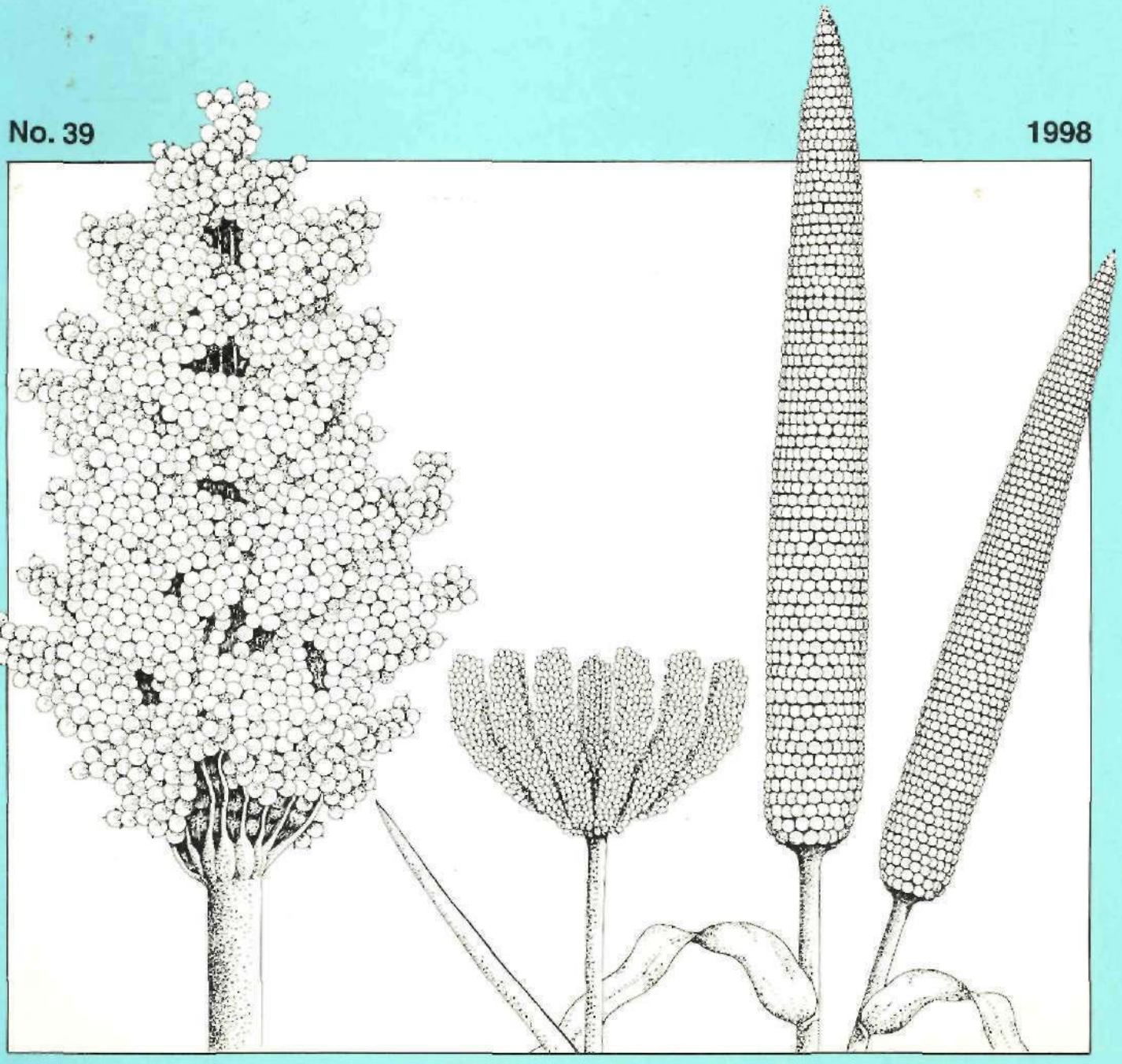
SICNA

International Sorghum and Millets Newsletter

No. 39 1998



International Sorghum and Millets Newsletter

Co-publishers

SICNA
Sorghum Improvement Conference of North America

ICRISAT
International Crops Research Institute for the Semi-Arid Tropics

About SICNA

In 1947, sorghum breeders formed an informal working group to meet and review items of interest in sorghum breeding and genetics. This organization was named 'Sorghum Research Committee'. In the 1960s, with the advent of a number of severe disease and insect problems, special half-day sessions, particularly on diseases. became a part of the Sorghum Research Committee. In 1973, a concept was put forward that all sorghum workers, irrespective of discipline and employer, should meet twice a year to discuss mutual concerns with sorghum research and development. The Sorghum Improvement Conference of North America was that new organization. It is composed of eight disciplinary committees, dealing with genetics and breeding, pathology, entomology, chemistry and nutrition, physiology and agronomy, biotechnology, utilization and marketing, and agribusiness and commerce. SICNA meets formally once a year in conjuction with the National Grain Sorghum Producers Board. A general program of research, education, and developmental activities is prepared by the disciplinary committees. Funding is through membership participation and contributions from commercial donors. Essentially. SICNA represents the United States sorghum activities but accepts reports and encourages memberships from sorghum and millet researchers worldwide.

About ICRISAT

The semi-arid tropics (SAT) encompasses parts of 48 developing countries including most of India, parts of southeast Asia, a swathe across sub-Saharan Africa, much of southern and eastern Africa, and parts of Latin America. Many of these countries are among the poorest in the world. Approximately one-sixth of the world's population lives in the SAT, which is typified by unpredictable weather, limited and erratic rainfall, and nutrient-poor soils.

ICRISAT's mandate crops are sorghum, pearl millet, finger millet, chickpea, pigeonpea, and groundnut; these six crops are vital to life for the ever-increasing populations of the SAT. ICRISAT's mission is to conduct research that can lead to enhanced sustainable production of these crops and to improved management of the limited natural resources of the SAT. ICRISAT communicates information on technologies as they are developed through workshops, networks. training, library services, and publishing.

ICRISAT was established in 1972. It is one of 16 nonprofit, research and training centers funded through the Consultative Group on International Agricultural Research (CGIAR). The CGIAR is an informal association of approximately 50 public and private sector donors; it is co-sponsored by the Food and Agriculture Organization of the United Nations (FAO), the World Bank, the United Nations Development Programme (UNDP), and the United Nations Environment Programme (UNEP).

ISMN Scientific Editors 1998

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Sorghum and Pearl Millet Production, Trade, and Consumption in Southern Africa

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Abstract

A review of regional production and trade data for sorghum and pearl millet in southern Africa reveals that while these crops remain important in the production system, they are being slowly replaced by maize and wheat in the average diet. The area sown to sorghum and pearl millet is still increasing in most SADC countries. Contrary to popular opinion, there is little evidence that these crops are being replaced by maize in the semi-arid farming system, at least since 1980. However, the production growth derived from rising crop areas has been largely offset by declining grain yields. Productivity levels remain so low that sorghum and pearl millet have difficulty competing in national and regional grain markets. One result is that, except in South Africa, sorghum and pearl millet remain largely semisubsistence crop enterprises. In addition, low sorghum and pearl millet yields have contributed to SADC's growing dependence on maize and wheat imports. The prospects for expanding sorghum and pearl millet production in the SADC region are briefly considered.

Introduction

Sorghum (*Sorghum hicolor* (L.) Moench) and pearl millet (*Pennisetum glaucum* (L.) R. Br.) account for 15% of cereal grain area and 9% of cereal grain production in

the Southern African Development Community (SADC) region of southern Africa. The dominant grain is maize (*Zea mays* L.), accounting for 70% of cereal grain area. The remaining area is largely made up of wheat (*Tritium aestivum* L.) and rice (*Oryza sativa* L.). In much of the region, maize competes directly with sorghum and pearl millet in the cropping system. Farmers will commonly grow sorghum or pearl millet in addition to maize. If rains are favorable, maize offers higher yields. If rains are poor, sorghum or pearl millet assures at least a minimum quantity of food production necessary to avoid starvation. As rainfall levels decline and become more variable, the proportion of sorghum or pearl millet in the cropping systems rises.

Sorghum and pearl millet must also compete with maize in the regional market. Since maize is the dominant cereal grain, the supply and demand for this commodity largely determine trading prices. Sorghum and pearl millet have difficulty competing on the industrial market because of their relatively low and variable productivity. Also, industry in many countries is unaccustomed to the use of these inputs. In the rural market, industrially processed maize is sometimes cheaper than locally produced sorghum or pearl millet.

To become competitive, the productivity of sorghum and pearl millet must improve. Limited gains may be derived from improved varieties. Larger gains must be derived from improvements in soil and water management. But investments in improved management need to offer competitive returns with alternative uses of farm capital and labor. If productivity fails to improve, southern Africa appears likely to become increasingly dependent on maize and wheat imports.

Sorghum and pearl millet area

Farmers in southern Africa sow over 1.9 million ha of sorghum and approximately 0.9 million ha of pearl millet [Table 1; the production and trade data used in this paper are derived from the Food and Agriculture Organization of the United Nations (FAO) 1998 unless otherwise indicated]. However, the accuracy of estimates of pearl millet area is lower than those for sorghum because national databases tend not to differentiate between alternative types of millet. The International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) estimates that about 70% of the millet area reported by FAO in southern Africa is sown to pearl millet (ICRISAT and FAO 1996). Virtually all of the remainder is sown to finger millet. In comparison, maize, the dominant cereal grain throughout most of the region, is grown on almost 12 million ha. Wheat and rice are grown on about 3.5 million ha, while finger millet is sown on about 0.4 million ha.

Tanzania accounts for about 35% of SADC's sorghum area (Table 1). Mozambique, Zimbabwe, South Africa, and Botswana are also significant producers.

Table 1. Sorghum and pearl millet production areas in SADC countries, 1995-97 averages.

	Sorghum		Pearl millet	
Country	Area ('000 ha)	SADC area (%)	Area ('000 ha)	SADC area (%)
Angola	82.6	4.2	66.1	6.8
Botswana	150.0	7.7	9.3	1.0
Congo	80.0	4.1	42.0	4.3
Lesotho	17.7	0.9	0.0	0.0
Malawi	74.7	3.8	13.8	1.4
Mauritius	0.0	0.0	0.0	0.0
Mozambique	439.8	22.5	69.9	7.2
Namibia	34.6	1.8	269.8	27.7
South Africa	172.5	8.8	21.0	2.2
Swaziland	2.0	0.1	0.0	0.0
Tanzania	683.2	34.9	263.3	27.1
Zambia	44.4	2.3	30.8	3.2
Zimbabwe	174.9	8.9	186.7	19.2
SADC total	1956.5	100	906.7	100

Source: FAO 1998.

Table 2. Sorghum, pearl millet, and maize area as a proportion of total cereal grains area in SADC countries, 1995-97 averages.

Country	Total cereal grains area ('000 ha)	Sorghum (%)	Pearl millet (%)	Maize (%)
Angola	789.4	10.5	8.4	75.6
Botswana	178.2	84.2	5.2	10.3
Congo	2086.1	3.8	2.0	64.6
Lesotho	147.5	12.0	0.0	56.5
Malawi	1390.5	5.4	1.0	90.4
Mauritius	0.2	0.0	0.0	100.0
Mozambique	1756.2	25.0	4.0	61.5
Namibia	335.9	10.3	80.3	9.4
South Africa	6177.0	2.8	0.3	60.7
Swaziland	62.8	3.2	0.0	96.2
Tanzania	3194.5	21.4	8.2	50.2
Zambia	748.1	5.9	4.1	80.0
Zimbabwe	2025.5	8.6	9.2	75.4
SADC total	18887.5	10.4	4.8	63.3

Source: FAO 1998.

Table 3. Growth rates in area sown to to sorghum, millet, and maize in SADC countries, 1980-1997.

Country	Sorghum (%year^{-1})	Millet (% year^{-1})	Maize (% year^{-1})
Angola	na[1]	5.2	1.0
Botswana	4.3	0.3	-0.2
Congo	5.9	4.0	4.2
Lesotho	-7.4	-	-2.2
Malawi	6.0	5.4	1.1
Mauritius	-	-	-6.5
Mozambique	1.9	9.7	2.1
Namibia	1.1	3.9	2.4
South Africa	-1.6	-0.3	-0.6
Swaziland	-1.8	-	-0.3
Tanzania	1.5	0.5	1.5
Zambia	5.0	9.6	1.5
Zimbabwe	-1.7	-4.2	0.4
SADC total	1.0	2.1	0.8

1. na = not available.
Source: FAO 1998.

The remaining eight SADC countries account for less than 20% SADC's sorghum area.

Namibia and Tanzania each account for about 27% of SADC's pearl millet area (Table 1). The area of land sown to this crop has been increasing in Namibia, but has changed little in Tanzania over the past 10 years. Zimbabwe sows almost one-fifth of the region's pearl millet area. The remaining 10 SADC countries account for only 27% of the total. Three of these countries, Lesotho, Swaziland, and Mauritius, produce no millet.

The importance of sorghum and pearl millet within each country can be measured in tenns of the proportion of total cereal grain area sown to each crop (Table 2). Sorghum accounts for the majority (84%) of cereal grain area only in Botswana. Sorghum accounts for 25% of cereal grain area in Mozambique and 21% in Tanzania. In all other counties the crop accounts for less than 15% of cereal grains area.

Pearl millet provides a major source of livelihood only in one country, Namibia, where it accounts for 81% of cereal grains area. The crop accounts for almost 10% of grains area in Tanzania, Zimbabwe, and Angola. Elsewhere, this crop is of relatively minor importance.

Though sorghum and pearl millet are not major components of the cropping systems of most SADC countries, these grains are critically important for the food security of many small-scale farmers. Sorghum and pearl millet are generally grown in some of the poorest and most drought prone agricultural regions of each SADC country. These tend to be isolated regions, distant from capital cities and major grain markets. They also tend to be regions attracting larger investments in public food distribution during periods of drought.

SADC's sorghum area has been increasing, since 1980, at an average annual rate of 1% (Table 3). Area growth has been recorded in all SADC countries growing sorghum except Lesotho, Swaziland, South Africa, and Zimbabwe. In general, area gains reflect the continuing growth of rural populations. Larger gains in Botswana reflect the impact of government efforts to promote expanded production with subsidies on land clearing and preparation. The gains in Malawi and Zambia reflect a shift from maize toward the production of more drought-tolerant crops.

SADC's millet area has also been increasing since 1980, at an average annual rate of 2%. (We are unable to differentiate the growth rates of pearl millet and finger millet.) Millet area is recorded by FAO databases to be increasing in every millet growing country except Zimbabwe and South Africa. As in the case of sorghum, these gains reflect the combined effects of drought and population growth.

The common view that maize has been replacing sorghum and pearl millet during the past two decades is

incorrect. Regional maize area has, in fact, been growing at a slower rate than the area growth of sorghum and pearl millet, Maize remains an important crop in many semi-arid areas. However, periodic droughts have reinforced sowings of the more drought-tolerant coarse grains.

Unexpectedly, the growth rate in coarse grains area as a whole is less than one-half the average 3.0% annual population growth rate in SADC. This reflects the relatively slower rates of farm population growth due to population movements from rural to urban areas. The limited area gains also reflect rising land constraints. Future increases in production will need to be derived primarily from improving yields.

Sorghum and pearl millet yields

Sorghum yields are low by global standards in all SADC countries except South Africa. Sorghum yields across the SADC region averaged only 0.8 t ha^{-1} during the 1995-97 period (Table 4). This compares with a average global sorghum yield of 1.4 t ha^{-1}. Grain yields in the more commercialized South African production system averaged 2.1 t ha^{-1}. The grain yields achieved in the remaining SADC countries averaged only 0.7 t ha^{-1}. No SADC country, other than South Africa, registered sorghum yields greater than 1.0 t ha^{-1}. In Botswana, where sorghum dominates the cropping system, sorghum yields averaged only 0.2 t ha^{-1}.

Pearl millet yields average even less than those of sorghum. In the SADC region as a whole, millet yields averaged only 0.6 t ha^{-1} over the 1995-97 period. (Again, the FAO data do not differentiate between pearl millet and finger millet yields.) Tanzania achieved an average millet grain yield 1.0 t ha^{-1}. In contrast, Namibia, which relies on pearl millet as the main national crop enterprise, achieved grain yields averaging only 0.2 t ha^{-1}. Zimbabwe's yields average only 0.3 t ha^{-1}.

While we would expect the grain yields of sorghum and pearl millet to be lower than those for maize, given the production of these crops in drier agroecologies, the magnitude of the difference provides the main justification for the dominance of maize in the southern African cropping system. Across the SADC region as a whole, maize yields an average 1.5 t ha^{-1}, more than double the average level of sorghum and pearl millet yields. In semi-arid agroecologies, where sorghum and pearl millet are most important, farmers still commonly sow maize in the expectation of a favorable harvest if rainfall is consistent through the season. In southern Zimbabwe, for example, farmers reason that if rainfall is favorable, maize will yield more than sorghum or pearl millet. If rainfall is poor, the maize may fail. But these risks are offset by the availability of drought relief, and alternative sources of income (Hedden-Dunkhorst 1993).

Table 4. Average grain yields for sorghum, millet, and maize in SADC countries, 1995-97.

Country	Sorghum (t ha^{-1})	Millet (t ha^{-1})	Maize (t ha^{-1})
Angola	n.a.	0.5	0.5
Botswana	0.2	0.3	0.6
Congo	0.6	0.6	0.8
Lesotho	L0	-	1.4
Malawi	0.7	0.6	1.4
Mauritius	-	-	2.6
Mozambique	0.5	0.4	0.9
Namibia	0.2	0.2	0.8
South Africa	2.1	0.6	2.1
Swaziland	0.7	-	1.7
Tanzania	0.9	1.0	1.4
Zambia	0.5	0.3	1.7
Zimbabwe	0.5	0.6	1.2
SADC total	0.8	0.6	1.5

Source: FAO 1998.

Table 5. Growth rates in grain yields of sorghum, millet, and maize in SADC countries, 1980-1997.

Country	Sorghum (%$year^{-1}$)	Millet (% $year^{-1}$)	Maize (% $year^{-1}$)
Angola	n.a.	-3.1	-0.7
Botswana	3.3	5.1	2.3
Congo	-2.6	-0.9	-0.1
Lesotho	2.2	-	3.3
Malawi	-1.1	1.0	0.2
Mauritius	-	-	0.3
Mozambique	-2.8	3.6	2.3
Namibia	-1.0	-1.4	-2.6
South Africa	-0.7	-0.9	0.3
Swaziland	-0.7	-	1.1
Tanzania	-0.3	-1.6	0.3
Zambia	-0.2	0.6	-1.0
Zimbabwe	0.9	-4.2	-0.9
SADC total	-1.0	-1.8	-0.2

Source: FAO 1998.

Over the 1980-1997 period, SADC's average yields of all three major coarse grain crops have been declining. Pearl millet yields were declining at an average annual rate of 1.8% per year (Table 5). Sorghum yields were declining at an average annual rate of 1.0% per year. Maize yields declined at an average annual rate of 0.2%. The justification for these losses cannot simply be attributed to poor rainfall. Estimates derived from FAO databases in the early 1990s indicate farmers in southern Africa use less than 27 kg of chemical fertilizer per hectare (Heisey and Mwangi 1996). Virtually none of this fertilizer is applied to sorghum and pearl millet, except in the commercialized sorghum sector of South Africa. As a result, soils are being mined of nutrients.

A growing array of experimental evidence highlights the magnitude of the gap between the average grain yields small-scale fanners are achieving, and the yields obtainable with even small improvements in crop management. Table 6 summarizes a few of these comparisons. In most cases, trial yields for 'local' varieties average more than twice the level of average grain yields on the fields of neighboring farmers. This gap is apparent even when variety trials are implemented in the fields of small-scale farmers and under the management of these producers. When seed varieties are changed, farmers may be able to obtain 0-25% yield gains depending on the cultivars involved and the character of the season (Rohrbach and Makwaje, in press; Rohrbach, in press). In severe drought years, the early maturity offered by recently released sorghum and pearl millet varieties may offer up to a 50% yield advantage. However, most of the yield gap apparent in experiment station and on-farm trials data is the result of differences in crop management.

Sorghum and pearl millet production

The distribution of sorghum and pearl millet production roughly matches the distribution of area sown. The SADC region as a whole produces about 1.5 million t of sorghum and an estimated 0.5 million t of pearl millet (Table 7; this estimate, derived from the aggregate FAO millet database, assumes the average yields of pearl millet and finger millet are similar). This compares with an production level of 17.7 million t of maize over the 1995-97 period. Given its higher average yields, Tanzania accounts for 42% of the region's sorghum production. South Africa accounts for 23% and Mozambique accounts for 15% of the SADC region's sorghum production.

Tanzania accounts for one-half of SADC's pearl millet production. Though Namibia grows about the same area of land to this crop, this country only produces 13% of the region's pearl millet production due to its low grain yields. Zimbabwe accounts for 11% of the region's pearl millet production.

The growth in SADC's area sown to sorghum and pearl millet has offset the decline in average grain yields over the 1980-1997 period. As a result, the region's sorghum production levels have remained essentially unchanged. Pearl millet production is marginally increasing at a rate of 0.3% per year. However, on a per

Table 6. Cap between trial yields and average farm yields for sorghum and pearl millet.

Country	Type and period of trials	Trial yields of local varieties (t ha^{-1})	Average national grain yield (t ha^{-1})	Yield gap (t ha^{-1})
Botswana[1]	Sorghum on station (1993-95)	1.6	0.3	1.3
	Sorghum on farm (1993-96)	0.5	0.3	0.2
Malawi[2]	Sorghum on station (1984-87)	1.4	0.6	0.8
	Pearl millet on farm (1994)	0.9	0.4	0.5
Namibia[3]	Pearl millet on farm (1993)	1.4	0.2	1.2
Zimbabwe[4]	Sorghum on farm (1993)	1.8	0.7	1.1
	Pearl millet on farm (1993)	1.3	0.4	0.9

1. Source: Rohrbach and Makwaje, in press.
2. Source: Chintu and Chigwe undated, Chintu and Monyo undated.
3. Source: Matanyaire and Gupta 1996.
4. Source: Heinrich and Mangombe 1995.

Table 7. Sorghum and pearl millet production in SADC countries, 1995-97 averages[1].

Country	Sorghum		Pearl millet[1]	
	Production ('000 t)	SADC production (%)	Production ('000 t)	SADC production (%)
Angola	37.5	2.4	30.0	5.8
Botswana	36.7	2.4	2.7	0.5
Congo	50.0	3.2	25.8	5.0
Lesotho	16.8	1.1	0.0	0.0
Malawi	53.2	3.4	7.8	1.5
Mauritius	0.0	0.0	0.0	0.0
Mozambique	235.5	15.1	30.4	5.9
Namibia	7.3	0.5	66.9	13.0
South Africa	356.9	22.9	13.0	2.5
Swaziland	1.5	0.1	0.0	0.0
Tanzania	648.6	41.7	255.7	49.7
Zambia	31.0	2.0	22.7	4.4
Zimbabwe	80.7	5.2	59.4	11.5
SADC total	1555.6	100	514.5	100

1. Production estimates for pearl millet are derived from FAO estimates for all millets and joint FAO and ICRISAT estimates of proportion of area sown to pearl millet.
Source: FAO 1998.

capita basis, the availability of both crops is declining by more than 2.5% per year. In effect, food security in the region's semi-arid regions is worsening. Declining production levels must be offset by increasing reliance on food grain imports.

The contribution of sorghum and pearl millet to SADC cereals production has also remained roughly constant since 1980. Sorghum accounts for about 6% of SADC cereal grain production and pearl millet accounts for only 2%. The relative contribution of maize to SADC cereal production is slowly increasing at about 0.6% per year, because declining maize yields are more than offset by rising area sown.

Sorghum and pearl millet trade

In all countries except South Africa, most of the sorghum and pearl millet being harvested is consumed on the farm. SADC/ICRISAT SMIP sponsored surveys (Hedden-Dunkhorst 1993; Rohrbach 1995; Minde and Mbiha 1993) indicate that little grain enters the market, and most of these transactions involve sales between neighboring households. In the rural market, sorghum is commonly priced about the same as maize. Pearl millet is commonly priced 10-30% more than maize.

Commercial market deliveries of sorghum and pearl millet are estimated to average less than 10 000 t in all SADC countries except Zimbabwe and South Africa. In Zimbabwe, the opaque beer industry purchases approximately 15 0001 of sorghum per year for malting. However, most of this is derived from large-scale farmers. In South Africa, 1995 estimates indicate industry purchases of about 300 000 t for use in animal feed (41%), opaque beer brewing (43%), and the manufacture of a range of other food products. Most of this is purchased from about 600 large-scale commercial fanners.

Botswana has a growing sorghum-based milling industry manufacturing sorghum meal for the retail market. Small-scale millers purchased around 30 000 t of sorghum grain in 1997 (Rohrbach and Makwaje, in press). However, at least three-quarters of this was based on sorghum imports, largely from South Africa. Smaller quantities of sorghum grain were imported from commercial farmers in Zambia and from small-scale farmers in Zimbabwe.

The magnitude of regional sorghum and pearl millet trade has been minuscule compared with trade in maize and wheat during the mid-1990s. Sorghum and pearl millet account for roughly 2% of the total volume of grain traded in the SADC region and only 1% of the

Table 8. Net imports ('000 t) of alternative cereal grains in SADC countries, 1994-96 averages.

Country	Sorghum	Millet	Maize	Wheat
Angola	0.4	0.3	193.0	242.1
Botswana	37.5	0.0	50.6	63.2
Congo	14.7	0.0	47.7	228.2
Lesotho	5.4	0.0	99.6	76.3
Malawi	6.7	0.0	294.3	60.0
Mauritius	0.0	0.1	49.0	102.2
Mozambique	1.4	0.8	227.9	227.4
Namibia	0.0	0.0	38.0	35.8
South Africa	-23.1	0.6	-1400.6	786.7
Swaziland	0.0	0.0	20.1	50.1
Tanzania	0.0	0.0	62.5	0.0
Zambia	13.3	0.0	60.2	40.8
Zimbabwe	-2.4	-0.9	-557.4	74.8
SADC total	53.9	0.9	-815.1	1987.5

Source: FAO 1998.

total value of grain traded (Table 8). Seven of the 12 SADC sorghum producers registered net sorghum imports between 1994 and 1996, though all but one country imported less than 15 000 t. Botswana imported almost 40 000 t of sorghum due to the country's domestic production shortfall.

The FAO statistics indicate very small net imports of pearl millet in six SADC countries during the mid-1990s. These averaged less than 500 t. Zimbabwe annually exported an average 900 t of pearl millet. Much of this was pearl millet seed for Mozambique and South Africa.

In comparison, all SADC countries had large trade volumes of maize and wheat. During the 1994-96 period, Zimbabwe and South Africa were net maize exporters. Each of the remaining 11 SADC countries were net importers of maize. All SADC countries, except Tanzania, were net importers of wheat.

The SADC region as a whole spent over US$280 million per year on maize and wheat imports over the 1994-96 period. This does not include the value of trade within the region. If South Africa is excluded, regional grain import costs totaled US$ 440 million per year. The import bill is increased by the high costs of transporting grain across much of the region. National import costs for wheat, the most significant regional commodity import, commonly average more than US$ 200 per t. Import prices for maize are commonly over US$ 175 per t.

The combination of declining aggregate cereal grain production and rising population levels have contributed to a rising dependence on grain imports. During the early 1980s, SADC exported an average 3.2 million t of maize per year. A decade later, the SADC region had become a net maize importer. During this same period, SADC's wheat imports more than doubled. Six of the 13 SADC countries now import at least 30 kg of maize or wheat per person. This is about 20% of the average calorie supply for a country primarily dependent on grains.

Sorghum and pearl millet utilization

In the SADC region as a whole, sorghum consumption has remained constant as a proportion of total coarse grain (maize, sorghum and pearl millet) consumption for food. Sorghum accounts for about 7% of the region's coarse grain calories. Pearl millet consumption has marginally declined from supplying about 3.5% of the region's coarse grain calories during the early 1980s to about 3.0% in the mid-1990s. Maize consumption has marginally increased. Wheat and rice consumption are rising more quickly.

Given the limited regional trade in sorghum and pearl millet, consumption levels for these crops closely reflect the levels of production. If production rises, consumption increases. If production falls, sorghum and pearl millet calories are replaced with those from maize and wheat. Since sorghum production levels have remained relatively steady in most SADC countries, aggregate consumption levels have not changed much. The major exception is Lesotho, where the contribution of sorghum to coarse grain calories declined by 50% between the early 1980s and the mid-1990s.

The declining regional contributions of pearl millet to SADC diets reflects the decline in production in two major producers—Tanzania and Zimbabwe. In a number of other countries, pearl millet consumption is marginally increasing as a result of the expansion of land area sown to this crop.

While more than 90% of SADC's sorghum and pearl millet production are consumed directly for food, increasing quantities are used for livestock feed. The feed industry as a whole absorbs approximately 4 million t of grain per year. However, almost all of this is maize. Sorghum and pearl millet account for less than 4% of the region's grain allocations to feed.

South Africa has the largest feed grain industry in the region. This industry accounts for 80% of SADC's feed grain utilization. Yet even here, where sorghum production is highly commercialized, this grain only accounts for only 3% of the total quantity of feed grains consumed. Most of the remainder is maize.

Sorghum accounts for about 20% of estimated feed grain utilization in Mozambique and 10% in Tanzania, but the total quantities of cereals being used for livestock feed in these countries are low.

The prospects for expanding industrial utilization are weakened by the continuing low productivity of these crops. Sorghum and pearl millet must ultimately compete with maize in terms of quality, consistency of supply and price. In industries where substitution is limited, such as opaque beer, demand may increase despite high grain costs. However, if substitution with maize is possible, industry will generally choose the cheaper input To date, this has generally been maize.

Future trends

The SADC sorghum and pearl millet sector has changed little over the past 15 years. In regional production systems, these crops are neither increasing nor decreasing in importance. However, declining per capita production levels have necessitated a growing dependence on cereal grain imports. A growing share of these imports is made up of wheat.

If sorghum and pearl millet are to have a future in the SADC food and feed system, current trends in declining grain yields must be reversed. These simply reinforce the competitive disadvantage of these crops. Pearl millet yields are already so low in northern Namibia that it is cheaper for consumers to purchase imported maize (Rohrbach 1995). Sorghum yields remain so low in Botswana that the domestic sorghum milling industry relies on sorghum imports from South Africa. Within a few years, wheat appears likely to overtake sorghum as the second most important source of cereal calories in this country. Maize has already become more important than sorghum (Rohrbach and Makwaje, in press). In Zimbabwe, most sorghum and pearl millet farmers have long resolved their food production deficits with industrially processed maize meal (Hedden-Dunkhorst 1993).

The prospects for a reversal of these trends are mediocre. Productivity gains will not be derived simply from changing in varieties. Larger yield gains require associated improvements in soil and water management. These investments are risky in the semi-arid environment. The investment returns must compete with the returns to alternative investment opportunities, including the migration of labor to urban, wage employment.

The best prospects for promoting investments in improved crop management probably lie in expanding production and trade for the industrial market. Sorghum is globally competitive with maize and wheat as a feed grain. Small gains in productivity, or marketing efficiency, could sharply increase the quantities of grain used by the SADC feed industry. Pearl millet and sorghum will retain a niche as industrially processed food grains, though the size of this market is difficult to estimate. If the costs of these grains remain relatively high, this market is unlikely to grow.

The largest and most immediate prospect for expanding utilization is in resolving continuing production deficits on the farm. Opportunities for improving the level and stability of semi-subsistence production should not be ignored. However, the long term future of these crops depends on the success of their commercialization.

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Socioeconomics in SMIP: Research Highlights, Impacts, and Implications

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Abstract

Economics research under the SADC/ICRISAT Sorghum and Millet Improvement Program (SMIP) has targeted an evolving diagnosis of the main constraints to improving productivity in the sorghum and pearl millet based cropping systems of southern Africa. The research began by examining whether product market constraints limited the incentives to produce sorghum and pearl millet. These investigations considered policy, institutional, and technological factors influencing industry demand for these crops. The results provided analytical input into national debates about grain market liberalization. Since more than 95% of sorghum and pearl millet trade was in the rural market, SMIP's analyses evolved to consider opportunities for improving grain flows from surplus to deficit rural regions.

Most market analyses indicated the importance of productivity growth in order for sorghum and pearl millet to become competitive with maize. Such analyses encouraged the allocation of greater resources in the third phase of the SMIP project toward technology transfer—in particular, the dissemination of new varieties developed during the previous project phases. Complementary analyses were initiated on seed market policies, and alternative strategies for seed multiplication and distribution. Results from these studies are contributing to the search for more sustainable methods of seed supply for open-pollinated varieties.

SMIP-supported assessments of the impacts of variety adoption offered mixed evidence of productivity gains. The yield gaps between on-station and on-farm trials and farmers' fields remain large. These analyses encouraged greater emphasis on the development of complementary, yet practical, fertility management options suited to the investment capabilities of small-scale farmers.

This review of some of the major products of SMIP's economics research highlights the difficulties of technological change and productivity improvement in the semi-arid cropping system. This has set the basis for the emphasis of the fourth phase of the SMIP project on developing more sustainable seed delivery systems, facilitating improvements in sorghum and pearl millet management, and exploiting market opportunities where these crops are most competitive. Priorities for economic analysis during this coming phase of the project are briefly summarized.

Economics research mandate

In 1988, an economist was hired under the Southern African Development Community (SADC)/International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) Sorghum and Millet Improvement Program (SMIP) to conduct studies of sorghum (*Sorghum hicolor* (L.) Moench) and millet marketing and utilization. SMIP hypothesized that the main constraint to the adoption of improved sorghum and millet technologies was the lack of demand for these crops. The evidence of mounting sorghum and pearl millet (*Pennisetum glaucum* (L.) R. Br.)