Market Reforms, Research Policies And SADCC Food Security

Edited by

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University of Zimbabwe UZ/MSU Food Security Research in Southern Africa Project

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Do Underdeveloped Rural Grain Markets Constrain Cash Crop Production In Zimbabwe? Evidence From Zimbabwe

Solomon Chigume and T.S. Jayne[1]

INTRODUCTION

The expansion of oilseed crops -- cotton, sunflower, and groundnuts -- present major opportunities for foreign exchange generation and income growth among Zimbabwe's smallholders. It has been estimated that these crops provide higher returns per acre than grain crops in many smallholder areas, especially those in semi-arid locations (Ministry of Lands, Agriculture and Rural Resettlement (MLARR), 1990). Cotton and groundnut exports also appear to generate foreign exchange more efficiently than maize in Zimbabwe (Masters, 1990). Considering the stockpiles of grain currently burdening the government budget, efforts to promote diversification into higher-valued cash crops could beneficially affect government budgets, hard currency earnings and farmers' income.

Except for a handful of communal areas, oilseeds constitute only a minor share of smallholder cropped area. This is especially ironic for the semi-arid areas, considering the drought-tolerance of oilseeds compared with maize.[2] Several constraints to the expansion of oilseed production are well-known: poor seed delivery systems, disease and pest problems and low adoption rates of AGRITEX-recommended production practices (Govereh, 1990; Mudimu *et al.* 1990).

This paper focuses on how production of high-valued cash crops may be constrained by marketing problems in the grain sub-sector. The analysis finds that the higher

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[2]For example, the combined area cropped to sunflower, groundnut, and cotton constituted less than 17 and 10 percent of total cropped area in two semi-arid communal areas surveyed in 1988-89 (Mudimu *et al.* 1990).

financial returns to oilseeds as compared with marketed maize production may be negated if the grain marketing system cannot deliver low cost grain to rural areas. The price many rural consumers in semi-arid areas pay for maize (*i.e.*, the retail price of roller meal) is 110 percent more than for the price which many smallholders sell maize (*i.e.*, the GMB producer price of maize). This difference between producer and consumer prices means that the household value of maize may be quite different depending on whether the household is a grain seller or grain buyer. If the latter, normalising for labour time, oilseed production rarely provides greater returns per acre than maize for home consumption. The consumer price is often the more relevant value of maize in semi-arid areas, where the majority of smallholders are net purchasers of grain.

This conclusion is derived from The Ministry of Lands, Agriculture and Rural Resettlement's farm budget data (MLARR, 1990). These data are analysed *via* a model that estimates the cost-effectiveness of two alternate strategies: (1) growing oilseeds for cash to buy back maize to eat, or, (2) growing maize for home consumption. The analysis also determines how low the acquisition price of maize meal must be for oilseed production to be viable in six of the communal areas studied by MLARR.

The results also suggest that price incentives to stimulate oilseed production may have concentrated benefits among relatively wealthy smallholders, similar to the grain sub-sector (Stack, 1989). Results from two semi-arid communal land areas indicate that household grain sales, oilseed sales, and *per capita* income are positively and significantly correlated. As with grain, the use of price incentives to stimulate oilseed production also may generate concentrated benefits among well-equipped farmers in high-potential areas.

CONCEPTUAL FRAMEWORK

A detailed analysis of farm production costs and returns was performed for eight communal areas by the Ministry of Lands, Agriculture and Rural Resettlement (MLARR, 1990). Table 1 presents the relative profitability of maize and oilseed crops grown in these areas as measured by gross margins and returns to own labour. These rankings are based on average prices received for various crops in the respective communal areas.

In the high-potential areas, maize appeared to be the most profitable crop, on average, in two of three cases. This is due in part to the suitability of the areas to maize production with yields of 2,9 tonnes, 3,2 tonnes and 3,7 tonnes per hectare in Kandeya, Chirau and Chiweshe, respectively.

Table 1
Ranking of crop profitability as measured by gross margins and returns to own labour in high and low rainfall areas of Zimbabwe (MLARR Farm Management Survey, 1988-89 Crop Season).

COMMUNAL LAND	GROSS MARGIN ($ per hectare)	RETURN TO OWN LABOUR ($ per hour)
High Rainfall:		
Chiweshe	maize groundnut sunflower cotton	maize groundnut sunflower cotton
Kandeya	maize cotton sunflower groundnut	maize cotton sunflower groundnut
Chirau	cotton maize groundnut sunflower	cotton maize sunflower groundnut
Low Rainfall:		
Buhera	groundnut sunflower maize	groundnut sunflower maize
Mutoko	groundnut sunflower maize	groundnut sunflower maize
Nyajena	groundnut sunflower maize cotton	groundnut maize sunflower cotton
Zvishavane	maize sunflower groundnut	maize groundnut sunflower

Source: MLARR, 1990.

In the semi-arid areas, maize was outperformed by groundnuts and sunflower in three of the four communal areas surveyed as measured by returns per hectare. Groundnuts also provided higher returns to labour than maize in three of the four cases. It must be noted that MLARR presents the cost, yield, and revenue data averaged across all households surveyed in each communal land. Variability in management and other practices may cause the relative ranking of crop profitability to differ somewhat among smallholders within a given area.

Relative returns to marketed crop production, however, may not accurately reflect smallholders' allocation decisions, especially in the grain-deficit areas of Natural Regions IV and V where 60 percent of Zimbabwe's communal population resides. Available survey data indicate that most households in these areas sell little or no grain -- most rely on the market for the purchase of residual grain requirements to feed their families, Table 2. For these households, the decision to grow a hectare of oilseeds must be at the expense of a hectare of food grain for home consumption. Thus, the decision facing these smallholders is whether to (1) grow oilseed or other crops for cash to buy back maize for home use, or, (2) to produce the maize directly for home use. Option (1) entails buying maize or maize meal at the acquisition price in rural areas. The amount of oilseed revenue per land unit remaining after buying back the quantity of maize that could have been produced on that land for home consumption may be evaluated by the following equation:

(1) $$NR_i = Y_i - [(Q_{mz})(s)(xr)(PC_{mz}) - (Q_{mz})(mc)] + (L_{mz} - L_i)w$$

where: NR_i = net returns per hectare from growing oilseed crop i for cash to buy maize for consumption;

Y_i = gross margin of oilseed crop i (\$/ha);

Q_{mz} = maize yield per hectare (kgs/ha);

s = 1 - storage loss factor (proportion of maize production that is consumed over one year);

xr = extraction rate from maize to maize meal (%);

PC_{mz} = acquisition price of maize meal in rural area (\$/kg);

mc = milling cost facing the household to convert maize to maize meal (\$/kg);

L_{mz} = labour input into maize production (hours/ha/year);

L_i = labour input into crop i production (hours/ha/year); and,

w = opportunity cost of own labour (\$/hour).

Table 2
Importance of alternative grain marketing channels used by households in selected semi-arid communal areas.

Communal Areas	Natural Region	% of Households That Are Net Grain Purchasers	% of Total Household Grain and Meal Purchases From			
			GMB	Neighbouring Households	Informal Traders	Shops
			---- Grain ----			Meal
Gokwe (south)[b]	III	12	7	80	13	0
Gokwe (north)[b]	IV	59	10	44	36	10
Buhera (north)[b]	III	26	16	70	1	13
Buhera (south)[b]	IV, V	57	0	36	11	53
Runde[b]	III, IV	61	0	23	37	40
Mberengwa[b]	IV, V	85	26	15	17	42
Nata[c]	IV	94	0	7[a]		92
Ramakwebana[c]	V	96	0	13[a]		87
Semukwe[c]	V	98	0	21[a]		79

Note: [a]The distinction between purchases from households and informal traders was not made in this study.
Source: [b]UZ/MSU/ICRISAT Grain Marketing Surveys, 1990; the quality of harvests in these areas during the survey period ranged from average to poor. [c]Hedden-Dunkhorst, Bettina, 'The role of small grains in semi-arid smallholder farming systems in Zimbabwe: preliminary findings', draft mimeo, SADCC/ICRISAT, Matopos; the quality of harvest in these areas during the survey period was poor.

This equation is composed of four terms: The first term, (Y_i), is the revenue generated after production costs (excluding own labour) for growing one hectare of oilseed crop i for sale, are subtracted. But cultivation of this crop means that one hectare of maize for home consumption is foregone. The second term, $(Q_{mz})(s)(xr)(PC_{mz})$, subtracts the cost of obtaining the amount of maize meal that could have been produced on that hectare, accounting for storage losses and grain-to-meal milling losses incurred by the household if it produced and processed the maize itself. The third term, $(Q_{mz})(mc)$, accounts for the advantage of oilseed sale/maize meal purchase by avoiding the cost of milling the own-produced maize for home use. The fourth term, $(L_{mz} - L_i)w$, accounts for differences in own-labour time per hectare between maize and crop i. Own labour is valued at the reservation wage used by MLARR in the respective areas (MLARR, 1991 :49).

The viability of producing oilseeds for cash to buy back maize is affected by the acquisition price of maize meal in rural areas. Table 2 shows the relative importance of various channels through which households purchased grain in seven communal lands during the 1989-90 marketing year. Purchases of commerical maize meal were the dominant form of acquiring grain in most areas, particularly the most severely grain deficit areas. The problems associated with acquiring grain through rural informal channels is discussed in more depth in Chisvo *et al.* 1990.

The control price of commerical maize meal is Z$0,47 per kg. This is significantly higher than the range of acquisition prices observed for maize through informal channels during 1990.[3] The commercial meal price is 110 percent higher than the GMB producer price. This indicates that the value of maize production may vary greatly depending on whether the household is a grain seller or buyer.

RESULTS

Equation (1) is calculated using farm production costs, yields, labour input and oilseed prices from MLARR, 1990. Average annual storage losses are set at 20 percent. Milling costs (Z$0,052 per kilogram) and grain-to-meal conversion rates facing the household (0,95) are from Jayne *et al*, 1990.[4]

The net revenue to the household from growing cotton, sunflower and groundnuts for cash to buy maize meal is presented in Table 3. Column 1 presents net revenues assuming the control price of commercial maize meal (Z$0,47).[5] In each of the areas where cotton and sunflower production were analysed by MLARR, the strategy of growing these crops for cash to buy maize meal was, on average, a loss-making endeavor. Groundnut sale/maize meal purchase strategy resulted in a loss, on average, in four of six cases. The productivity of oilseeds in these areas, during the crop year in question appears to be simply too low relative to maize meal acquisition prices to make this strategy viable. The situation facing households deciding how to allocate crop land remaining after devoting sufficient area to meet annual food consumption requirements is different. In this case, the decision may

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[3]These prices ranged from Z$0.21 to Z$0.42 per kg, depending on location, during the first six months of 1990. The cost of obtaining and milling the maize through informal channels, accounting for milling losses, was $0.37 per kg on average. Price monitoring surveys were conducted bi-weekly within eight semi-arid communal areas during 1990 by AGRITEX officials.

[4]This milling cost is 20 percent higher than the average milling cost found in surveys of 648 households and 52 informal millers operating in seven communal areas in Zimbabwe during 1990. Moreover, the grain-to-meal conversion rate is also 20 percent lower than the average found in these surveys. We have chosen these estimates to show the robustness of the results even when figures more advantageous to the oilseed sale/maize meal purchase strategy are used.

[5]Price monitoring surveys revealed that the actual prices paid by households for commercial meal frequently exceeded the control price in more remote rural areas further from urban mill distribution points.

be influenced by the relative returns to production for sale illustrated in Table 1. The contrasting results presented in Table 1 and Table 3 are due to the difference between the maize producer prices recorded by MLARR and the consumer price of commercial maize meal.

Table 3
Net returns of growing oilseeds for cash to purchase maize meal

COMMUNAL AREA	(1) RECORDED YIELDS (kgs)		(2) NET RETURNS FROM CULTIVATING: AFTER BUYING BACK MAIZE MEAL ($/HA)			(3) MAIZE MEAL PRICE AT WHICH OILSEED AND MAIZE PRODUCTION BREAK EVEN ($/KG)		
			Cotton	Sunflower	Groundnut	Cotton	Sunflower	Groundnut
BUHERA	maize:	785						
	sunflower:	258	na	-163,9	-7,9	na	,22	,45
	groundnut:	802						
CHIRAU	maize:	3,157						
	cotton:	776	-440,7	-932,2	-990,7	,31	,13	,12
	sunflower:	468						
	groundnut:	217						
CHIWESHE	maize:	3,661						
	cotton:	299	-1,118,9	-1,136,4	-972,4	,13	,13	,15
	sunflower:	454						
	groundnut:	578						
KANDEYA	maize:	2,939						
	sunflower:	138	-825,1	-502,5	-1036,6	,15	,21	,06
	groundnut:	367						
MUTOKO	maize:	1,146						
	sunflower:	598	na	-209,0	+263,6	na	,26	,74
	groundnut:	1,296						
NYAJENA	maize:	440						
	cotton:	810	-53,3	-47,7	+132,8	,33	,40	,82
	sunflower:	482						
	groundnut:	402						
ZVISHAVANE	maize:	572						
	sunflower:	131	na	-153,5	-206,6	na	,29	,27
	groundnut	173						

Source: Computed from data from MLARR, 1990.

How much lower must the consumer price of staple meal be to make oilseed production viable in these areas? This issue is relevant because not all rural households in deficit areas fill their residual grain requirements with commercial meal. Those able to buy grain and have it milled locally face a lower consumer price. By setting net revenue in equation (1) equal to zero and solving for PC_{mz}, one may discern the acquisition price of maize meal in a particular area at which it becomes profitable for grain-purchasing households to grow oilseeds for cash. These threshhold prices are presented in Column 3 of Table 3. In several cases, these prices are in the range of informal maize prices plus milling costs observed from price monitoring surveys in 1990. This suggests that a more reliable supply of grain through informal channels for rural consumers may promote diversification away from maize and into various oilseed crops. This must, of course, be complemented by improvements in seed distribution, management practices and other factors that currently constrain oilseed production in Zimbabwe.

Table 4
Correlation coefficient matric for selected household characteristics in Mutoko and Buhera communal areas

	X1	X2	X3	X4	X5	X6	X7	X8
X1								
X2	,04							
X3	,09	,23 **						
X4	,27**	-,00	,24**					
X5	,32**	,10	,22**	,90**				
X6	,18*	,05	,40**	,45**	,43**			
X7	,35**	-,07	,12	,42**	,35**	,27**		
X8	,25**	,11	,14	,31**	,27**	,25**	,72**	
X9	,05	,02	,00	,09	,06	,02	,03	,06

* = significant at ,01 level
** = significant at ,001 level

X1 = Inome per resident member (*per capita*)
X2 = Area planted to grain (ha)
X3 = Area planted to oilseed (ha)
X4 = Net grain transaction (kgs)
X5 = Grain sales ($)
X6 = Oilseed sales ($)
X7 = *Per capita* grain availability (kgs *per capita*)
X8 = Grain production (kgs)
X9 = Fruit and vegetable sales ($)

THE COMPLEMENTARITY BETWEEN OILSEED AND GRAIN SALES: HOUSEHOLD LEVEL

These results indicate that, in the semi-arid areas, the viability of oilseed production for sale may be influenced by whether the household in question in a grain buyer or grain seller. This hypothesis is supported by data on household cropping patterns from two semi-arid communal areas in Natural Regions IV and V. Of those households that were net grain sellers (n=162), 46 percent grew and sold $83 of oilseeds per household. Of those farm households that were net grain purchasers (n=110), only 32 percent sold any oilseeds, valued at $37 per household. In the entire sample, household oilseed sales were highly correlated with grain sales, Table 4. These were both highly correlated with *per capita* income and grain availability (a proxy for consumption). These results suggest that, in general, grain-deficit rural households are not purchasers because they are growing other crops for cash to buy food, but rather because they do not have the land or other resources to grow enough staple food to feed themselves. These households also tend to have lower incomes, especially those which earn more than 50 percent of their total income from agriculture.

THE COMPLEMENTARITY BETWEEN OILSEED AND GRAIN SALES: PROVINCIAL LEVEL

We examined provincial smallholder data from the Grain Marketing Board and Cotton Marketing Board to determine the degree of complementarity between *per capita* grain and oilseed sales (cotton and sunflower only -- groundnut information is not yet available). Figures 1, 2 and 3 indicate a positive relationship between these crops over the past three years. Simple OLS regressions of the form:

$$Y_i = a + b^*(X_i)$$

where Y_i is *per capita* smallholder cotton and sunflower sales in Province i, and X_i is *per capita* smallholder grain sales in Province i, produced the following results (t-statistics in parentheses):

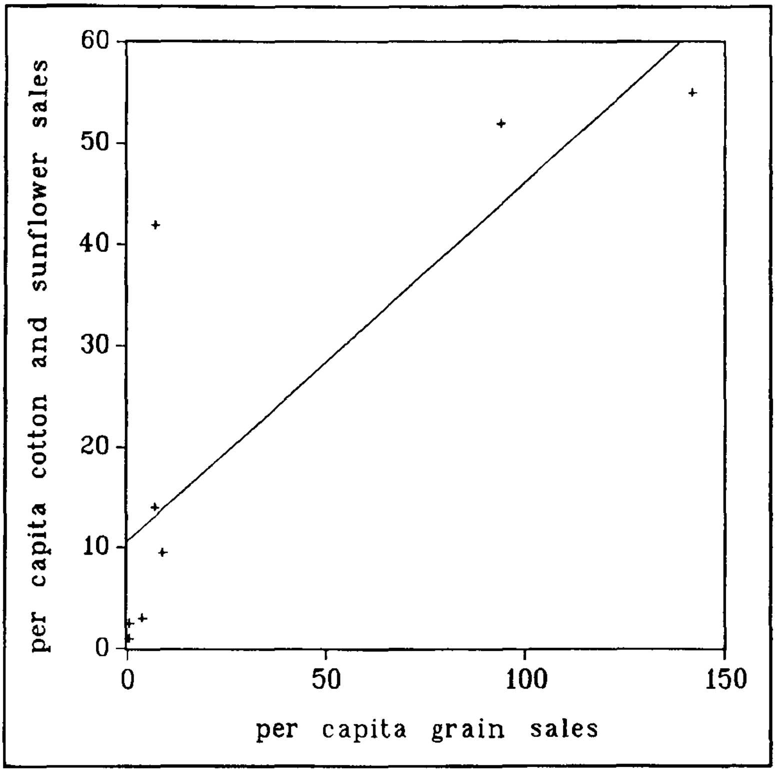
$$\text{1987-88: } Yi = \underset{(1{,}84)}{11{,}04} + \underset{(3{,}50)}{0{,}34}{}^*(Xi) \quad R2 = {,}67 \quad DW = 2{,}76 \quad F = 12{,}24$$

$$\text{1988-89: } Yi = \underset{(0{,}22)}{3{,}35} + \underset{(2{,}89)}{0{,}19}{}^*(Xi) \quad R2 = {,}58 \quad DW = 2{,}14 \quad F = 8{,}34$$

$$\text{1989-90: } Yi = \underset{(1{,}19)}{9{,}61} + \underset{(2{,}16)}{0{,}11}{}^*(Xi) \quad R2 = {,}44 \quad DW = 2{,}41 \quad F = 4{,}67$$

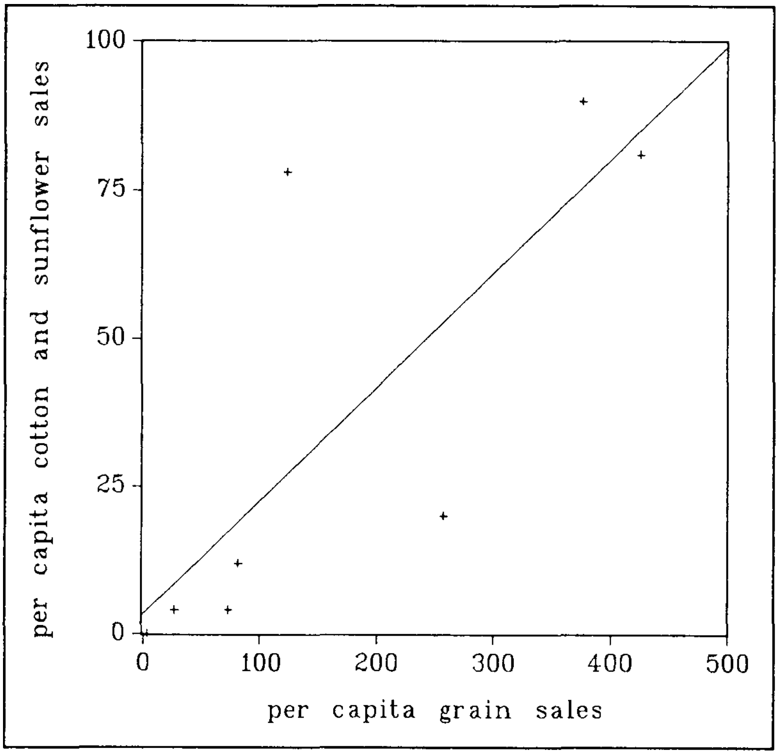
The coefficients on grain sales were statistically significant at the ,05 level in two of three cases.

While causality cannot be inferred in this *ad-hoc* model, the results suggest that *per capita* oilseed production and sales tend to be relatively high in areas of the country where *per capita* grain sales are also high. These areas contain relatively fewer grain deficit smallholders. In addition, it is easier in these areas for those households who are grain deficit to acquire grain from surplus neighbours through informal channels.



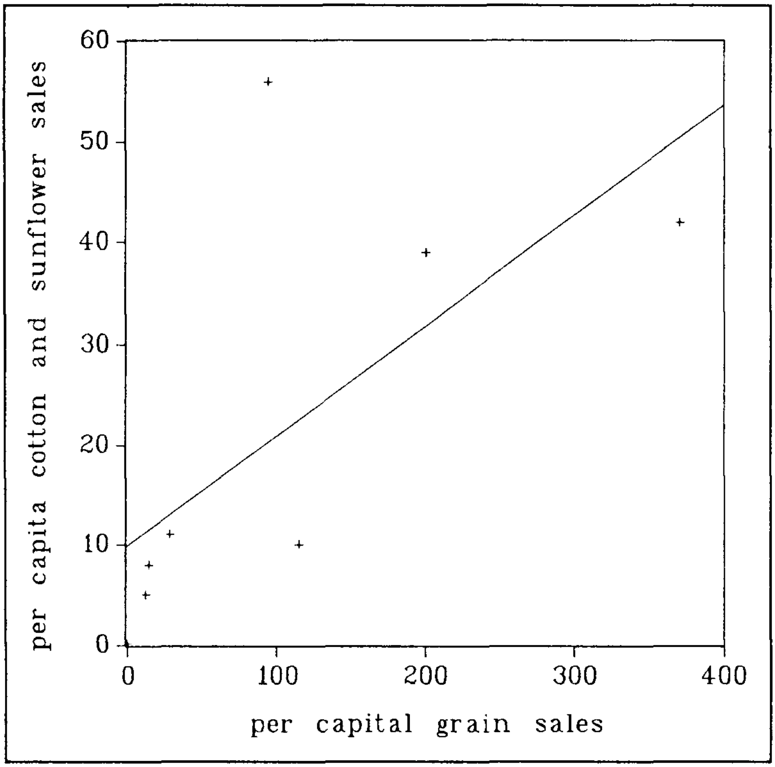
Source: Grain Marketing Board and Cotton Marketing Board data files.

Fig. 1. Relationship between per capita grain and oilseed sales to the GMB from the smallholder sector, by province: 1987-88 marketing year.



Source: Grain Marketing Board and Cotton Marketing Board data files.

Fig. 2: Relationship between per capita grain and oilseed production in the smallholder sector, by province: 1988-89 marketing year.



Source: Grain Marketing Board and Cotton Marketing Board data files.

Fig. 3: Relationship between per capita grain and oilseed production in the smallholder sector, by province: 1989-90 marketing year.

CONCLUSIONS AND AREAS FOR FURTHER RESEARCH

The foregoing provide several preliminary conclusions that should be explored in more depth. The robustness of these conclusions may be examined by carrying out a larger number of surveys in various smallholder production environments.

1. Apart from other oilseed production constraints, high rural grain prices constitute an important limitation to the expansion of higher-valued crops well-suited to semi-arid areas. Poorly developed informal food markets in rural deficit areas constrains income growth directly due to high-priced staple grain through the market and indirectly due to the shifting of production to food crops for household food security rather than potentially higher-valued cash crops.

2. Smallholders cotton and sunflower sales are concentrated in high-potential grain producing areas. Two communal areas, for which data were available, showed oilseed sales to be concentrated among a relatively few well-endowed farmers. Therefore, government attempts to stimulate oilseed production through price incentives or investments in marketing infrastructure may generate highly concentrated benefits.

3. The potential for income growth from oilseed production among smallholders in semi-arid areas might be enhanced if more reliable markets to acquire grain at relatively low cost were available. The results suggest that a 15 to 20 percent decrease in maize meal costs would make groundnut and sunflower production increasingly viable for grain deficit smallholders in several of the areas examined. Efforts to develop a more reliable low-cost informal grain trade may simultaneously stimulate oilseed production and sales in semi-arid areas.

   Due to the apparent entertwined relationship between oilseed production and grain marketing, strategies to promote drought tolerant crop diversification in semi-arid area of Zimbabwe should be conceived and designed in tandem with grain marketing and pricing strategies.

There are several *caveats* to this analysis. First, the analysis examines the effect of a household being grain deficit on its incentives to grow oilseeds for sale. The analysis does not examine incentives to grow oilseeds for own consumption, gifts, or other non-market purposes. Second, we do not examine the effect of risk aversion in semi-arid areas prone to frequent drought on the incentives to grow oilseeds. In such cases, the yield stability of grains *versus* oilseeds becomes important. The risk of drought may induce households to put more of their land into grain to assure adequate supplies even under poor yield conditions. Third, the MLARR results are based on average cost, yield and price data in a particular communal area. Yet there is often substantial micro-variability within a given area such that the relative profitability of oilseeds *versus* maize based on average yield and cost data, may not accurately reflect the situation. Lastly, the MLARR data used to calculate the viability of grain vs. oilseed production pertained only to the 1988-89 crop season which was relatively poor in terms of rainfall over much of the country. The robustness of these results may be examined with crop budgets pertaining to normal and good rainfall years.

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