially milled sorghum and millet flour. Millingindustries throughout the SADCC region are geared to the use of maize and wheat. Although several millers in Zimbabwe have experimented with the use of white sorghum, only one miller in Botswana has attempted to market a sorghum flour. This has proved difficult due to uncompetitive grain prices (imported maize is cheaper) and the poor and variable quality of the sorghum. Several millers in Zimbabwe state that they do not believe a demand exists, but limited market trials by Environment Development Activities (ENDA) indicate the possibility of an urban demand for sorghum or millet flour.

The largest potential demand for sorghum and millet is from the stockfeed industry. This is one of the most rapidly growing industries in the SADCC region. If sorghum and

millet were substituted for most of the maize currently used for feed, the aggregate demand could be five to ten times higher than the demand for sorghum and millet in the brewing and composite milling industries.

The stockfeed industry provides a source of demand for all grain that does not meet the premium quality standards of the milling and brewing industries. To meet this demand, however, sorghum and millet must be priced competitively with maize. This requires a price discount of 5 to 25% depending on the type of stockfeed being produced and the experience of the industry. This again implies significant improvements in sorghum and millet productivity.

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Strategies for developing the small grains food system

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Priorities for developing the small grains food system must be derived from a sense of the structure of supply and demand for these grains. They must also reflect an understanding of how grain policies, infrastructure, and technology affect incentives for production and consumption. Strategies designed to improve the performance of the small grains food system should be defined in terms of specific changes in the various components of this enabling environment.

Below is a brief list of some of the critical components of a small grains development program, highlighting policy variables and infrastructural issues as well as opportunities for technological change. This list is clearly incomplete, but it identifies some of the critical pressure points in the small grains food system.

Strategies for improving the performance of the small grains food system

Aggregate development strategies

- **Development plan for semi-arid regions**
- **Household food security strategy**
- **Environmental sustainability strategy**

Production development strategies

- **Technology development**
- **Input supply systems**
- **Extension support systems**
- **Credit**
- **Market information systems**

Market development strategies

- **Grain storage systems**
- **Grain transport systems**
- **Price/market information systems**
- **Rural roads**
- **Grain processing systems**
- **Grain standards and grading**
- **Trade regulations**

    i. **licensing**
    ii. **movement and price controls**

- **Capital accessibility**

i. **finance for market infrastructure**
ii. **finance for trade operations**

- **New product development**

The introduction of structural adjustment policies throughout the SADCC region offers new opportunities for developing a framework of policies to support the small grains food system. Grain market reforms, including reductions in both direct and indirect subsidies for maize, will dramatically shift the structure of incentives facing producers, marketing agents, and consumers in the extensive semiarid areas of southern Africa.

Significant improvements are still needed in the productivity of small grains, but priority must also be placed on the establishment of a postharvest market system to employ these technologies efficiently. Broadly defined strategies are needed to ensure that sorghum and millet will become more competitive on both rural and industrial markets and, more importantly, to increase the contribution of small grains to the resolution of persisting food deficits.

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Summaries of supplementary presentations

Policies for grain

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Zimbabwe government policy on grain production is intended to ensure food self sufficiency for Zimbabwe on a sustained basis and to provide sufficient quantities for export. Current policy, therefore, has extractive aims and rural surpluses are assumed at all times and in all areas. Grain deficit areas are supplied with processed maize meal from a central supply. Policy effectively inhibits movement of grain from areas of surplus to those with a deficit. The major shortcoming of the current system is its inability to make grain available to numerous, geographically dispersed, consumer units in the semi-arid areas where 60% of the communal population lives.

Policy options in the context of market liberalization include: abolishing restrictions on the movement of grain; decentralizing markets and encouraging the formation of small rural processing centres; introducing seasonal pricing to encourage longer on-farm retention and to spread marketing board intake more evenly over the year; and reexamining reasons for past failure of reliance on private and cooperative sectors.

To permit the entry of private traders into the sector, a number of issues will need to be addressed: access to credit for small traders; improvement of infrastructure, including roads and access to vehicles and spare parts; and understanding the

complexities of risk for the small trader. Continuing liaison among government, parastatals, and the private sector must be initiated and sustained.

Technology available to smallholder producers

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J. Govereh (agricultural economics) University of Zimbabwe, Zimbabwe

The level of adoption of new technology is determined by its suitability to farmers and the strength of the extension messages. In the current system, both within agricultural colleges and the university, sorghum and millets are given cursory treatment. Extensionists in the marginal areas lack information about the small grains.

Farmers will adopt production technologies if the yield of new varieties approaches that of maize in reasonable rainfall years and if price incentives are strongly coupled to market access and other infrastructure. Although fertilizer, tillage, and pesticides, for example, are available, the interaction of existing seed technology with the poor environment is not profitable enough to merit their use.

Existing programs related to education in research development and extension in sorghum and millet food systems

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Small farmers in the semi-arid areas are starved of appropriate pre- and postharvest technologies to suit their farming systems and circumstances. The tradition of selection and management for maximum yield of a single crop does not meet the need to maximize returns from a multicommodity farm system

Researchers are too isolated from farmers. Most research is initiated on research stations; not enough takes place on farms. More emphasis must be placed on diagnosing problems on-farm by multidisciplinary teams and analyzing indigenous technologies and current farmer practices. The interfaces between education, research, extension, and the farmer must improve.

Storing the grain

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The technical issues with respect to storage of grain include: preventing contamination; preventing germination in storage; grading in accordance with standards; practicing fumigation appropriately; assessing the strengths and weaknesses of traditional storage systems.

The prevailing marketing system in the region consists of central market organizations that procure, store, and market the grain. This practice ensures a stable supply, an assured price for the farmer, and better pest control. However, the system has high transportation costs for redistribution to deficit areas. Two models for change can be considered:

- **The central marketing organization could operate in commercial or highly productive areas, while private entrepreneurs operate in marginal regions and**

manage rurally located storage. Consideration will have to be given to ensuring business viability and sources of financing and the design and introduction of new storage technologies, including training in their use.

- **The central marketing organization could retain its monopoly position and farmers would be either paid for their grain or given an incentive for on-farm storage. Consideration has to be given to the ability of farmers to practice new technologies, some not yet devised.**

Processing small grains in rural areas

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Environment Development Activities (ENDA) Zimbabwe

ENDA is executing a project for the wider dissemination of small grain mills, including dehullers for use on sorghum and pearl millet. One reason for a shift from small grains to maize is the ease of processing of maize. Eliminating the processing "bottle-neck" for small grains may increase their production and use. The strategy is to bring the processing equipment as close to the producer as possible to stimulate the rural

economy.

The Rural Industries Innovation Centre (RIIC) in Botswana and ENDA in Zimbabwe have demonstrated that rural processing of small grains can be achieved. There must be effective demand for processing, sites must be carefully selected, the scale of technology must be appropriate to the needs of the communities, credit must be generated, maintenance systems must be established, and entrepreneurship must be stimulated and developed in potential mill owners. A sustainable system of delivery of the machinery and training in its use must be established.

Small grains as industrial raw materials

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SADCC/ICRISAT Regional Sorghum and Millet Improvement Program, Zimbabwe

From a utilization perspective, small grains are not viewed merely in the context of competitive advantage" over maize; they are an additional and underused resource in the cereal subsector of the food supply. Care must be taken not to differentiate too sharply between urban and rural demands and markets. In terms of uses and

products, similar demands exist in both target areas, e.g., porridge meat bread, and opaque beer. The main differences lie in level of technology and scale of operations. Conversion of the grains to usable products can be simple or complex, small scale or industrial scale.

The aim in upgrading and improving the small grains sector is to accelerate transition of the current peasant-grown, subsistence crop to a commercial crop and to bring these grains into the mainstream of cereal use and trade.

Efforts to ensure good genetic quality must be matched by good postharvest practices to achieve consistent and high quality for market. Grades and standards for food use of small grains are lacking in most SADCC countries or are inappropriate, because they were developed mainly for feed grains and brewing sorghum.

Industrial processors, such as millers or brewers, enforce specific and stringent quality standards for evaluating their raw materials. Unreliable quality of small grains has discouraged and frustrated commercial processors who attempt to use them. In addition, work is needed on the forward and backward linkages that ensure a continuous and consistent supply of grain for processing.

Current research work of the Food Technology Unit comprises: identification of

potential and current products and technologies and opportunities for replacing imported grain or making up deficits with local grains in existing and new food products; development of appropriate food products; bulk grain production for a pilot plant and in-plant trials; product and process optimization in in-plant trials with processors; technology transfer and adoption leading to eventual full-scale industrial processing.

Discussion points

The participants were asked to join one of three discussion groups whose broad themes were:

- **Policy for the food system,**
- **The rural food system, encompassing the domain of the producer who is also a consumer of the grains, and**
- **The urban food system, encompassing the domain of the consumer who is not a producer of the grains.**

Each group was asked to state its perception of the broad objectives for the

production-to-consumption system (PCS), to set utilization priorities, and to identify desired strategies. Groups were also asked to identify critical (or limiting) problems; priorities for intervention and solutions to be provided by policy, research, and investment in infrastructure; and to indicate the main actors in the desired improvement. Preparing recommendations for future action was the final step.

The results of the deliberations of the three groups were merged into the points that follow. The recommendations are grouped in relation to the PCS. However, the reader can extract the implications for the main factors influencing the supply of and demand for these grains: policies, infrastructure, and technologies.

Broad objectives

1. **To achieve food sufficiency and security at the household level;**
2. **To ensure an adequate and consistent supply of good-quality sorghum and millet in rural and urban markets;**
3. **To improve grain handling and storage technology at the farm and medium-scale levels; and**
4. **To improve the market for sorghum and millets by introducing better processing**

techniques and products for rural and urban markets.

Problems and limitations

Production

- **Availability of seed and high-yield varieties acceptable for different end uses;**
- **Sound extension and educational packages on sorghum and millets;**
- **Availability and access to credit for producers via financial institutions;**
- **Loss of grain, especially white varieties, to birds from the soft-dough stage on; and**
- **Informed agroecological characterization of the cropping systems for development of information packages for farmers.**

Handling storage, and marketing

- **Grain threshing technologies at the smallscale level;**
- **Conducive environment for better private-sector storage and marketing of grains (which will be inevitable with the structural adjustment programs);**

- **With development of private-sector marketing of grains, the following factors must be addressed:**

  i. **better information and experience in the design and management of medium-scale stores,**
  ii. **access to credit,**
  iii. **transport and distribution infrastructure, and**
  iv. **market information systems;**

- **Practical grading standards.**

Processing and utilization

- **Belief that sorghum is a "poor man's food.;**
- **Gaps in knowledge about traditional processing and consumption patterns;**
- **Focus of R&D support (governmental and nongovernmental);**
- **Effects of pricing policy;**
- **Storage facilities that are inadequately equipped for separate and appropriate classification of varieties;**
- **Inadequate awareness of consumer needs and wants; and**
- **Policy environment that is not conducive to investment in the sector.**

Summary

There were some fresh contextual themes that differed from those raised in the 1987 meetings:

- **Broad recognition of the potential contribution of the private sector, including small-scale rural enterprises; there is need for greater government support and encouragement to develop the private sector and investment;**
- **General concern with the impact of deregulation and relaxing of control and a recognition of the readiness of the private sector to participate; and**
- **Recognition that grains are used in different end products and that their quality and characteristics are important to both industry and the consumer.**

These led to several strategic priorities:

- **To study the impact of deregulation and discover new opportunities offered by it;**
- **To encourage development of the smalland large-scale private sector, its involvement in storage, trading, and marketing, and the formation of competitive trading networks;**

- **To compare experiences across countries, including those in West Africa, and integrate the results in the national planning process;**
- **To improve productivity in relation to market requirements and consumer acceptability (have national agricultural research systems addressed this issue adequately?);**
- **To ensure quality of products (there is a need to identify and implement appropriate grading and quality standards);**
- **To develop new products and uses and to encourage urban utilization of these grains; and**
- **To create a system of government support that is comprehensive (the policies favouring extraction must be replaced with ones favouring intrarural grain markets).**

Specific action

- **Increase the level of training of professionals working in all aspects of the PCS;**
- **Develop and implement quality standards in relation to end products and for all stages of the PCS; and**
- **Develop new relations between government and the private sector to exploit the competitive niche of the semiarid food grains.**

Recommendations

Covering the whole system

- **Create effective government policies to encourage investment in the small grains sector, e.g., support to R&D, pricing policy, drought relief, credit for entrepreneurs; and**
- **Forge strong R&D linkages among national, international, and mentor organizations.**

Production

- **Develop high-yield, stable varieties of seed suitable for the different agroecological zones and end uses (must include verification trials);**
- **Assure availability of quality seed to all producers;**
- **Develop sound information and training packages for extensionists and farmers in the semi-arid regions, including material about:**

  i. **available cultivars,**
  ii. **planting populations,**
  iii. **inputs,**

iv. **pest control,**
v. **economics of production; and**

- **Government encouragement of banking institutions to extend credit to producers.**

Handling, storage, and marketing

- **Research and development of grain threshing technologies suitable for smallscale farmers;**
- **Government creation of an environment conducive to private-sector investment in medium-scale storage, e.g.,by**

i. **removing prohibitive legislation and**
ii. **extending credit to private-sector ventures;**

- **Investigation through research and feasibility studies of private, medium scale storage of grains with a focus on**

i. **market research,**
ii. **economics,**

iii. **classification and grading of commodities,**
iv. **design of storage structures,**
v. **transport and infrastructure,**
vi. **registration and use of pesticides;**

- **Development of quality standards for sorghum and millets for different end uses.**

Processing and utilization

- **Determination, through national studies, of gaps in knowledge about traditional processing and uses of sorghum and millets, i.e., processes and socioeconomic factors;**
- **Research and development of food products made from sorghum and millets, such as**

i. **soft and stiff porridges,**
ii. **composite flours,**
iii. **traditional and industrial brewing,**
iv. **rice sorghum,**
v. **snacks (popped sorghum, etc.),**
vi. **pasta, and**

vii. **malt;**

- **Research and development of industrial products from sorghum and millet, with closer cooperation between public and private sectors, including**

  i. **stockfeed,**
  ii. **ethanol**
  iii. **yeasts and other fermented foods, and**
  iv. **cellulose.**

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