# HOUSEHOLD AND NATIONAL FOOD SECURITY IN SOUTHERN AFRICA

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*University of Zimbabwe UZ/MSU Food Research in Southern Africa*

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# SMALL GRAIN MARKETS IN ZIMBABWE: THE FOOD SECURITY IMPLICATIONS OF NATIONAL MARKET POLICY

Charles Mbwanda and David D. Rohrbach[1]

## INTRODUCTION

Over 60% of Zimbabwe's farmland lies in drought prone regions receiving an average of less than 650 mm annual rainfall. This includes 75% of the nation's smallholder farming areas. Yet, only 15% of Zimbabwe's cereal supplies are provided by the relatively more drought tolerant small grains: red and white sorghum, bulrush millet, and finger millet. Roughly 70% of national cereal calories are provided by maize. Consumption of wheat, 10-20% of which is normally imported, holds secondary importance.

The Zimbabwe Government has sought to use market policy to help redress this balance. In 1984, after a 20 year hiatus, bulrush and finger millet were again declared controlled crops. Sorghum prices have generally been set equal to or higher than the price of maize.[2] Scheduled millet prices have been set substantially higher. Access to Grain Marketing Board (GMB) buying points has recently been expanded in low-rainfall regions.

A costly consequence of this strategy has been the buildup of small grain stocks. GMB intake has increased. Meanwhile, high GMB selling prices have choked off domestic market demand. Sorghum and millet are only being purchased from the GMB for uses without close substitutes.

The contribution of this strategy to food security in the nation's drought prone regions has been limited. Smallholder small grain sales have increased faster than production. Absolute production gains in the semi-arid regions have been limited. Most GMB deliveries have been derived from a small minority of producers, many situated in relatively higher rainfall zones.

This paper argues that the construction of a market policy more attuned to Zimbabwe's agroclimatic comparative advantage requires an improved understanding of the determinants of small grains supply and demand. The different production opportunities facing large- and small-scale farmers must be considered. Producer pricing strategies must be balanced against consumer market requirements. The opportunities for expanding small grain utilization by industry require consideration.

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[1]Planning Department, Small Enterprise Development Corporation (SEDCO); and Economist, International Crop Research Institute for the Semi-Arid Tropics (SADCC/ICRISAT), Motopos, Zimbabwe, respectively.

[2]A major exception is the sharp reduction in red sorghum producer prices in 1987. This aimed to discourage sorghum sales from the large-scale commercial farm sector.

Zimbabwe's food security and development objectives will best be served by the reestablishment of supply-demand equilibrium in the small grains subsector. Ultimately, however, price and market interventions cannot replace the need for technological change. The welfare of most farmers in Zimbabwe's semi-arid regions can only be significantly improved with advances in sorghum and millet productivity.

## SMALL GRAINS SUPPLY

Small grain production in Zimbabwe has historically been dominated by the smallholder or communal farm sector.[3] At independence in 1980, smallholders planted over 95% of the nation's sorghum area and harvested roughly 80% of the sorghum crop. Virtually the entire millet crop was grown by small farmers. By 1988, smallholders had further increased their relative contribution to Zimbabwe's small grain production.

In sharp contrast, small grain marketing has historically been dominated by the commercial farm sector. In 1980, commercial farmers delivered over 90% of the GMB sorghum intake. Millet sales were uncontrolled and only small quantities were being directly purchased from small-scale producers by the brewing and feedgrain industries. Eight years later, millet sales had become controlled. Smallholder deliveries of small grains to the GMB had increased while commercial farmers had sharply reduced their deliveries to the GMB.

### Commercial sorghum production and sales: 1970-1988

Commercial sorghum production has historically been restricted to red varieties, high in tannins and low in susceptibility to bird damage. Commercial sorghum production trends have been broadly characterized by sudden adjustments in area planted and rising average yields (Table 1). A decline in area planted during the mid-1970s was largely offset by continuing yield improvements. When commercial sorghum area rebounded, in 1985 and 1986, production and market deliveries increased sharply, reaching record highs.

Since commercial sorghum deliveries have dominated GMB intake, small shifts in commercial cereal grain area can have a large impact on GMB stocks. In most years since 1970, almost the entire commercial sorghum harvest was sold to the GMB. Retentions for animal feed tended to increase after drought years. But on average, approximately 80% of harvests were delivered to GMB depots. When production levels rose sharply in 1985 and 1986, the national market was flooded.

The explanation for these shifts in area planted are not easy to determine because sorghum represents such a minor commercial sector crop. On average, less than 5% of summer cropped area has been allocated to this sorghum. This crop has

[3]In this paper, the terms smallholder and communal farmer are used interchangeably. While most resettlement farmers are also small landholders, this sector still represents a small contributor to national production and sales of small grains. The commercial sector includes medium- and large-scale land owners. However, most commercial production and sales are derived from the large-scale sector.

**Table 1. Sorghum production and deliveries to the GMB, Zimbabwe, 1970 to 1988.**

| | Commercial Farm Sector | | | Smallholder Farm Sector | | |
|---|---|---|---|---|---|---|
| Harvest Year | Area (000 ha) | Production (000 mt) | Sales (000 mt) | Area (000 ha) | Production (000 mt) | Sales (000 mt) |
| 1970 | 16.8 | 6.8 | 2.6 | 198.8 | 65.3 | 0.7 |
| 1971 | 12.3 | 7.6 | 2.5 | 240.0 | 136.5 | 1.5 |
| 1972 | 14.3 | 19.9 | 18.5 | 240.0 | 120.1 | 4.5 |
| 1973 | 30.5 | 27.9 | 23.6 | 122.0 | 22.8 | 2.2 |
| 1974 | 13.6 | 14.0 | 9.5 | 275.0 | 150.0 | 3.5 |
| 1975 | 5.0 | 5.6 | 4.2 | 210.0 | 105.0 | 0.8 |
| 1976 | 7.1 | 16.3 | 13.2 | 235.0 | 120.0 | 0.8 |
| 1977 | 6.5 | 15.2 | 13.5 | 90.0 | 36.0 | 0.5 |
| 1978 | 7.7 | 16.2 | 15.9 | 120.0 | 57.0 | 0.8 |
| 1979 | 7.5 | 18.9 | 19.2 | 76.0 | 30.0 | 0.7 |
| 1980 | 6.8 | 16.3 | 15.8 | 120.0 | 66.0 | 2.0 |
| 1981 | 9.3 | 25.1 | 22.9 | 200.0 | 100.0 | 7.5 |
| 1982 | 8.2 | 17.4 | 17.2 | 200.0 | 50.0 | 2.0 |
| 1983 | 7.7 | 7.5 | 5.1 | 280.0 | 44.0 | 0.3 |
| 1984 | 9.9 | 18.1 | 5.8 | 156.0 | 37.4 | 3.9 |
| 1985 | 15.0 | 54.0 | 53.4 | 215.0 | 81.0 | 20.6 |
| 1986 | 27.0 | 68.0 | 64.4 | 145.0 | 63.2 | 4.9 |
| 1987 | 7.5 | 11.6 | 2.9 | 172.7 | 40.4 | 0.7 |
| 1988[a] | 7.1 | 12.7 | 6.8 | 213.0 | 163.2 | 70.5 |

[a]Crop Forecasting Committee Estimates, 1987-88 season.
Source: Muir-Leresche (1985), GMB (various years), AMA (various years, a), AMA (various years, b), CSO (various years, b).

never accounted for more than 10% of total commercial cereal grain area. As a result, a relatively small change in the profitability of sorghum or its principal substitutes could result in a large change in sorghum production levels.

Sorghum is commonly believed to substitute most closely with maize in production. Correspondingly, the explanation for the 80% decline in commercial sorghum area and production in 1974 and 1975 might initially be linked with a 30% decline in the sorghum-to-maize producer price ratio. Yet the commercial area planted to maize also was estimated to have declined, albeit marginally, during this period. Commercial soybean and tobacco plantings were increasing. These are not generally viewed as sorghum substitutes. Again, however, the relatively small proportion of land involved may disguise the true resource allocation determinants.

The explanation for the 1985 and 1986 increase in sorghum area and production appears similarly unclear. The sorghum-to-maize producer price ratio did not

change. Commercial farmers may have been responding, in part, to the widespread incidence of drought during the previous three years. Also, a sharp increase in fertilizer costs had reduced the net returns to fertilizer intensive crops. Yet, while sorghum acreage was growing, maize acreage also increased. Again, a tradeoff with soybeans seems apparent. Only a greater understanding of commercial land allocation patterns, however, will ultimately clarify these relationships.

In response to the sharp increase in sorghum deliveries over the previous two seasons, the government reduced the producer price of red sorghum by 40% in 1986. This pre-planting price announcement was followed by a 75% decline in commercial sorghum area. Commercial farmers refused to shift to the production of white sorghums because of fear of bird damage. During the following 1987-88 cropping season, commercial sorghum production levels and deliveries remained low. Yet the GMB sorghum stocks remained.

**Smallholder sorghum production and sales: 1970-1988**

Throughout the 1970s, sorghum was essentially a subsistence crop for the smallholder farm sector. Area planted peaked in 1974, then declined, during the late 1970s, as a result of the war. In contrast to the rise in commercial sector yields, smallholder yields were declining. On average, less than 3% of smallholder production was sold to the GMB.

Immediately after independence, smallholder sorghum production levels largely returned to the levels achieved ten years previous. Sorghum plantings regained their pre-war levels, but yields remained low. More significantly, smallholders began delivering an increasing proportion of their harvests to the GMB. In 1981, more than 7% of smallholder sorghum was sold. In 1985, with the introduction of GMB collection points throughout the small farm sector, approximately 25% of smallholder sorghum production was sold.

Record sorghum harvests were forecast for the smallholder sector in 1988. For the first time, smallholders were expected to deliver the majority of sorghum purchased by the GMB. Actual deliveries now appear significantly lower than the forecast levels, but the small farmer has clearly become an important market participant.

Two factors highlight the growth of smallholder participation in national sorghum markets since independence. First, smallholder sorghum sales have increased faster than production. Between 1980 and 1985, small farm production of sorghum increased by 15,000 mt. Deliveries to the GMB increased by almost 19,000 mt. The main surge in production occurred in 1981. In contrast, the major gain in smallholder sales did not occur until 1985. If smallholder production estimates are correct, sorghum retentions were declining.

Second, smallholder sorghum deliveries appear more closely dependent on market access than the official producer price. The sudden growth of smallholder deliveries in 1985 can largely be explained by the establishment of 135 temporary GMB collection points that year. The sharp decline in the number of collection points the following year brought a corresponding decline in smallholder deliveries. The

distribution of deliveries closely corresponds with the distribution of GMB buying points.[4]

The sharp decline in red sorghum prices announced in 1986 appears to have had a limited impact smallholder planting decisions. Total smallholder sorghum area increased during the 1986-87 cropping season. While market deliveries declined as a result of the drought, almost one-half of all sales in 1987 were of red varieties. Despite declining real producer prices, smallholder sorghum plantings again increased in 1987-88.

**Smallholder millet production and sales: 1970-1988**

Bulrush millet represents the second most important smallholder food crop after maize and is consumed in much the same manner. Finger millet tends to be used for village beer production and as a porridge for the sick. This crop is used as a maize substitute when maize supplies are depleted as a result of drought.

The production trends for bulrush and finger millet are difficult to interpret due to incomplete information (Table 2).

The area and production levels of both crops appear to have sharply fluctuated since 1970. Production levels of both crops seem to have sharply increased during the mid-1970s. Since then, millet areas have declined. For unknown reasons, average millet yields appear to be increasing.

During the 1970s and early 1980s, bulrush millet and finger millet were not controlled crops. Small quantities of these grains were purchased from producers directly by private sector millers and brewers. In 1984, the government established control over these crops in an effort to improve the incentives for smallholder millet production. Sales across district boundaries had to be made to the GMB.

The level of private sector bulrush and finger millet sales prior to 1984 is unknown. When first recontrolled, millet deliveries to the GMB stood at about 4,500 mt. Once the GMB collection point system had been established in 1985, millet deliveries increased more than tenfold. These now stood almost three times higher than smallholder sorghum deliveries.

As with sorghum, the impact of official product prices on millet production levels and marketing decisions remains ambiguous. The sharp decline in real producer prices between 1984 and 1988 seems to have had little impact on area planted. Delivery levels and the distribution of smallholder millet sales appear more closely related to rainfall levels and the changing number of collection points, than to official prices.

## GMB GRAIN SALES AND THE ACCUMULATION OF SORGHUM AND MILLET STOCKS

The recent buildup in small grain stocks can only partly be attributed to the growth of GMB intake. Perhaps more significantly, GMB sales of small grains onward to

[4]This relationship will be subjected to more detail analysis in the coming year.

**Table 2. Zimbabwe smallholder millet production and deliveries to the GMB, Zimbabwe, 1970 to 1988.**

| | Bulrush millet | | | Finger millet | | |
|---|---|---|---|---|---|---|
| Harvest Year | Area (000 ha) | Production (000 mt) | Sales (000 mt) | Area (000 ha) | Production (000 mt) | Sales (000 mt) |
| 1970 | 176.0 | 55.0 | 0.0 | 53.0 | 59.0 | 0.0 |
| 1971 | 191.0 | 73.0 | 0.0 | 35.0 | 51.0 | 0.0 |
| 1972 | 202.0 | 110.0 | 0.0 | 30.0 | 47.0 | 0.0 |
| 1973 | 225.0 | 109.0 | 0.0 | 69.0 | 56.0 | 0.0 |
| 1974 | na | na | 0.0 | na | na | 0.0 |
| 1975 | 441.0 | 146.0 | 0.0 | 76.0 | 38.0 | 0.0 |
| 1976 | 456.0 | 165.0 | 0.0 | 120.0 | 81.0 | 0.0 |
| 1977 | 497.0 | 191.0 | 0.0 | 141.0 | 87.0 | 0.0 |
| 1978 | 254.0 | 83.0 | 0.0 | 35.0 | 11.0 | 0.0 |
| 1979 | 233.0 | 88.0 | 0.0 | 150.0 | 58.0 | 0.0 |
| 1980 | 293.0 | 100.0 | 0.0 | 147.0 | 61.0 | 0.0 |
| 1981 | na | na | 0.0 | na | na | 0.0 |
| 1982 | na | na | 0.0 | na | na | 0.0 |
| 1983 | na | na | 0.0 | na | na | 0.0 |
| 1984 | na | na | 4.1 | na | na | 0.4 |
| 1985 | 241.0 | 120.5 | 44.7 | 93.0 | 72.2 | 13.1 |
| 1986 | 169.0 | 77.7 | 22.8 | 107.0 | 48.2 | 8.5 |
| 1987 | 187.3 | 56.5 | 1.9 | 109.2 | 40.4 | 0.5 |
| 1988[a] | 237.0 | 184.0 | 64.9 | 119.6 | 83.7 | 30.2 |

[a]Crop Forecasting Committee Estimates, 1987-88 season. na = data not available.
Source: Muir-Leresche (1985), GMB (various years), AMA (various years, a), AMA (various years, b), CSO (various years, b).

industry remained limited. The government set the GMB selling prices of small grains at levels designed to cover the GMB's basic storage and handling costs. In contrast, the selling and/or milling costs of maize were subsidized. As a result, small grain purchases were limited to uses for which there were no close substitutes. As stocks mounted, the GMB was faced with a choice of selling the stocks at a loss or reducing the prices at which it purchased small grains. No clear strategy was chosen. Consequently, the GMB is expected to incur a small grains trading deficit of over Z$25 million during the 1988-89 market year (AMA, various years, c).

**GMB sorghum stocks 1970-1988**

From 1970 to 1980, the GMB's selling price for sorghum averaged 35% higher than the price of maize (Table 3). As a result, domestic demand was limited to uses such as opaque beer brewing, for which demand was inelastic. This did not present a problem as long as GMB intake of sorghum remained low. Throughout the 1970s, sorghum deliveries to the GMB roughly equalled the level of onward sales to industry (Table 4). In the occasional years when intake was low, Zimbabwe imported small quantities of sorghum. When intake was well above domestic demand (greater than 20,000 mt), small quantities of sorghum were exported.

The decline in the sorghum-to-maize selling price ratio during the early 1980s was partially offset by a milling subsidy paid on the processing costs of maize. While sorghum sales to domestic industry increased in 1982, these remained equivalent to only 2% of industry purchases of maize.

The limited industrial market for sorghum became clearly evident when both smallholder and commercial deliveries increased sharply in 1985. While 13,000 mt

**Table 3. Official coarse grains selling prices (Z$/mt), Zimbabwe. 1970 to 1988.**

| Harvest Year | Red & white sorghum | Finger millet | Bulrush millet | Maize | Sorghum/ maize |
|---|---|---|---|---|---|
| 1970 | 55.60 | a | a | 41.70 | 1.33 |
| 1971 | 54.95 | a | a | 41.70 | 1.32 |
| 1972 | 54.67 | a | a | 41.90 | 1.30 |
| 1973 | 54.84 | a | a | 41.90 | 1.31 |
| 1974 | 54.56 | a | a | 43.25 | 1.26 |
| 1975 | 54.56 | a | a | 51.54 | 1.06 |
| 1976 | 71.75 | a | a | 51.54 | 1.39 |
| 1977 | 71.75 | a | a | 51.54 | 1.39 |
| 1978 | 90.00 | a | a | 57.07 | 1.58 |
| 1979 | 98.00 | a | a | 63.89 | 1.53 |
| 1980 | 117.00 | a | a | 89.00 | 1.31 |
| 1981 | 117.00 | a | a | 137.00 | 0.85 |
| 1982 | 117.00 | a | a | 137.00 | 0.85 |
| 1983 | 147.00 | a | a | 157.00 | 0.94 |
| 1984 | 165.00 | 365.00 | 281.00 | 177.00 | 0.93 |
| 1985 | 239.00 | 365.00 | 281.00 | 222.00 | 1.08 |
| 1986 | 239.00 | 365.00 | 281.00 | 222.00 | 1.08 |
| 1987 | 239.00 | 365.00 | 281.00 | 222.00 | 1.08 |
| 1988 | 281.00 | 365.00 | 281.00 | 222.00 | 1.27 |

[a]No purchases, not a controlled crop in this year.

Source: AMA (various years, a), AMA (various years, b), AMA (various years, c).

**Table 4. GMB intake and disposal of sorghum, Zimbabwe, 1970-1988.**

| Harvest year | Domestic deliveries (000 mt) | Imports (000 mt) | Exports (000 mt) | Local sales (000 mt) | Closing stocks (000 mt) |
|---|---|---|---|---|---|
| 1970 | 3.0 | 7.0 | 0.0 | 12.0 | na |
| 1971 | 4.0 | 9.0 | 0.0 | 13.0 | 1.0 |
| 1972 | 23.0 | 0.0 | 0.0 | 15.0 | 9.0 |
| 1973 | 26.0 | 0.0 | 8.0 | 21.0 | 6.0 |
| 1974 | 13.0 | 3.0 | 2.0 | 17.0 | 3.0 |
| 1975 | 5.0 | 12.0 | 0.5 | 18.0 | 2.0 |
| 1976 | 14.0 | 0.0 | 0.0 | 14.0 | 2.0 |
| 1977 | 14.0 | 0.0 | 0.0 | 14.0 | 2.0 |
| 1978 | 16.7 | 0.0 | 0.0 | 14.7 | 3.0 |
| 1979 | 19.9 | 0.0 | 0.0 | 17.4 | 6.0 |
| 1980 | 17.8 | 0.0 | 0.0 | 19.3 | 4.0 |
| 1981 | 30.4 | 0.0 | 0.0 | 18.4 | 15.9 |
| 1982 | 19.1 | 0.0 | 2.5 | 23.8 | 8.5 |
| 1983 | 5.3 | 8.7 | 0.0 | 18.3 | 3.9 |
| 1984 | 20.7 | 0.0 | 0.0 | 14.2 | 10.7 |
| 1985 | 82.0 | 0.0 | 13.4 | 21.5 | 56.0 |
| 1986 | 77.0 | 0.0 | 1.0 | 25.0 | 106.7 |
| 1987 | 3.8 | 0.0 | 2.0 | 24.0 | 76.8 |
| 1988[a] | 77.3 | na | na | na | na |

[a]Crop Forecasting Committee Estimate, 1987-88 season.
na = data not available.
Source: Muir-Leresche (1985), GMB (various years), AMA (various years, a), AMA (various years, b), CSO (various years, b).

were disposed of as food aid to Ethiopia, most of the increase in deliveries ended up in GMB stocks. Strong commercial deliveries in 1986 raised these stocks still further. By the end of the 1986-87 market year, the GMB held stocks equivalent to five years worth of domestic sorghum sales.

In early 1988, the GMB's sorghum selling prices were increased in order to partially offset the rising storage costs. This further discouraged industry purchases at a time when sorghum stocks were rapidly deteriorating. In mid-1988, the government authorized the GMB to dispose of 10,000 mt of this grain as animal feed at a 40% price discount. Even so, the GMB's trading loss continues to mount.

Low red sorghum deliveries in 1988 and the deterioration of red sorghum stocks have caused a shortage of malting quality sorghum required by the brewing industry. Paradoxically, imports of malting sorghums may be required, despite the persistence

of substantial GMB stocks. The government is under pressure to raise producer prices to promote red sorghum production while reducing the losses incurred in holding large low quality sorghum stocks.

**GMB millet stocks 1984-1988**

The GMB's stockholding position for bulrush and finger millet is even worse than that for sorghum. Since the GMB began purchasing these crops in 1984, sales onward to industry have been minimal. Since 1985, official selling prices for bulrush millet have remained 26% higher than the price of maize. Official selling prices for finger millet have been almost 65% higher. The only domestic purchases have been those essential for the production of established products.

At the end of the 1986-87 market year, bulrush millet stocks stood 34 times higher than the level of domestic sales. These would have been even higher if the GMB had not offered pig and poultry producers a 43% discount on almost 2,000 mt of grain. In 1988, the GMB is similarly offering a 33% discount of 10,000 mt of bulrush millet for stockfeed. As in the case of sorghum, this price cut is viewed necessary in order to dispose of deteriorating grain stocks. The 1988-89 GMB trading deficit for bulrush millet has been forecast at a level equal to almost three-quarters of the total cost of bulrush millet purchased over the previous four years.

At the end of the 1986-87 market year, finger millet stocks similarly stood 36 times higher than the level of domestic sales. The opaque beer brewing industry purchased small quantities to help flavor sorghum-based beer. A few specialty foods also used small amounts of finger millet. Yet, no prospect was available for expanded purchases.

In 1988, as with the other small grains, the GMB was authorized to dispose of 10,000 mt of finger millet at more than a 50% price discount. The forecast 1988-89 trading loss will be more than the total original cost of the finger millet purchased over the previous four years.

## REASSESSMENT OF THE JUSTIFICATION FOR HIGH SMALL GRAINS PRICES

The establishment of high official producer prices for sorghum and millet has been viewed as essential for improving smallholder incomes and for discouraging the shift of smallholder land out of the more drought-tolerant small grains to maize. Yet, the GMB's correspondingly high sorghum and millet selling prices have limited the competitiveness of these crops as industrial inputs and ultimately on formal sector consumer markets. The justification for the maintenance of high producer prices merits reexamination.

**High producer prices and smallholder income growth**

The maintenance of high producer prices as a means to support smallholder incomes assumes those producers in greatest need of such support sell small grains to the GMB. This strategy also assumes income support through a price incentive is more

effective than alternative investments of the GMB trading loss. Both assumptions can be questioned.

To date, large-scale commercial farmers have been the greatest beneficiaries of high red sorghum prices. When smallholder sales peaked following the 1985 harvests, commercial farmers still accounted for almost 75% of GMB deliveries.

While the largest beneficiaries of high white sorghum and millet prices have been smallholders, the distribution of these benefits has been heavily skewed (Table 5). In 1984-85, the last year of widespread, good rainfall for which delivery data is available, over one-half of all smallholder sorghum deliveries came from five of the 162 communal areas in Zimbabwe. These account for only 18% of the smallholder sector's sorghum crop area and 20% of its production. Five communal areas accounted for over 70% of smallholder deliveries of bulrush millet to the GMB. These accounted for 39% of the smallholder bulrush millet area and 42% of the estimated production. Finger millet deliveries, though concentrated, correspond more closely with the distribution of production.

**Table 5. Concentration of smallholder crop deliveries, Zimbabwe, 1984-85 cropping season**

| | Percent of total | | |
|---|---|---|---|
| | Deliveries | Crop area | Crop production |
| Sorghum | | | |
| Top 5 communal areas | 54 | 18 | 20 |
| Top 10 communal areas | 69 | 27 | 30 |
| Bulrush millet | | | |
| Top 5 communal areas | 71 | 39 | 42 |
| Top 10 communal areas | 85 | 48 | 53 |
| Finger millet | | | |
| Top 5 communal areas | 46 | 45 | 44 |
| Top 10 communal areas | 62 | 63 | 60 |
| Maize | | | |
| Top 5 communal areas | 38 | 19 | 25 |
| Top 10 communal areas | 52 | 25 | 30 |

Source: GMB (various years); AGRITEX (various years).

Survey data recording the distribution of crop sales within various communal areas displays even a narrower distribution of sales income[5]. Only 20% of small grain producers within each of the top selling communal areas may be responsible for 50-75% of total sector crop deliveries.

In effect, the additional income generated from high producer prices is largely flowing into the hands of better than average producers. Insofar as high GMB prices raise local village sorghum and millet prices, the poorest producers facing production deficits are being forced to pay more for their grain. The value of the disposable income of those facing the greatest food insecurity may be declining.

These observations are supported by the fact that only 27% of smallholder producers were even registered to sell crops to the GMB in 1985, the year of highest small grains sales from the smallholder sector. Every farmer registered will not sell in every year. Other farmers could sell through approved buyers or via friends, but the registered producers probably encompass the largest and most consistent sellers of crops.

In sum, a broadly-focused pricing policy will primarily affect those farmers who participate most actively in formal grain markets. In the case of coarse grains generally, and small grains in particular, this is a small proportion of the total. Alternative policies or programs could more efficiently increase the incomes or consumption levels of the poorest farm households who tend to suffer the most severe food security constraints.

**Promoting the production of drought tolerant crops**

The establishment and maintenance of high sorghum and millet prices has also been justified as a means to reverse the substitution of relatively less drought-tolerant maize for relatively more drought-tolerant sorghums and millets in the nation's low-rainfall zones. The existence of this trend is commonly assumed. Yet, available evidence contradicts these assumptions. Estimates of smallholder sorghum area during the 1987-88 cropping season are roughly equal to those for 1981 and only marginally lower than those in 1971. Estimates of smallholder millet area in 1987-88 are more than 50% higher than those available for the early 1970s.

The existence of this substitution trend may have been surmised from the observation that many farmers in drought prone regions of the country are growing maize. Further, smallholder maize acreage has been growing more rapidly than the acreage allocated to most other crops. The production of maize in highly drought prone, low-rainfall regions is contradictory to agronomic principal. Yet several explanations help justify these smallholder investments in the maize enterprise.

First, the high returns to maize achieved in the unusually good-rainfall year may more than offset the low returns obtained during several consecutive low-rainfall years. Dependable food aid programs may reinforce this sort of risk preference.

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[5]Prelimi :ry results from 1988 University of Zimbabwe surveys in Mudzi, Mutoko and Buhera. See also Rohrbach (1988).

Second, a review of extension worker yield estimates for alternative coarse grains during the 1986-87 drought year indicates relative yield risks associated with low-rainfall may be less than imagined. Maize still performed better than sorghum or millet in many communal areas receiving much less than their average 650 mm of rainfall. The improvement of sorghum and millet varieties could reverse this relationship. With varieties currently available, however, the production of maize in many low-rainfall regions could be justified.

Third, some farmers in the nation's low-rainfall regions may simply be willing to forgo grain yield in return for some alternative grain characteristic. Many of these farmers state their taste preference for maize. These preferences also appear linked with the relative ease of maize processing.

Finally it must be noted that official producer prices probably have little effect on the decisions of most producers in the low-rainfall and drought-prone regions. Few of these farmers have ever sold anything to the GMB. Deliveries occurring can be much more closely linked to the accessability of GMB buying points than to the level of official prices.

## THE POTENTIAL GROWTH OF SMALL GRAINS UTILIZATION BY INDUSTRY

The extent of price reductions required depends on the potential growth in industrial demand for small grains. As noted above, industry use of small grains has been relatively low and constant over the past 15 years. Purchases have been restricted for uses for which there are no close substitutes.

In a survey of five of the six largest coarse grain purchasers from the GMB, current small grain utilization patterns were assessed. A preliminary evaluation was conducted of economic factors constraining the expansion of small grain usage.

Since 1982-83[6], small grains accounted for less than 1% of coarse grain usage in the five firms surveyed (Table 6). The lack of close substitutability between the alternative grains is indicated by the relatively consistent levels of usage despite changes in price. Between 1982 and 1987, the GMB's selling price for sorghum increased 25%, relative to that for maize. Sorghum usage appears little affected. In effect, small grains appear closer compliments than substitutes with maize. Surprisingly, finger millet usage appears to have been largely unaffected by the establishment of product market controls in 1984. Throughout the 1982-83 to 1987-88 period, purchases of white sorghum were minimal and no use was made of bulrush millet.

Over the six-year period, the largest quantities of sorghum and millet were used in beer and stockfeeds. Beyond this, the small grains are simply used in specialty products. Only one company produced a product containing more than 15% sorghum. This was a 100% red sorghum porridge. In other products red sorghum was employed simply to impart a preferred reddish color and unique taste. Firms

[6]This was the earliest year the firms were allowed to provide data due to government restrictions.

**Table 6. Coarse grain usage (mt) in the production of alternative products, five firm sample, Zimbabwe, 1982 to 1988.**

| Product | 1982-83 | 1983-84 | 1984-85 | 1985-86 | 1986-87 | 1987-88 |
|---|---|---|---|---|---|---|
| Flour | | | | | | |
| Maize | 142,847 | 93,096 | 73,249 | 107,475 | 111,033 | 103,344 |
| Beer[a] | | | | | | |
| Maize | 45,660 | 44,000 | 3,600 | 41,200 | 7,100 | 42,200 |
| Red sorghum | 695 | 747 | 62 | 749 | 07 | 720 |
| Finger millet | 85 | 80 | 13 | 93 | 3 | 100 |
| Stockfeed | | | | | | |
| Maize | 3,000 | 2,000 | 2,000 | 2,000 | 2,000 | 2,000 |
| Red sorghum | 130 | 180 | 10 | 120 | 50 | 170 |
| Porridge | | | | | | |
| Maize | 383 | 618 | 65 | 585 | 60 | 550 |
| Red sorghum | 41 | 39 | 6 | 34 | 1 | 28 |
| White sorghum | 2 | 2 | 2 | 2 | 2 | 2 |
| Snacks | | | | | | |
| Maize | 20 | 21 | 4 | 22 | 3 | 24 |
| Subtotal | | | | | | |
| Maize | 191,910 | 139,735 | 19,538 | 151,282 | 50,716 | 148,118 |
| Red sorghum | 866 | 966 | 28 | 903 | 88 | 918 |
| Finger millet | 85 | 80 | 13 | 93 | 3 | 100 |
| White sorghum | 2 | 2 | 2 | 2 | 2 | 2 |
| TOTAL | 192,863 | 140,783 | 20,481 | 152,280 | 51,699 | 149,138 |

[a]Includes premix beer
Source: Industry survey (1988).

noted that in the case of most maize-based products, however, these traits discouraged the use of sorghum.

The lack of substitution across coarse grains partly reflects the high levels of small grain selling prices. Representatives of each firm were asked what sorghum selling price adjustments were required in order to promote greater use of these crops. The respondents indicated they would be interested in using greater quantities of red sorghum if current selling prices declined by 10-20% (Table 7).

**Table 7. Proposed selling price adjustments by interviewed firms, Zimbabwe, 1988.**

| | Percentage discount sought from current selling price[a] | |
|---|---|---|
| Firm | Red sorghum | White sorghum |
| A | 20 | 50 |
| B | 10 | 40 |
| C | 15 | 40 |
| D | 10 | 50 |
| E | 20 | 50 |

[a]Current selling prices for both red and white sorghum are Z$281/mt.
Source: Industry survey (1988).

**Table 8. Firm ratings of factors influencing sorghum use levels, Zimbabwe, 1988.**

| | Firm | | | | |
|---|---|---|---|---|---|
| Factor | A | B | C | D | E |
| GMB selling price | 1 | 1 | 2 | 1 | 1 |
| Flour selling price | 3 | 3 | 2 | 2 | 1 |
| Price of other grains | 2 | 1 | 2 | 3 | 2 |
| Level of consumer demand | 2 | 2 | 1 | 1 | 1 |
| Consumer concerns about price | 2 | 2 | 1 | 3 | 1 |
| Availability of technology | 4 | 3 | 1 | 1 | 1 |
| Cost of processing technology | 2 | 3 | 2 | 1 | 1 |
| Appropriate processing technologies | 1 | 3 | 1 | 1 | 1 |

Codes: 1 = very important, 2 = important, 3 = minor problem, 4 = not important.
Source: Industry survey (1988).

They would use greater quantities of white sorghum following a 40-50% price decline.[7] This implies a change in red sorghum prices from Z$281/mt to around Z$239/mt and a reduction in white sorghum prices from Z$281/mt to Z$155/mt. The GMB's current selling price for maize is Z$222/mt.

The five firms were also asked to rate a series of factors influencing their use of sorghum in current and future grain-based products. The GMB selling price was cited as the most important determinant of sorghum usage (Table 8). In addition, most of the firms questioned consumer acceptability of sorghum-based products. Consumers are believed to have a strong preference for maize-based products. Most of the firms also expressed concerns about the availability of appropriate processing technologies for sorghum. Technology investment costs were regarded as high. Such investments were also viewed as risky as long as the government's small grains market policy remained unclear.

In addition to the above constraints, four of the companies indicated improved grading of sorghum varieties is essential for greater utilization. It was suggested that such grading should distinguish variety differences required for different end uses. The respondents noted that grain currently received from the GMB includes mixtures of different varieties and substantial foreign matter. This makes grain processing difficult.

Gomez (1987) reviews the potential for expanded use of sorghum as a replacement for maize and wheat and in the manufacture of new products. This study identifies a potential demand for almost 500,000 mt of sorghum for products such as sorghum meal porridge, biscuits, clear beer, pasta, starch, a rice substitute, and glucose. Many of these alternatives still need to be tested for their economic and technological feasibility. Also, consumer preferences require further evaluation. But this report helps convey the potential scope for expanding domestic sorghum and millet food utilization.

Gomez did not consider the opportunities for the expanded use of sorghum and millets in stockfeeds. Yet, this could provide the largest single source of growth in sorghum and millet consumption over the next ten to twenty years. The only significant constraint to the expanded use of small grains in livestock feed is relative feed grain prices.

## FUTURE SMALL GRAINS POLICY

The development of an improved market policy for small grains requires a clear perception of the broad range of price and non price variables influencing production levels, market deliveries, and industrial demand. Available evidence has shown that the link between producer price adjustments and the food security of most sorghum

[7]White sorghum had been hypothesized to be a closer substitute to maize than red sorghum. These surprising results could reflect a preference for small quantities of red sorghum for specialty products. Greater usage of red sorghum might require larger price discounts. In other words, the demand schedule could be kinked. This issue will be subject to further investigation.

and millet producers is limited. The high levels of small grains stocks indicate the need for a reduction in both producer and consumer prices. In the long run, the welfare of both producers and consumers in the nation's low-rainfall regions can best be served by strategies aiming to balance sub-regional and national small grains supply and demand.

**Red sorghum market policy**

In late 1988, the Zimbabwe opaque beer brewing industry announced the existence of critical shortages in the availability of brewing quality red sorghum. Though stocks stood almost three times the average level of domestic industrial demand, most of these had deteriorated below standards required by the brewing industry. Paradoxically, despite the still high stocks, consideration was being given to the need to import malting quality red sorghum grain. An increase in red sorghum producer prices was offered to stimulate deliveries to the GMB.

The disruption of national red sorghum markets, during the mid-1980s largely resulted from an unexpected, and still difficult to explain, sharp increase in large-scale commercial farm deliveries in 1985 and 1986. Prior to 1985, marketed supplies and demand remained in rough equilibrium. Since 1986, the government has adjusted producer prices in response to each year's expected deliveries. Despite evidence of low demand, the only consumer price adjustments have been for limited quantities of deteriorating stocks. The losses associated with maintaining these stocks continue to mount. A new long-term market strategy is badly needed. This must encompass improved understanding of the determinants of red sorghum supply and demand.

Though accurate estimation of commercial sector red sorghum supply response remains difficult, the above assessment of recent production and sales patterns highlights several factors requiring consideration. Commercial producers are highly responsive to producer prices, particularly to the relative level of these prices. Since red sorghum represents a relatively minor crop, the reallocation of only small proportions of commercial land to and from sorghum can have a major impact on GMB intake.

The recent growth in commercial sector retentions of sorghum for animal feed represents an additional variable in the supply response equation. Over the past two years, commercial farmers have more than tripled their sorghum retentions for livestock feed. This results in part because feedgrain-to-beef price ratios have reached historically low levels. In 1986, commercial farmers were offered a Z$0.30/kg price incentive for export quality beef. Strong interest has been sparked in the establishment of pen-feeding enterprises. Longer-run trends in red sorghum use for feed will depend on livestock prices and competitiveness with its main substitute--yellow maize.

Smallholder supply responsiveness remains similarly difficult to estimate. Smallholder sorghum deliveries during the 1984-85 marketing year were originally forecast at 36,000 mt, but only 19,700 were delivered. In 1988-89, deliveries were

forecast at 67,500 mt. Actual GMB intake, however, may be closer to 15,000 mt.[8] These differences arise, in part, from difficulties encountered in the estimation of production levels, but they also indicate a lack of understanding of the range of factors influencing marketed output.

The above analysis suggests market deliveries may be more heavily contingent on the level of market accessability in red sorghum producing areas than on the level of official producer prices. Further investigation of these relationships is required.

A major ingredient in the future market outlook for red sorghum in Zimbabwe is the potential for expanding industrial demand. To date, such demand side considerations have been largely ignored. The structure of industrial demand has changed little over the last 20 years because red sorghum substitution has remained uncompetitive. Maize has been priced cheaper and industry has received little encouragement to develop alternative coarse grain utilization technologies. As long as such circumstances continue, red sorghum will remain a minor industrial input. Supply incentives will remain limited by demand constraints. Such demand constraints could be resolved through the establishment of a consistent and long-run strategy of promoting sorghum utilization.

**White sorghum and millet market policy**

White sorghum, bulrush millet, and finger millet--in contrast to red sorghum--are primarily smallholder sector crops. At least in the near term, market policy for these crops will primarily affect communal area producers. Policy adjustments will have the greatest impact on the limited number of small farmers participating actively in national grain markets.

As in the case of red sorghum, smallholder sales responsiveness for white sorghum and the millets is difficult to estimate. In 1988-89, smallholder bulrush millet deliveries to the GMB were forecast at 63,000 mt. Actual deliveries will be closer to 10,000 mt. Finger millet deliveries were forecast at 27,000 mt. Halfway through the marketing season these appear unlikely to reach one-tenth of this level.[9]

Again, one reason for these discrepancies may be inaccurate estimates of production levels. Alternative estimates of smallholder crop area frequently differ by more than 100% (Table 9). Alternative yield estimates have shown similar differences. Officially published (CSO, various years, c) estimates of smallholder sorghum production can only be viewed as extremely rough. These publications do not even provide estimates of millet production levels. Even if production levels were known, these would not necessarily correspond with the levels of market deliveries.

Perhaps more significantly, the development of a market policy for these crops must consider the requirements for stimulating a consistent and growing level of

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[8]These data are for both red and white sorghum. The forecasts were made by the CSO Crop Forecasting Committee based on information available during the midst of the production season. The latest estimate of 1988-89 deliveries was made in August 1988.

[9]See footnote 7.

**Table 9. Alternative estimates of coarse grains crop area for the smallholder sector Zimbabwe, 1987-88 cropping season.**

| Coarse grain | CSO | AGRITEX | |
|---|---|---|---|
| | agricultural survey | Extension worker | Aerial photo |
| Maize | 1,164 | 1,548 | 1,945 |
| Bulrush millet | 218 | 172 | 391 |
| Sorghum | 108 | 154 | 445 |
| Finger millet | 34 | 90 | 63 |

Source: CSO (various years, a), AGRITEX (various years), AGRITEX (1988).

industrial demand. The build-up of white sorghum, bulrush millet, and finger millet stocks has largely been a result of the simple lack of small grain purchases from the GMB. These crops have been priced out of the market. Substitution for maize and wheat has not been encouraged. Without industry purchases, the GMB will simply increase its stocks. In the future, producer prices must better reflect the determinants of industrial demand. Adjustments in regulatory and investment policies affecting industrial usage of coarse grains could further stimulate the usage of more drought-tolerant crops.

## SMALL GRAINS TECHNOLOGIES AND SMALLHOLDER FOOD SECURITY

Adjustments in market policies will have a limited impact on the food security of the majority of smallholder small grain producers, given their lack of participation in national markets. A larger and more direct impact will come from improvements in crop production technology geared to production systems characterized by limited resources. Such technologies could serve to improve average yields or raise the minimum yield experienced in years of drought. Improved technologies could also serve to reduce storage losses and reduce processing costs.

Survey results in some of the major sorghum and millet producing regions of the country indicate few of these farmers employ fertilizer or insecticide.[10] Yet, these farmers have shown an almost universal proclivity to adopt hybrid maize. Such adoption patterns indicate a clear perception of the value of the relatively low cost

[10]Initial results of SADCC/ICRISAT and UZ/MSU surveys during the 1987-88 and 1988-89 cropping seasons.

seed input. In contrast, the chemical inputs are viewed as highly risky or as offering low returns.

Until recently, little breeding research had been conducted to develop improved sorghum and millet varieties or hybrids attuned to the needs of Zimbabwe farmers. Recent advances by the SADCC/ICRISAT and Zimbabwe sorghum and millet research programs offer the prospect for major improvements in smallholder yields. These are likely to have a substantially larger impact on smallholder food security than simple adjustments in alternative coarse grain prices.

The ultimate impact of these biological research gains on domestic small grains markets depends on the specific form of the technological advance (*e.g.*, its degree of adaptability) and its relationship to consumer preferences. In recent University of Zimbabwe surveys in Buhera Communal Area, farmers in three out of six wards expressed a strong preference for consuming maize. In contrast, each ward was dominated by sorghum and millet production. Given good access to producer and consumer market outlets, these households could sell their small grains and purchase maize. Some farmers were doing this.

Market analysts must recognize that the impact of improved sorghum and millet varieties will depend on the grain characteristics. Alternative variety traits could lead to increased small grain consumption or to an increase in market deliveries. Smallholders also have the option of feeing greater quantities of sorghum and millet to livestock. Animal sales could fund larger purchases of maize.

Improved sorghum and millet varieties are probably essential for improving smallholder food security in Zimbabwe. The form of this relationship will depend, however, on the relative correspondence between variety characteristics and alternative channels of consumer demand. Food security may be attained either through direct consumption or via the income generated by market sales of small grains or small grain-based products.

This analysis has shown that adjustments in market policy will not provide a sufficient basis for improving smallholder food security. This must be coordinated with improvements in small grain technologies, but the reestablishment of domestic small grains market equilibrium will ultimately prove necessary to support expanded sorghum and millet production.

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