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STRENGTHENING CROP PRODUCTION AND MARKETING SYSTEMS FOR SEMI-ARID AREAS IN THE SADCC REGION

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INTRODUCTION

Food insecurity persists throughout the SADCC region because of a historical failure to develop improved and appropriate cropping technologies for drought-tolerant crops. Agricultural development strategies have broadly promoted maize production at the expense of sorghum and millet. Agricultural research and extension programs have assumed the need for high levels of crop inputs. Credit markets tie input availability to product market deliveries. Improved maize varieties have been widely adopted. But the greatest beneficiaries of the maize promotion strategies have been a limited number of better-endowed farmers based in higher rainfall zones.

Efforts to promote high input smallholder agriculture have been reinforced by policies favoring the development of extractive grain markets designed to feed urban industry and national grain stocks. The surplus production of maize farmers has been channelled into centralized grain stores. Meanwhile, poor households in most low rainfall regions continue to face serious food deficits. These farmers often do not produce enough to meet their household consumption requirements. They must rely on wage remittances for the purchase of industrially milled grain. Many face a growing dependence on food distribution under drought relief programs.

The food security of most households in the SADCC's extensive semi-arid lands depends on the construction of agro-ecological zone-specific production and market systems. Improved technologies must be better targeted toward high risk, semi-subsistence production systems. Priority must be attached to investment strategies designed to strengthen intra-rural grain markets.

COARSE GRAINS IN THE SADCC REGION

Sorghum and millet account for 26 percent of cereal grain area and 17 percent of cereal grain production in the SADCC region (Table 1). Though semi-arid areas cover large portions of each SADCC country, maize is the dominant cereal grain. Even in Botswana and Namibia, more maize is consumed than any other grain.

As little as thirty years ago, sorghum and millet were important components of the production and consumption systems of Southern Africa. Colonial and post-independence efforts to promote maize, however, have broadly stimulated the replacement of small grains. Research and extension services emphasized the production of maize. Large subsidies backed the distribution of maize inputs and extraction of grain surpluses. In comparison, improved technologies and industrial markets for sorghum and millet have remained virtually non-existent.

Table 1
SADCC: Coarse grains production, 1985-1987

	AREA (000 ha)		PRODUCTION (000 mt)	
	Sorghum and		Sorghum and	
	Millet	Maize	Millet	Maize
Angola	85	600	55	277
Botswana	82	8	14	1
Lesotho	66	127	40	91
Malawi	137	1 185	152	1 291
Mozambique	220	600	178	330
Namibia	100	100	49	48
Swaziland	2	65	2	89
Tanzania	1 184	1 857	976	2 221
Zambia	59	596	40	1 142
Zimbabwe	457	1 260	301	2 117

Source: FAO, 1988.

In Zimbabwe, for example, 75 percent of all smallholder farmland and over 60 percent of the small-farm population lies in semi-arid regions receiving less than 650 mm of annual rainfall. These areas are frequently subject to mid-season dry spells and drought. They are agro-ecologically suited to more drought-tolerant crops. Yet most of these lands are now planted to maize. Sorghum and millet only account for 14 percent of cereal grain area and less than 10 percent of cereal grain production. The small grains have come to be viewed as secondary, minor or traditional crops.

AGRICULTURAL GROWTH STRATEGIES

Post-independence efforts to promote maize production have been viewed by the governments of Southern Africa as principal means to attain national food security and to commercialize the smallholder production system. Such strategies have taken little account of the differences characterizing smallholder agriculture in drier agro-ecological zones. Not surprisingly, the benefits of such strategies have primarily accrued to a subset of better endowed small farmers in higher rainfall areas. Available maize technologies are most productive in such regions. This is also where institutional support systems (credit, input supply and product marketing), originally developed to serve larger-scale colonial agriculture, are most prominent.

The skewed benefits of maize promotion strategies are clearly evident in the pattern of growth in smallholder grain production in Zimbabwe after independence. Between 1979 and 1985, fertilizer sales to the smallholder sector increased from 27 000 mt to 127 000 mt. Sales of hybrid maize seed to small farmers increased from 4 300 mt to 20 250 mt. The Agricultural Finance Corporation (AFC) initiated a pilot agricultural credit scheme for small farmers in 1978. By 1985, almost 20 percent of all small farmers received credit averaging Z$500 per household. The Grain Marketing Board (GMB) began establishing buying depots in the small farm areas in 1975. At independence, three such facilities had been established.

In 1985 the GMB operated 14 buying depots and 135 collection points in the smallholder areas. The availability of improved technologies and favorable market incentives brought a tripling of smallholder maize production. Smallholder maize sales to the GMB rose 30-fold. Smallholder production of sorghum and millet has declined.

Other SADCC countries pursued similar strategies. Farmers were widely encouraged to adopt hybrid maize seed and fertilizer. Extension recommendations broadly promoted high input enterprises and extension agents often viewed themselves as key elements of special maize promotion programs. Emphasis was placed on the establishment and expansion of agricultural credit programs designed to facilitate the adoption and use of purchased inputs. Parastatal marketing facilities were expanded, often with heavy subsidies to support operations in remoter regions. These programs experienced varying degrees of success. But they widely stimulated expanded plantings of maize.

The skew in the distribution of benefits of these programs follows the distribution of good soils, high rainfall and favorable transport infrastructure. Continuing the Zimbabwe example, fertilizer, credit and extension support are now most accessible to the 20 percent of small farmers in the higher rainfall regions (Table 2). These farmers account for two-thirds of all grain production and over 80 percent of all grain sales. Though the post-independence maize promotion programs were widely focussed, most of the 80 percent of small farmers based in medium and low rainfall regions still use little or no fertilizer, receive no credit and receive little extension advice. Though Zimbabwe faces large maize surpluses, most of these small farmers continue to suffer consistent food deficits.

Evidence of the distribution of grain production and sales within individual smallholder farming areas sharpens this skew. Estimates derived from farm survey samples reveal that approximately four percent of all small farmers contribute more than half of all smallholder grain sales to the national market. Twelve percent contribute three-quarters of the officially marketed grain. National policies, including credit and market subsidies, primarily increased the returns to this small minority of grain sellers.

IMPROVED MAIZE OR UNIMPROVED SORGHUM AND MILLET

Farmers throughout the semi-arid regions of the SADCC have periodically been advised to grow the more drought-tolerant sorghum and millets. In recent years, such advice has become more prominent in response to the incidence of drought, the rising costs of food distribution programs and the increasing costs of food imports. But small farmers in many low rainfall regions continue to allocate large portions of their drought-prone lands to maize. Farmers state that maize generally offers high yields. Statistical evidence supports this claim (Table 3).

Extension workers are correct to note that sorghum and millet are genetically more tolerant of drought. Farmers are correct to note that improved maize varieties or hybrids often produce better yields than unimproved sorghum or millet. In Zimbabwe, decades of consistent investment in a hybrid seed-breeding program brought varieties which performed well even in drier conditions. Hybrid seed offered a low-cost input promoted by a well-established seed multiplication and marketing system. Other countries built maize promotion programs on the basis of these gains. If a portion of the historical allocation to maize improvement had been redirected to sorghum and millet, the relationship might have been different.

Table 2
Zimbabwe agricultural indicators: Distribution of participation in the commercial grain economy by smallholders across rainfall zones, late 1980s[a]

	High rainfall	Medium rainfall	Low rainfall
Natural regions	I-II	III-IV	V
Annual rainfall	750 mm +	450-800 mm	650 mm -
Probability of drought	low	medium	high
Percent of smallholder:			
Population	19.8%	61.0%	19.2%
Grain production	68.4%	18.2%	13.5%
Grain sales	80.2%	16.9%	2.9%
Fertilizer use	91.4%	8.4%	0.3%
Percent of smallholders who:			
Use hybrid maize seed	93.6%	98.6%	77.8%
Use fertilizer	84.6%	14.0%	3.5%
Receive credit	33.5%	3.1%[b]	4.2%[b]
Receive extension advice	53.4%	15.8%[b]	12.5%[b]

[a] Derived from four sets of detailed farm surveys covering a wide cross-section of smallholder farming areas of Zimbabwe.
[b] Includes households which have received credit or extension advice at some time.
Source: Rohrbach, et al., 1990.

Table 3
Relative maize vs. sorghum yields in low rainfall regions

	Maize	P. Millet	Sorghum
Ramakwebane, Zimbabwe (1988/89)[a]	1147	804	526
Nata, Zimbabwe (1988/89)[a]	1677	879	1269
Gwembe, Zambia (1987/88)[b]	1800	-	450
Senangwa West, Zambia (1987/88)[c]	1400-1800	-	1100
Dodoma, Tanzania (N.D.)[d]	750	640	800
Mafeteng, Lesotho (1986/87)[f]	283	-	269
Lowveld, Swaziland (1980-84 ave.)[g]	825	-	600

Sources: [a]SADCC/ICRISAT, 1988/89; [b]Southern Province, 1988; [c]Adaptive Research Planning Team, Western Province, 1988; [d]Marketing Development Bureau, 1987a; [e]Marketing Development Bureau, 1987b; [f]Agricultural Planning Division, Lesotho Ministry of Agriculture, 1987; [g]Central Statistical Office, various years.

Grain-processing industries were constructed in the path carved out by the improved maize enterprise. Small maize mills are ubiquitous in much of the SADCC region. But these

mills tend to charge more for milling sorghum or millet to a poorer end product.

Another corollary of the improved maize technologies is the extractive character of grain market infrastructure and institutional arrangements. Market policies aim to move rural grain surpluses toward industrial maize mills based in urban areas. While rural grain markets exist, these tend to be small and are dominated by direct inter-household trade. As a result, rural food deficits tend to be resolved by imports of maize meal manufactured by urban industry rather than the movement of grain direct from surplus to deficit regions.

THE FUTURE OF SEMI-ARID CROP PRODUCTION

A view of the response of sorghum and millet producers to historical maize promotion strategies highlights the outline of a grain production and market system more suited to the SADCC semi-arid regions. These must be geared around the requirements of grain production for household utilization and intra-rural markets. Significant increases in the productivity of semi-arid regions may ultimately offer a competitive set of inputs for industrial markets. But these farmers first need a sustainable food and income source. Otherwise they are best off moving out of agriculture.

Household utilization

Though maize often yields more than sorghum in many drought-prone regions, sorghum and millet are still widely grown as food-security crops. Few farmers in the lowest rainfall regions will risk only growing maize. More likely, they will allocate a part of their land to maize and another part to sorghum and/or millet. If the maize dies, at least some grain will be available.

These crop production systems have evolved into a labor reserve for the rest of the economy. The returns to labor from sorghum and millet production are commonly less than one-fifth of the lowest wages offered in the formal economy. Such returns justify investments in school fees before agricultural inputs. They also justify extensive labor migration off the farm.

The virtually universal adoption of hybrid maize in Zimbabwe shows that farmers with even the most limited production resources will adopt technologies offering clear benefits. But few farmers in the lower rainfall zones apply fertilizer. This is generally perceived too risky an input, particularly at the rates and times recommended by extension workers.

Most current extension advice is viewed as irrelevant. High input recommendations seeking to maximize production levels (or even profits) are generally inappropriate to rain-fed semi-arid systems. New technologies must aim to increase the returns to household labor without significantly increasing production risks. High priority must be attached to the development and dissemination of improved seed. Substantial gains may also be sought through the improved management of the limited resources these farmers already have available - for example, through improved water-harvesting techniques. Fertilizer recommendations need not be optimal. High returns can often be achieved through low levels of application.

Given the likelihood of grain shortfalls in many sorghum- and millet-growing regions, breeders must also take account of the storage qualities of new varieties. Agricultural engineers need to develop improved small-scale grain dehulling and milling equipment. Immediate increases in sorghum and millet productivity will serve primarily to expand family food supplies and inter-annual food stocks.

Intra-rural markets

The structure of grain flows in many semi-arid regions reveals that sorghum and millet are widely treated as specialized trade commodities. Rural, informal (unregulated) market prices for sorghum and millet appear higher than those for maize through much of the SADCC region (Table 4). The relatively lower maize prices reflect the availability of improved maize technologies and the ready availability of maize and/or maize meal on local markets. The relatively higher prices for sorghum and millet reflect the low productivity of these crops and the high value attached to their use in specialized foods, particularly as a source of malt for traditional beer. In some regions sorghum or millet are viewed as premium inputs for breakfast porridge or specialized wholegrain dishes. These are uses without close substitutes.

Evidence (Tables 4 and 5) also suggests there should be substantial scope for moving grain from surplus to deficit regions. These flows have been discouraged by the orientation of national market policies toward building extractive grain markets. In some countries, strict trading regulations forbid such movements. In most, poor transport infrastructure and limited grain supplies restrict trade movements.

Recent moves toward market liberalization in many of the SADCC countries (Lesotho, Malawi, Mozambique, Tanzania, Zambia and Zimbabwe) appear unlikely to promote the exploitation of these differentials. In high rainfall areas, private sector market agents may take over the activities of the public sector. But in low rainfall areas, trading costs sharply rise. Transport costs are high and trade volumes low. Transport and grain storage infrastructure are limited. Traders offering market services in these areas are commonly subject to accusations of exploitative pricing.

Liberalization needs to be complemented by a positive strategy to build competitive rural markets. Planned investments must be directed toward expanding rural market infrastructure and transport facilities.

Industrial markets

As long as sorghum and millet productivity remain low and rural food supplies are in deficit, the priority placed on the promotion of sorghum and millet for industrial utilization should be limited. The only exception to this strategy comes with the potential for exploiting specialty markets. One such established market is the opaque beer industry demand for red sorghum for beer-flavoring and malt. Here, sorghum has no close substitute. But maize will probably remain the cheaper source of adjunct.

White sorghum may have potential as an input in a composite wheat flour for the production of bread or bread products. White sorghum has superior baking and keeping qualities compared to maize, the most common alternative grain substitute. If bread markets are rationed and prices controlled, the incentive to substitute sorghum for maize will remain limited. But significant increases in the productivity of white sorghum may change this relation.

The greatest long-run demand for sorghum and millet should be in the livestock industry. Annual growth rates in grain and grain by-product feed utilization in the SADCC region ranged up to 8 percent over the 1961 to 1983 period. As incomes rise, the demand for livestock products will escalate. Most grain demand will initially be in the pig and poultry industries. Over time, however, demand for grain-based stockfeeds in the beef and dairy industries should rise.

Table 4
SADCC: Sorghum and maize prices on informal markets

	Sorghum	Maize grain
Tanzania (1986/87)[a]	Tsh per kg	
Dodoma	19.24	12.01
Tabora	19.28	8.76
Singida	10.13	8.46
Dar Es Salaam	30.10	13.39
Swaziland (1990)[b]	E per bucket	
Lumbombo Plateau	20	7
Highveld	10-15	5-7
Lowveld	10	5
Zambia (1989)[c]	ZK per 70 kg bag	
Central Province	300	80
Western Province	200 +	80
Lesotho (1989)[d]	M per 70 kg bag	
Leribe	40	27
Mountains	60	
Mafeteng	40-50	25

Sources: [a]Marketing Development Bureau, 1987a; Marketing Development Bureau, 1987b; [b]Rohrbach & Malaza, 1990; [c]Ministry of Finance and National Commission for Development Planning, 1989; [d]Lesotho Research Division and SADCC/ICRISAT, 1989.

Table 5
Coarse grain prices on intra-rural markets in high and low rainfall communal areas of Zimbabwe, 1987-89 (Z$/90 kg bag)

Zone	High rainfall zone		Low rainfall	
	Low price	High price	Low price	High price
Maize	16.61	20.47	21.90	26.79
Red sorghum	28.86	37.57	28.79	32.07
White sorghum	19.88	24.00	30.38	34.80
P. millet	23.57	30.64	34.96	40.76
F. millet	42.39	55.00	49.79	61.00

Source: SADCC/ICRISAT, 1988/89.

CONCLUSION

A large portion of the SADCC population resides in low rainfall and drought-prone areas. Though long-term trends point to the absorption of these farmers in the rest of the economy, the probability of this occurring in the foreseeable future appears limited. Without greater efforts to develop production and market systems more suitable to the sorghum- and millet-growing areas, poverty will worsen, malnutrition will increase and the degradation of the fragile semi-arid environment will quicken. Rising incentives to migrate will accompany higher urban unemployment rates and greater urban poverty.

While farmers in the semi-arid regions of the SADCC are probably better off as a result of the development of improved maize technologies, many have also been left reliant on food aid delivered through drought-relief programs and wage remittances. Continuing droughts bring a costly process of disinvestment in agriculture. Most strikingly, rural malnutrition coincides with overflowing national grain stocks.

The sorghum and millet subsector can be made more productive with a set of strategies more suited to these limited-resource farmers. New technologies must be defined which increase labor returns while limiting farming risks. Improved seed technologies are essential. The development of water-harvesting techniques may be more important than fertilizer promotion. The promotion of greater production of drought-tolerant crops should not be simply viewed as an extension of agricultural policies successfully applied in high rainfall regions. Agricultural assistance should not simply be geared toward the extraction of grain for an industrial market. Intra-rural grain trade requires direct policy support.

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