

# FOOD SECURITY FOR SOUTHERN AFRICA



*Edited by*  
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University of Zimbabwe UZ/MSU Food Security Project

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## CHAPTER NINE

### WHEAT POLICY OPTIONS IN ZIMBABWE AND SADCC COUNTRIES: Preliminary Findings

Jim Longmire, Peter Ngobese and Solomon Tembo

#### WHEAT IN THE SADCC REGION

Traditionally, wheat has not been a major staple food in the SADCC countries. However, demand for wheat is growing rapidly in the region. At the same time, few of the countries have a sizeable domestic wheat industry. Thus, the region relies on imports for two-thirds of its wheat consumption. Table 1 shows that only 4 SADCC countries have wheat production exceeding ten thousand tonnes per annum. The scope for expanding production in the region is limited because environmental conditions of some SADCC countries simply do not favour the economic production of wheat. Nevertheless, wheat's productivity in more tropical environments is being improved (CIMMYT, 1985). Some economic considerations for developing a domestic wheat industry are discussed in Byerlee and Longmire, (1986).

This chapter reports on work being conducted on wheat in Zimbabwe, the largest wheat producing country of the SADCC region. We hope that the study will serve as a model for similar studies in other SADCC countries, and other countries of Africa. In the Zimbabwean case, much of the analysis is on the question of the real costs of expanding domestic production versus importing wheat, especially when world wheat prices are at an all-time low. For some other SADCC countries, other issues might receive more attention.

Zimbabwe has a policy of seeking self sufficiency in basic foodstuffs, including wheat. Although 85 percent of consumption of wheat is locally grown, the demand for bread and other wheat products is growing faster than demand for other food staples. By the year 2000 Zimbabwe could

Table 1: Wheat Supply and Utilization in the SADCC Region, 1985

Country	Production	Imports	Consumption	Self Sufficiency
	'000 t	'000 t	'000 t	Percent
Angola	7	174	180	4
Botswana (1)	1	28	29	4
Lesotho	18	77	95	19
Malawi	0	30	28	0
Mozambique	3	103	106	3
Tanzania	85	56	134	63
Swaziland (1)	1	14	15	7
Zambia	15	74	89	17
Zimbabwe	210	112	248	85
SADCC Total	340	694	924	37
South Africa	2 200	0	2 000	110

Source: US Department of Agriculture, Economic Research Service

(1) FAO data 1984. Consumption estimated as production plus imports.

readily be consuming more than double the amount of bread and other wheat products currently consumed. Because of rationing, the amount currently consumed is also lower than would be the case with unrestricted allocation of supplies.

The plan of this paper is as follows. A brief analysis of growing demand for wheat products in Zimbabwe is followed by a review of wheat production, drawing heavily upon a 1986 University of Zimbabwe survey of commercial wheat growers. The questions of expanding domestic production, slowing consumption growth and importing wheat are then considered. The focus of this part is on the economics of expanding production. Finally, we present the main findings and suggest high priority areas for both technical and economic research.

WHEAT CONSUMPTION TRENDS

Demand for wheat has grown rapidly in Zimbabwe, in the past 25 years (Table 2). Consumption of wheat products has trebled from 84 000 tonnes in 1965 to just under 250 000 tonnes last year. This represents an annual growth of almost 5 percent. In the late 1970s the country was more than self sufficient in wheat. However, very strong demand growth since then has led to the need for imports. Furthermore, millers and bakers contacted recently indicated that consumption could expand by more than 10 percent if the rationing of wheat to millers, implemented in 1982, was removed.

The principal causes of this growth in demand have been the increase in population and real income per capita, rapid urbanization, changing lifestyles, shifting consumer preferences and bread subsidies. Similar patterns of demand growth have been observed in many countries of the developing world (Byerlee, 1983). Bread is a convenience food, requiring much less time and fuel in preparation than other major food staples. High costs of fuel for cooking have probably been an important factor encouraging households to switch to bread. Another important factor is the increased emphasis being placed on convenience. The growth in demand for bread in Zimbabwe is not confined to the cities. Consumption has grown rapidly in rural areas as well and has the potential for further expansion, especially if additional outlets were to become available. Of the 33 registered bread bakeries in 1980, 29 were located in major cities.

Using the following data, and the assumption that a 10 percent increase in real income per capita leads to a 5 percent increase in per capita bread consumption, consumption was projected to the year 2000. A projected population of 14 million was used and total consumption of wheat products in the year 2000 is estimated to be around 500 000 tonnes, or a doubling over the next 15 years.

Table 2: Wheat Consumption in Zimbabwe, 1965 to 1985

Year	Total Population	Consumption Total	Per Capita	Real Income/ Capita	Real Price Bread	Real Price Maize Meal
	mill.	'000t	kg	Z\$	Zc/loaf	Zc/kg
1965-66	4.4	84	19.0	441	42	30
1970-71	5.3	116	22.0	724	50	28
1975-76	6.3	146	23.4	840	48	26
1980-81	7.2	205	28.5	951	42	20
1985-86	8.4	248	29.7	758	45	30

Source: GOZ and Grain Marketing Board

Note: One loaf of bread weighs 500gm.

#### WHEAT PRODUCTION IN ZIMBABWE

Although wheat has been grown since 1890 in Zimbabwe, a sizeable industry has only emerged in the past 20 years. In 1965, only 4000 tonnes of wheat were grown in the country, meeting 4 percent of total requirements. The 1986 crop yielded 245 000 tonnes. The development of Zimbabwe's wheat industry has been largely due to expansion of irrigation facilities and the adoption of input-responsive semi-dwarf wheats. The national average wheat yield of Zimbabwe is well over 5 t/ha and is the highest in the Third World. Currently, wheat is grown exclusively during the cool winter period (May-September) under irrigation.

Over the past two decades the wheat industry has expanded mainly on 350 to 400 large-scale farms, which presently contribute 94 percent of the wheat crop. About 4 percent is produced on state farms. Communal farmers are producing around 2 percent of total output, most of which is for home consumption or local markets. Wheat production by the latter has been historically confined to the Eastern Districts.

Within the large-scale commercial sector, about 70 percent is produced on the highveld, above 1 200 metres. Soils in

this region range from sandy-loams to heavier clays. The remainder is produced in the middle and lowveld, down to 400 metres. The soils of the latter are more alluvial, with greater variability than the highveld. Wheat in the highveld is grown between latitudes 16.5 - 20 degrees south, and 19.5 - 22 degrees south in the lowveld.

#### Water Applied

Wheat in Zimbabwe is largely irrigated by sprinkler, in contrast with flood irrigation in most other developing countries. The main equipment used in Zimbabwe is hand-moved, although it is recognised that mechanically-moved systems offer benefits in reduced labour input, lower pumping costs and more precise application. Pumping is virtually all electrical, so charges for electricity are an important cost component.

The amount of water applied to wheat varied considerably across the 41 commercial farmers surveyed during the 1985/86 season. On average the total water applied to wheat was 570 mm/ha. However, some farmers were applying as little as 360 mm/ha and others more than 800 mm/ha. Most farmers have adopted some form of water scheduling to cut back on water applied. Those with relatively low rates of water application have managed to save on water and costs of application without an apparent loss of yield. This is demonstrated in Figure 1, which shows the relationship between water applied and wheat yield by farm.

The relationship is very weak, suggesting that there is potential to save water without significant losses of yield. From the chart it can be seen that some farmers can achieve yields of 5 t/ha with around 400 mm/ha applied while others achieved the same yield even though they applied more than 600 mm/ha.

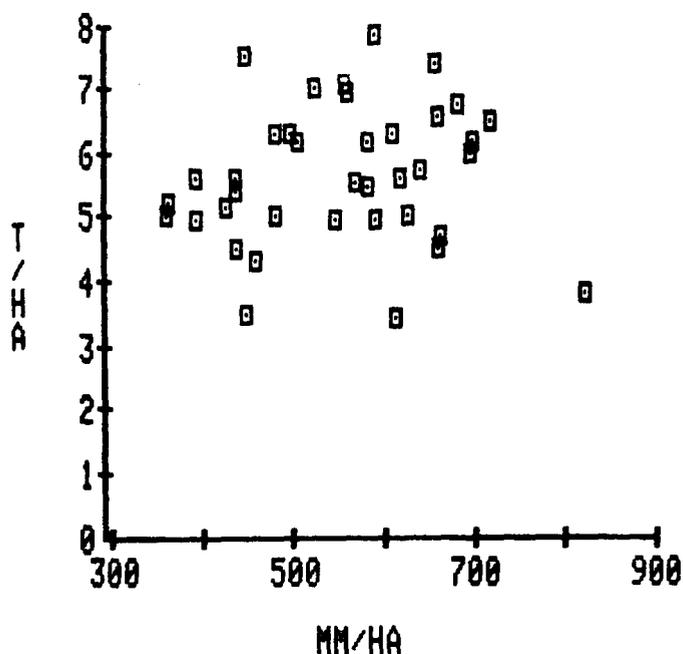


Figure 1: Wheat Yield Related to Water Applied  
Source: Wheat Survey, 1986

Analysis was undertaken to attempt to explain the amount of water applied on wheat. The key variables hypothesised to affect this were: soil types, location, water source and pumping costs. However, these variables explained less than 5 percent of the variation in water applied between farmers. When the average application by source was calculated, some differences were observed. The average application by source was:

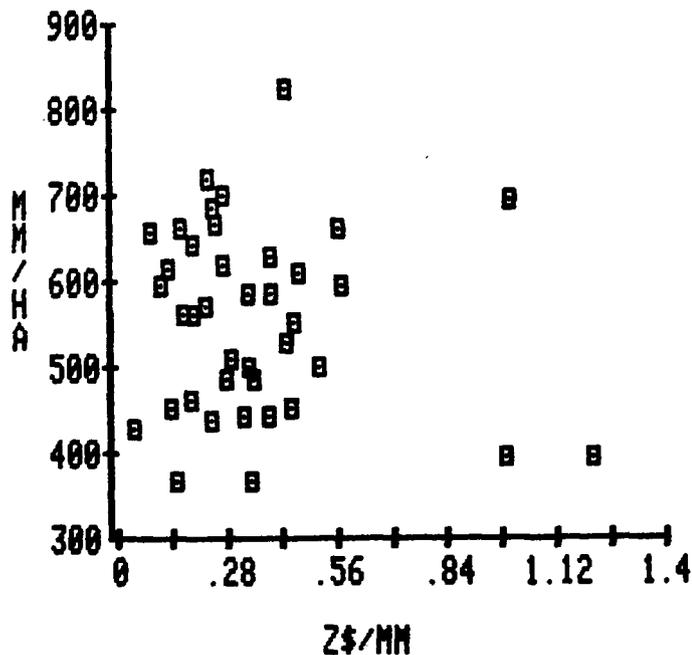
Borehole	500 mm/ha
Own dam	530 mm/ha
Government dam	540 mm/ha
Shared dam	550 mm/ha
Flow right	630 mm/ha

This pattern suggests that the water applied is responsive to institutional and economic factors.

A stronger relationship was hypothesised to exist between water applied per hectare and unit cost of water applied (\$/mm), Figure 2. Other than giving an indication of the average cost of applying a unit of water (\$0.35/mm), the relationship was also found to be weak.

The water efficiency in growing wheat was calculated by dividing wheat yield (t/ha) by total water applied per hectare (mm/ha). The average of this was 10.6 kg wheat/mm of water applied. There was wide variation in water efficiency on wheat, ranging from 4.6 to 16.7 kg/mm.

Further analysis of water application efficiency was conducted and the main relationships are presented in Figures 3 and 4. Figure 3 shows that as wheat yield increased water efficiency also increased, indicating that, in general, farmers with higher yields were more efficient in their water application. However, an even more significant finding of the analysis was that increased



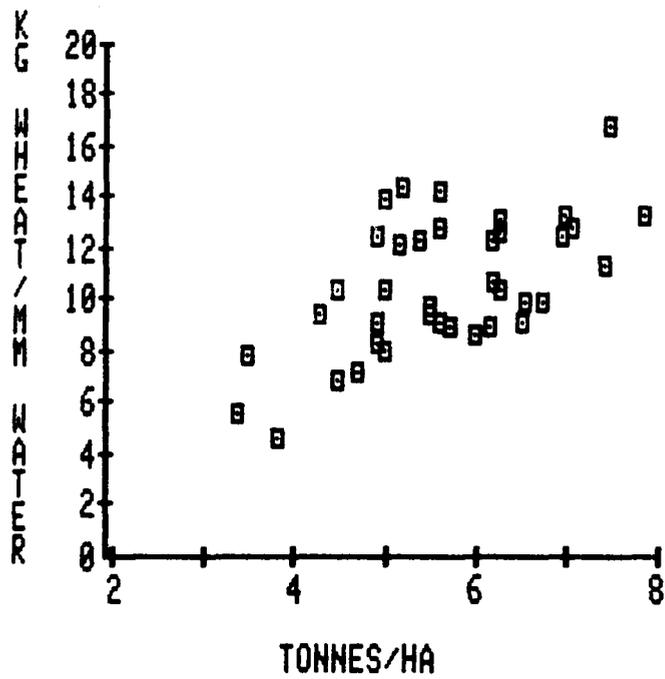


Figure 3: Water Efficiency against Wheat Yield  
Source: Wheat Survey, 1986

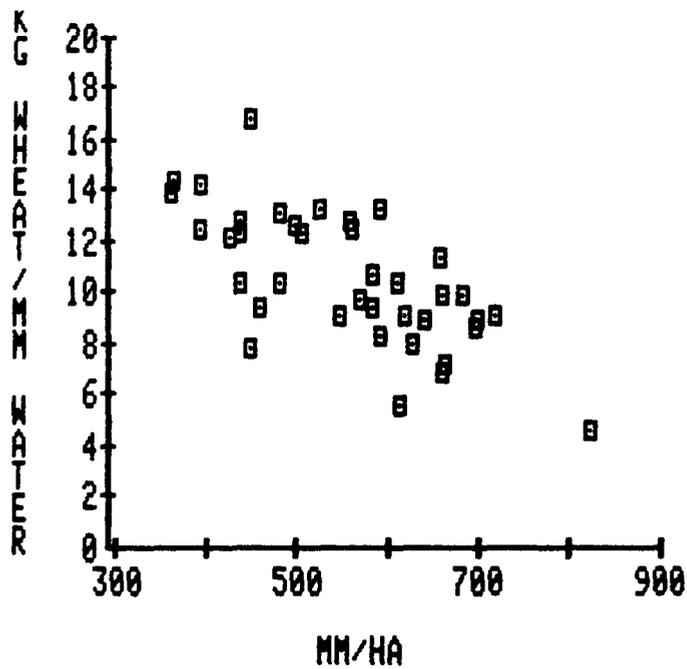


Figure 4: Water Efficiency Against Water Applied  
Source: Wheat Survey, 1986

application of water resulted in a general decrease in water efficiency, as shown in Figure 4. This preliminary evidence also suggests that there is scope for improving water efficiency by reducing water use.

#### Factors Determining Wheat Yield

A regression analysis was undertaken to determine the key factors affecting wheat yields across farmers surveyed. The explanatory factors included in the analysis were: variety, amount of nitrogen applied, amount of water applied, previous summer crop and soil type. The equation estimated for 1985 yields was:

$$\begin{aligned} \text{Yield} = & -5.2 + .105 \text{ Variety} + .012 \text{ Nitrogen} \\ & \quad (1.44) \quad \quad \quad (2.63) \\ & - .00022 \text{ Water} + .501 \text{ Summer Crop} + .437 \text{ Soil Type}, \\ & \quad (-.18) \quad \quad (1.59) \quad \quad (1.39) \\ \bar{R}^2 = & .23, \quad \text{D.W.} = 2.47 \end{aligned}$$

where:

Yield	=	average wheat yield, t/ha
Variety	=	year of release of variety, if released in 1982, equals 82
Nitrogen	=	average nitrogen applica- tion, kg/ha
Water	=	average water application, mm/ha
Summer Crop	=	1 if previous summer crop is leguminous, 0 if non- leguminous
Soil	=	1 if clayey, 0 if sandy, and t-statistics are in brackets.

Although this equation explained only 23 percent of the variation in wheat yields, it generally conformed to expectations. For example, the estimate of the varietal effect suggests that an extra 105 kg/ha per year has been associated with the release of new varieties and related production practices of farmers growing new varieties. The positive relationship between nitrogen applied and yield suggests that on average each unit of nitrogen added

12 kg of wheat per hectare. The yield of wheat following leguminous crops is estimated to be about 500 kg/ha higher than yield of wheat following non-leguminous crops. Similarly, yields on clayey soils on average were over 400 kg/ha higher than yields on sandy soils.

Interestingly, no meaningful relationship between wheat yield and water applied is observed in the above equation. A non-linear (quadratic) relationship between wheat yield and water applied was then estimated with the other variables above remaining in the new equation in linear form. Again a very weak statistical relationship was estimated between water applied and wheat yield. However, from these estimates the point of maximum yield with respect to water applied was calculated. This was calculated to be approximately 580 mm of water applied. This adds further to the hypothesis that a sizeable number of farmers might be over-watering wheat.

### THREE BASIC OPTIONS

There are three basic options that can be used to meet the growing demand for wheat products in Zimbabwe. These are:

- o expand wheat production
- o adopt policies to slow consumption
- o import wheat

Which of these options or combination of options to pursue is ultimately for commercial and political judgement, but in the next three sections we consider some economic factors to aid in making important for the policy choice.

### EXPANDING WHEAT PRODUCTION

The survey and developments over the last twenty years have shown that further expansion of wheat production in Zimbabwe is feasible. What is at issue is the extent and

cost of such expansion. These considerations are affected by the availability, cost and efficiency of use of water, a key limiting factor to further wheat expansion. Also important are the prices that would be necessary to induce expansion and to encourage substitution at the margin towards wheat.

The farmers surveyed were asked to rank the constraints on increased wheat production on their farms in order of importance. The results of the open-ended question in the survey were as follows:

<u>Constraint on Higher Production</u>	<u>Percentage</u>
Low profitability	46
Lack of irrigation water	21
Cost of capital for irrigation development	18
Land fully utilised	8
Lck of combine capacity	3
Other	4

The first three of these factors are considered in the discussion that follows.

Wheat farmers were also asked a follow up, on what can be done to double wheat production in Zimbabwe in the next fifteen years. This was also an open-ended question. The results were as follows:

<u>What can be done to expand</u>	<u>Percentage</u>
Increase the producer price	49
Government build more dams	26
More low-cost irrigation credit	10
Reduce input costs	8
Greater availability of farm machinery	5
More yield research	2

What do the above results tell us? Farmers believe that production can be expanded in various ways, and it is a question of weighing these different suggestions. In addition there are two other ways of possibly expanding

wheat production considered here: using water more effectively and growing summer wheat.

### Producer Prices

Studies from a number of countries suggest that industry-wide production of wheat is responsive to price incentives. The question for Zimbabwe is how responsive to producer prices in the future will wheat production be? The adjustments of the industry to price changes in the late 1970s and in the early 1980s suggests there is some responsiveness. Evidence from other countries with irrigated wheat grown in rotation with summer crops also adds weight to this point. For example, Seeley (1985) reports that for every 10 percent increase in producer prices in Pakistan, India, and Egypt farmers responded by increasing production between 1 to 8 percent.

In the case of Zimbabwe, the degree of price responsiveness is likely to be on the low side of these estimates. This is because of some constraints faced by the industry (e.g. lack of combines, spare parts, etc.) as well as the lack of opportunity to increase yield further by applying more purchased inputs. Generally, studies of supply response in many African cases suggest that responsiveness to prices is low because of constraints faced by industries (Eicher, 1986). Hence, raising real producer prices might have a limited impact on total output and would tend to be an income transfer to wheat farmers.

Another factor affecting the aggregate area planted to wheat will be the real price to farmers and the relative profitability of alternative crops (Figure 5). Since wheat already occupies 95 percent of the winter irrigated area on wheat farms, there is little potential for further substitution of wheat for other winter crops on existing wheat farms. However, there is scope for substituting water away from summer crops to wheat. In addition, some farmers

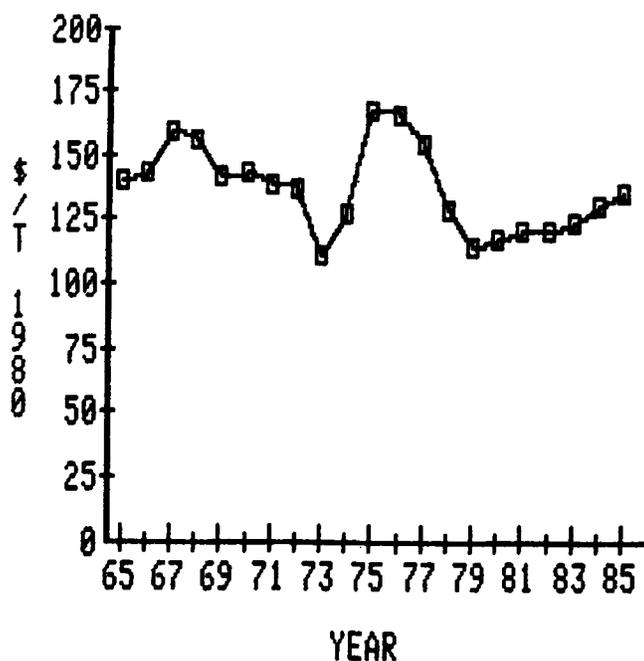


Figure 5: Real Producer Price of Wheat  
Source: Wheat Survey, 1986

currently not growing wheat might be encouraged to start producing wheat if prices of export crops decline relative to wheat. Such thinking might be currently occurring as commercial farmers seek to diversify out of maize.

Previous studies suggest that the producer price of wheat in Zimbabwe has been around import parity, or slightly above (Muir-Leresche, 1984). Most export crops have been priced above export parity, notably maize. Currently, with severely depressed international prices, both the producer prices of wheat and maize are above the world equivalent prices based at the farmgate. There is probably a good case for setting a price of import-competing goods, including wheat, above import parity in Zimbabwe, and in other SADCC countries, given the current shakeout in the international grains markets and the potentially high costs of future importation through South Africa. On the same basis the price of export crops moving into the world market via export ports in Southern Africa would have to be lowered.

### Expanding Irrigation Water

The potential for irrigation development in Zimbabwe has been reviewed by a number of specialists (Watermeyer 1981, Blackie et al, 1984 and World Bank, 1984). Currently, the total area irrigated is 165 000 hectares. The area of land suitable for irrigation has been estimated to be 600 000 hectares. However, estimates by the Ministry of Energy and Water Resources and Development indicate that there is sufficient water from runoff in Zimbabwe to irrigate approximately 430 000 hectares. This suggests that there is scope for future development of irrigation, although most remaining water developments will be in less accessible and naturally suitable locations. Moreover, the demand for water for urban and industrial use is growing rapidly. A number of catchment areas in wheat regions have been restricted from further private water development.

The main constraints on future irrigation development are economic. The costs of schemes are increasing over time, especially the costs of capital and the increasing cost of construction and delivery systems for less suitable sites. Some indication of how costs of development of dams for irrigation was obtained by asking wheat farmers the actual costs of dams built, the volume and the year of completion. Only a limited number of responses were obtained. These are summarised in Table 4. The real (inflation adjusted) costs of dam construction per unit area irrigated are shown in Figure 6. These indicate that over time private dams are becoming increasingly expensive. A similar trend probably exists for public sector dams. Data were obtained on the budgeted cost of 11 proposed public dams (Mitchell, 1986). The average unit cost of water from these public sector dams was estimated to be Z\$132 per thousand cubic metres, similar to the unit costs of water from private dams in 1985.

More Effective Use of Water

From the results of this preliminary study, more effective use of irrigation water on wheat is a strategy worthy of further research in Zimbabwe. There is little information on the response of wheat varieties to water applications in Zimbabwean conditions. If more efficient use of water can be achieved, greater wheat output will be realised from a given stock of water by applying less water per hectare for equivalent yields and applying the additional water to a larger area of wheat. Alternatively, less water might actually lead to reduced yields, but the water saved would more than offset this reduction when applied to a larger area. In addition, reducing application losses through improved irrigation technology would add to the amount of wheat that could be grown from the water available.

The economic aspects of such a strategy were analysed for this study. Using preliminary wheat budgets, the profitability of wheat under different water regimes and associated levels of yield was calculated. Although a reduced input of water would probably be associated with reductions of other purchased inputs, for this analysis we held those constant. Thus, the only factors varying in this analysis were the amount of water applied and associated wheat yield. The relationship between wheat yield and water applied was based upon data reported in the following studies (Fischer, Lindt and Glave, 1977; French and Schultz, 1984; and CIMMYT 1986). The results are presented in Table 5.

Some interesting relationships can be drawn from the data above. First, the point of maximum water efficiency is well below the point of maximum wheat yield (also the point of maximum gross returns per hectare). Maximum water efficiency is around 350-400 mm/ha, whereas yield is assumed to peak at around 650-700 mm/ha. However, the point of maximum net returns to land (including capital and

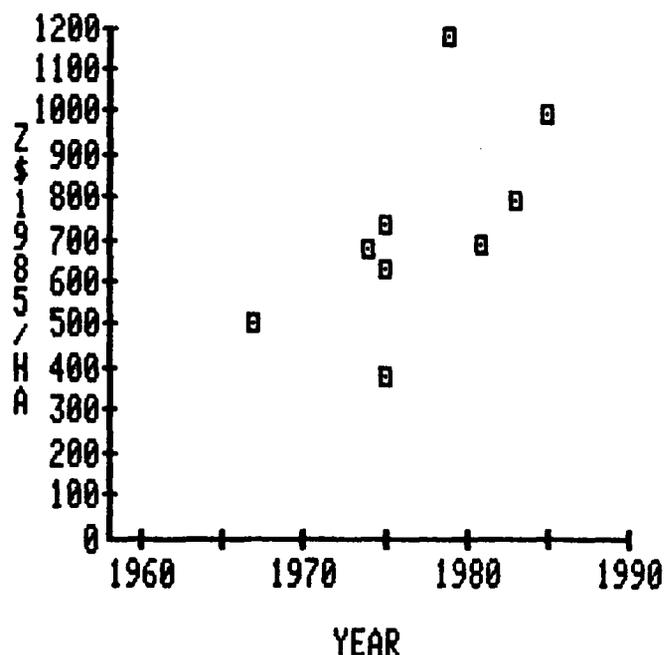


Figure 6: Real Capital Costs of Private Dams  
Source: Wheat Survey, 1986

Table 4: Capital Costs of Constructing Dams on Selected Wheat Farms in Zimbabwe, 1967 to 1985

Year Installed	Capital Cost	Capacity	Cost per Unit of Water	Cost per Unit of Area
	Z\$	000m <sup>3</sup>	Z\$/000m <sup>3</sup>	Z\$/ha
1967	23 000	1 000	23	115
1974	33 000	810	40	204
1975	40 000	850	47	235
1975	5 000	125	40	200
1975	12 000	500	24	120
1979	120 000	300	400	2 000
1979	20 000	185	108	540
1981	96 000	1 160	83	414
1983	170 000	1 320	129	643
1985	37 000	187	198	989

Source: Wheat Survey, 1986

management) is around 500 mm/ha. But land is not the limiting factor in wheat production. Net returns to water, an even more important criterion, occurs at an application level of around 440 mm/ha. These results are based on a

Table 5: Estimated Levels of Profitability for Assumed Levels of Water Applied and Assumed Wheat Yields, Natural Region II, Zimbabwe, 1986 Prices

Water Applied mm/ha	Number Irrig- ations	Wheat Yield t/ha	Water Effic- iency kg/mm	Net Returns to:			
				Land Z\$/ha	Water Z\$/mm	Labour Z\$/hr	Cash %
792	18	6.00	7.6	199	.98	1.32	22.6
748	17	6.05	8.1	249	1.06	1.56	26.3
704	16	6.10*	8.7	298	1.15	1.81	30.2
660	15	6.10*	9.2	333	1.24	2.03	33.3
616	14	6.05	9.8	356	1.31	2.21	35.6
572	13	6.00	10.5	378*	1.39	2.41	38.0
528	12	5.88	11.1	381*	1.45	2.53	39.0*
484	11	5.70	11.8	369	1.49	2.59	39.0*
440	10	5.50	12.5	352	1.53*	2.63*	38.5
396	9	5.05	12.8*	267	1.41	2.29	32.3
352	8	4.50	12.8*	156	1.17	1.70	23.2
308	7	3.20	10.4	-166	0.22	-0.59	-6.3
264	6	2.00	7.6	-442	-0.94	-3.43	-27.2

Source: Preliminary Budgets for wheat.

Note: Net returns also includes returns to capital and management. Maximums are denoted by an asterisk.

simplified crop-water relationship. However, they are probably indicative of tradeoffs involved.

Farmers are also concerned about risk in their water management and the results summarised in Figure 7 indicate some of these considerations. Because of the steep decline of net returns to water to the left of the point of maximum, risk averse farmers would optimally apply more water than at the profit maximising level. This might explain partly why some farmers are applying high amounts of water.

The above analysis considers profitability per hectare. The farm wide perspective is also of interest. For example, take a hypothetical scheme of 40 hectares irrigation in which a farmer is maximising yield. He will be applying 660 mm/ha, a total water application on wheat of 264 000 cubic meters. If the farmer then applied this water at the rate of maximum net return to water, 440 mm/ha, he could irrigate 60 hectares. This would mean an

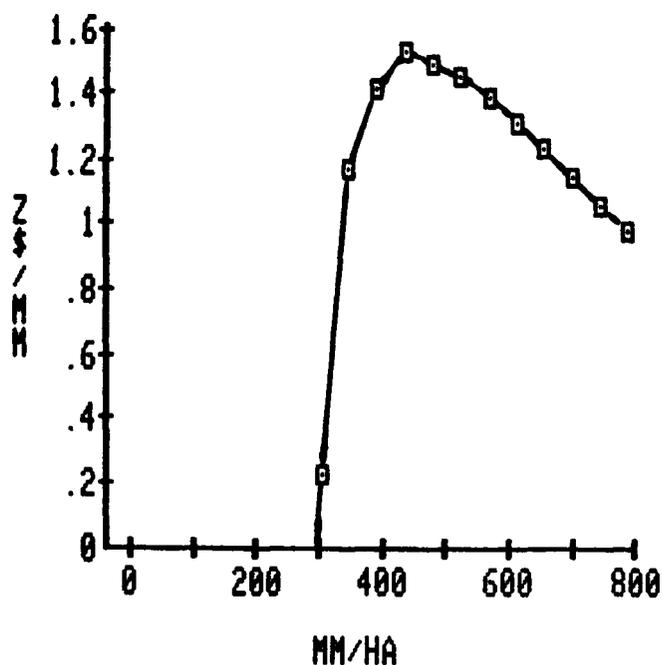


Figure 7: Net Returns to water and Water Applied  
Source: Wheat Survey, 1986

increase in total wheat production from 244 tonnes from 40 hectares to 330 tonnes off 60 hectares. In addition, net returns from the 40 hectares would be Z\$13 320 and Z\$21 120 from 60 hectares. In this particular case, if this increase in net returns is sufficient to cover the interest and finance costs of expanding the wheat area and associated risks, then the change would be attractive.

Clearly, these results depend upon the relationship between wheat yield and water application and the assumption that extra irrigable land is available. There is scope for further refinement of this analysis, especially with more precise technical relationships. Nevertheless, this is one promising option for expanding wheat production in Zimbabwe that deserves further investigation.

#### Other Productivity Increasing Strategies

In addition to more effectively utilising water, there is

also the potential for further improving wheat productivity in Zimbabwe. The most obvious way that this can be achieved is through varietal improvement. The estimated increase associated with varietal improvement and related crop management has been sizeable, probably close to 100 kg/ha per year. There is no obvious reason why this underlying rate of productivity should slow down in the next 15 years. A speed up in the adoption of new varieties would also add to this productivity growth. Yet another way of adding to this productivity growth in Zimbabwe's case is the selection of more water-efficient wheat varieties.

Overall, the scope for yield increases through additional fertilizers and chemicals seems limited. It appears that farmers are applying close to the economically optimal levels of these inputs. If the prices of these inputs were reduced from current levels, relative to wheat prices, an increase in input use would occur. If the machinery fleet could be upgraded and increased, some marginal gains in yield could also be expected. Other new crop management methods might have the potential to increase yields. However, there is a considerable time lag in learning to apply these methods to the Zimbabwean situation. Overall, the skills and managerial capacities of wheat farmers are high so the scope for improvement through extension and training is marginal. It is interesting to note that much of the extension advice and an increasing share of crop management research on wheat in Zimbabwe is being conducted in the private sector.

#### Summer Wheat

Summer wheat production is an option for expanding production that is being studied. Wheat is currently being tested for suitability to high rainfall areas in the cooler eastern highlands. In addition, some trials have been conducted near Harare. The critical factor in the development of summer wheat is its ability to cope with

diseases. In addition, there is a concern that summer wheat could act as an incubator of diseases and transfer these to the winter crop. Given the conditions in the cooler eastern highlands, triticale might be worthwhile evaluating there. Triticale is a man-made crop, formed by a cross between wheat and rye with strong disease tolerance.

Maize yields in the areas where summer wheat has been targeted are around 2.5 t/ha on small farms. With the ratio of farm prices of wheat to maize being 1.7 on small farms in this region, summer wheat yields would break-even with maize at around 1.5 to 2 t/ha and would probably have to be significantly higher on farmers' fields before they would adopt the technology. On larger farms now receiving lower prices of maize for the 1986/87 crop year, the breakeven summer wheat yield would probably be higher. Whether or not such yields can be achieved is an issue for crop research.

#### SLOWING GROWTH IN CONSUMPTION

There is little doubt that the underlying demand for wheat in Zimbabwe will grow strongly in the next 15 years. However, there is the opportunity through price policies, food product development and milling research to have an impact on the rate of growth of demand for bread. By increasing prices of bread to prices of maize and other staple foods, there is the scope to slow the growth in consumption of bread in Zimbabwe over the longer term. Similarly, new maize product development and further mixing of flours, especially those of maize and sorghum, might help slow the growth in consumption of wheat.

Wheat is a regulated product in Zimbabwe with the Grain Marketing Board having sole responsibility for trading in the commodity, both imported and domestic. Pricing of wheat or wheat products is controlled at the producer

level, mill level, and the wholesale and retail levels in Zimbabwe. Generally, the margins for the milling, baking and retailing of wheat products in Zimbabwe are low (Longmire and Heid, 1985). There have been direct subsidies on wheat products in the past. These took two forms, payments to the Grain Marketing Board to make up losses on trading accounts and direct payments on flour to millers by the Ministry of Trade and Commerce.

The subsidy on flour was terminated in 1984, and bread prices rose accordingly. However, deficits have been made on the trading account for wheat in 1983-84 and 1984-85 amounting to Z\$ 24.97/t and Z\$ 20.16/t, respectively (Grain Marketing Board, 1984, 1985). These losses come from selling grain to millers at prices below those actually paid by the Board, plus the Board's administrative costs. For example, the cost of imports of grain, landed Zimbabwe, were Z\$ 296.92/t in 1984-85. For the same year, the average price realised in domestic sales of wheat to millers was Z\$ 272.67. After allowing for some quality differences, any difference between the two prices would represent a subsidy that is distributed in part to domestic wheat consumers.

An equation relating per capita consumption of wheat products to real per capita income and the ratio of prices of bread to maize meal was estimated to assess the price and income responsiveness of consumption. The data were for Zimbabwe and the years 1965-1985. The results of this aggregate and preliminary analysis were:

$$\begin{aligned} \log_e \text{CONS/CAPITA} &= 2.79 + 0.473 \log_e \text{INCOME/CAPITA} \\ &\quad (2.22) \\ &\quad - 0.205 \log_e \text{PWHEAT/PMAIZE} \\ &\quad (-.55) \end{aligned}$$

$$\bar{R}^2 = .30 \qquad \text{D.W.} = .76$$

where: t-statistics are in brackets

Although there are obvious weaknesses with this equation, it tends to suggest that consumption is income responsive. Thus a 10 percent income increase in per capita income leads to just under 5 percent increase in bread consumption. The price responsiveness is insignificant statistically, and somewhat below the expected degree of responsiveness. However, we remain convinced that consumers are responsive to bread and maize product prices.

If retail prices of bread and maize products are set to reflect the supply prices of these grains at the producer level, this would probably increase bread to maize meal prices and slow the growth in consumption of wheat products over the longer term. However, since rationing of wheat is a current practice, the likely impact of higher relative bread prices would be to reduce the amount rationed. There would probably be little observable impact on actual consumption up to the level of price at which rationing became unnecessary.

#### IMPORTING WHEAT

Three considerations are important for Zimbabwe in the decision to import wheat commercially. These are:

- (1) developments in international markets for wheat and other commodities,
- (2) difficulties that Zimbabwe faces with high costs of importing wheat and being dependent on South Africa for inland transportation,
- (3) foreign exchange concerns.

There have been dramatic declines in world wheat prices in the past year (Figure 8). From a level of around \$ 130/t in mid 1985, U.S. export prices of wheat have fallen to around \$ 100/t in recent months. Currently, world wheat prices are at all-time low when allowance is made for inflation. The sharp decline in world wheat prices has

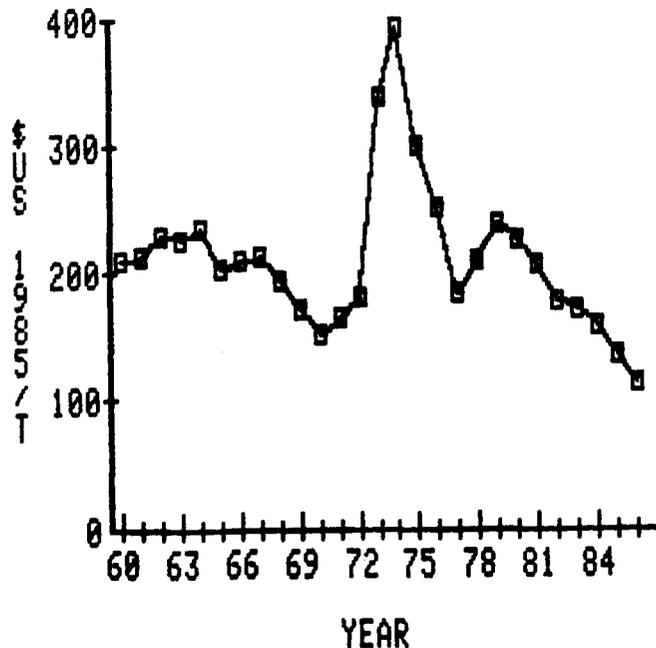


Figure 8: Real Export Price of Wheat, USA  
Source: Wheat Survey, 1986

been exacerbated by several bountiful global grain harvests, but much of the instability of world wheat prices is policy induced. A recent study suggests that the variability of international wheat prices has been quadrupled by the combined effect of domestic policies in many countries of the world (Tyers and Anderson, 1986).

The 25 percent reduction in support prices for the 1986 wheat crop in the U.S. has flowed on to international prices. In addition, bonuses equivalent to up to \$US 15/t have been offered to make U.S. wheat exports more competitive. With the EEC continuing to use variable export subsidies to export wheat, other grain exporters have been forced to lower their offer prices. The world is in a grain subsidy war, not very different from that of the late 1960s and early 1970s.

Cheaper wheat is good news for importers and consumers. However the question that must be asked for Zimbabwe and

other SADCC countries is: how long will the current low prices persist? There is every indication that the grain exporters will take some years before the adjustments are made to bring supply more into balance with demand. Many important producing countries have divorced local production incentives from the world price, so many farmers as yet do not intend to significantly reduce output. With other grains also experiencing sharp price declines, alternatives to wheat are generally not attractive.

Another implication of the prospects of relatively large supplies of wheat entering the world market in the next 5-10 years is that food aid is likely to remain at high levels. Although food aid in wheat has fallen recently from the levels of 1984, exporting countries will obviously be keen to continue aid programmes with wheat. Zimbabwe and SADCC countries might take advantage of this situation. A continuance of some imaginative barter trading will allow some of this aid to be switched to domestic maize, thus saving on heavy freight costs both ways.

Zimbabwe's transport situation means that a high cost of moving grain from port to mill and higher risk of disruption of transport routes should be factored into future deliberations on the local wheat industry. High transport costs should also be attached to export crops moving into markets via ports. An important implication of potentially higher costs of transport is that prices of import-competing crops relative to export crop prices would increase. Thus the ratio of farm prices of wheat to maize in the country would increase if guided by international developments. This has occurred with recent pricing announcements on maize.

Zimbabwe has had very tight restrictions on foreign exchange for a number of years. Given the strong emphasis placed on foreign exchange, an important factor to consider is the net foreign exchange effect of continuing to import

wheat commercially or to move towards self-sufficiency. In follow up work, we plan to undertake an analysis of the net foreign exchange savings of alternative strategies for expanding wheat production, including an analysis of the domestic resource cost of the alternatives.

## CONCLUSIONS

### Overview of the Options

This paper has focussed on various options that Zimbabwe might adopt with respect to domestic wheat production, consumption and imports. Although our analysis is preliminary, some indication of the relative costs of different options can be deduced from our work to date.

First, with regard to expansion of irrigation water supplies, there appear to be no easy low-cost options. The increasing real costs of future dam construction and irrigation schemes means that water will be increasingly expensive, and other demands for water will tend to reinforce this. Thus expansion of total irrigated area appears to be a high-cost option. In addition to the high cost of water, irrigation equipment costs and pumping costs are very high in Zimbabwe.

A potentially lower cost option is to encourage farmers to economise on water use and to expand wheat area with the water saved. This, however, requires further technical, and economic research. Another method for expanding production of wheat is to encourage farmers to switch their resources towards wheat and away from other crops. While export crop prices are low and high transport costs must be factored into Zimbabwe's commodity trade, this approach is also probably a relatively low-cost option to the country, although farmers will find these adjustments more costly.

On-going varietal improvement is probably the least expensive method of expanding wheat production. Some

speeding up of the pace of adoption of new varieties would also add to productivity gains, and seed distribution and extension play key roles in this. The opportunity to expand output from greater use of purchased inputs appears limited, and therefore, relatively expensive. However, greater availability of critical spare parts would reduce losses that farmers incur with delays.

An option for Zimbabwe in dealing with growing demand for wheat would be to increase prices on bread and other wheat products. This would reduce and eventually remove direct budgetary costs incurred. However, there are costs involved which would be thrust on consumers in the form of higher prices. There are obvious equity considerations involved with this. Nevertheless, with relatively cheap bread (see Table 2) it seems unlikely that Zimbabwe can expand of production to keep pace with growing demand<sup>1/</sup>.

The other option for Zimbabwe and SADCC countries is to use earnings from export crops and other export products to pay for commercial wheat imports. But the general decline in world commodity prices has made this option less attractive and this is exacerbated by the high costs of transport and geopolitical realities of the region. New transport routes that worked efficiently would remove some of these concerns and open up considerable opportunities for trade, thus allowing countries to specialise more in those crops in which they have a natural and economic advantage.

#### Further Research

Given that water is the principal limiting factor on wheat production in Zimbabwe, a high priority area for research is analysing the response of wheat to different amounts of water applied, to different amounts applied per watering

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1/ In November 1986, the government increased bread prices by 11 percent or from Z\$ .45 to .50 for a 500 gram (1/2 kilo) loaf.

and to timing of irrigations. Further research ought to be undertaken to evaluate alternative irrigation technologies. Although soil types will account for some differences, it is uncommon for more than 5-6 irrigations to be applied to wheat in other developing countries, including Mexico, Pakistan and India. But our 1986 wheat survey revealed that farmers in Zimbabwe applied an average of 13 irrigations. Related to research on water should be further analysis of wheat's response to different levels of fertilizer and alternative planting dates and densities under different watering regimes.

With regard to varieties, our analysis suggests that an important criterion for selection should be water efficiency. In the case of summer wheat, a key criterion is resistance to diseases. Triticale might offer some advantages over wheat in this regard and ought to be evaluated, especially as flour of triticale can readily be blended with wheat flour.

In addition to production related research, there is scope for further food technology research on milling and blending and on new maize and sorghum products which might substitute for bread. A number of maize products in the Americas have convenience properties and offer attractive alternatives to bread.

Follow-up research on the economics of wheat in Zimbabwe will concentrate on three issues. First, more analysis will be done on the economics of irrigation development and on alternative irrigation methods with crops, wheat and summer crops. Second, more detailed analysis of the farm survey will be undertaken with emphasis on profitability. Third, the analysis will be undertaken of the net foreign exchange earning capacity of different crops and development strategies. Similar analyses of the economics of wheat should be pursued in other SADCC countries, including pricing policies, transport, infrastructure, trade and the geo-political realities of Southern Africa.

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