



FOOD SECURITY RESEARCH PROJECT

**IMPROVING SMALLHOLDER AND
AGRIBUSINESS OPPORTUNITIES
IN ZAMBIA'S COTTON SECTOR:
KEY CHALLENGES AND OPTIONS**

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By

**Food Security Research Project
Lusaka, Zambia**

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IMPROVING SMALLHOLDER AND AGRI-BUSINESS OPPORTUNITIES IN ZAMBIA'S COTTON SECTOR: KEY CHALLENGES AND OPTIONS

By
the Food Security Research Project¹

1. INTRODUCTION

A Cotton Industry Consultative Meeting was held in Lusaka on 26 October 1999 to discuss the current problems and challenges facing smallholders and agri-businesses in Zambia's cotton sector.² The meeting was attended by representatives of farmers' groups, assemblers, ginners, and MAFF officials. Discussion centered around four key challenges that are addressed in this note:

1. How Zambia's cotton sector can remain competitive in the face of a projected long-term decline in world cotton prices as well as shorter price cycles;
2. How cotton pricing can be made more transparent and less uncertain for farmers;
3. How to channel inputs and extension support to smallholder farmers to achieve productivity growth while addressing ginners' problems with "pirating" and loan repayment.
4. How to finance investments in agricultural research and extension systems needed to achieve long-run productivity growth in an environment where the public sector is not likely to provide these investments.

This note is a direct follow-up to the Industry Consultative Meeting. The purpose of this note is to identify underlying causes and characteristics of the current crisis facing the industry and to propose a set of actions for further consideration by industry, government, and analysts. Because of the current crisis, this note focuses on actions that can be taken in the short- and medium-term. The final section also considers strategies to improve the industry's viability over a longer-run time frame.

¹The Zambia FSRP team is comprised of Jones Govereh, Jan Nijhoff, Ballard Zulu, Cynthia Donovan, T.S. Jayne, David Tschirley, and Michael Weber. This report has also been reviewed and strengthened by stakeholder representatives in Zambia's cotton sector, including from the Ministry of Agriculture, Food, and Fisheries; Lonrho Cotton Zambia; Amaka Holdings, and the Agricultural Consultative Forum. The FSRP also thanks members of Central Statistical Office, in particular W.C. Mayaka, for their support in the analysis of 1997/98 CSO Post Harvest Survey data.

²The meeting was jointly sponsored by the Agricultural Consultative Forum (ACF), Ministry of Agriculture, Food and Fisheries (MAFF), and the Food Security Research Project, a joint collaboration between ACF, MAFF, and Michigan State University.

2. BACKGROUND

2.1. Recent Production Trends

Cotton has played an increasingly important role in Zambian agriculture. Studies for the World Bank and more recently project development work by IFAD establish the robust comparative advantage of cotton in making efficient use of Zambia's scarce domestic resources (Keyser, 1996, IFAD, 1999). Available data sources, however, provide a conflicting picture of actual production and yield trends (Table 1). CSO's Crop Forecast (CF) estimates indicate that Zambia's farmers have produced over 100,000 tons of seed cotton (with yields over one ton per hectare) in 1998 and 1999. CSO's Post Harvest Surveys (PHS), which provide a picture of small- and medium-scale farming only, indicate a significantly lower level of production but higher average yields since the mid-1990s.³ FAO estimates, which are ostensibly drawn from government estimates, show no significant increase in either yields or production over the 1994/95-1997/98 period, in contrast to the other two sources. These conflicting data sources indicate the difficulties of discerning recent trends in Zambia's cotton sector and the effects of policy reforms in the sector since the early 1990s.

Table 1. Cotton Production and Yield Trends

Harvest Year	----- Production (tons) -----				----- Yield (kgs per hectare) -----		
	Crop Forecast Surveys	Post Harvest Surveys	FAO Estimates	Derived Ginnery Estimates*	Crop Forecast Surveys	Post Harvest Surveys	FAO Estimates
1990	36,536		30,667		571		479
1991	48,721		48,720		658		658
1992	25,899		25,896		434		434
1993	47,851	23,103	58,326		626	714	735
1994	33,093	18,384	25,901		653	641	783
1995	16,578	27,991	50,003		471	984	667
1996	40,824	63,858	37,075	61,200	617	996	560
1997	70,000	58,051	22,872	79,900	933	782	511
1998	110,000	72,560	21,197	104,500	1,048	915	476
1999				84,700			
Average (95-98)	75,485	55,615	35,628		879	919	589

note: * seed cotton production estimates derived from lint production figures of Lonrho, Clark, and Amaka, and based on ginning outturn ratio (GOR) of 0.38. This estimate does not include amounts ginned by other ginneries, which may increase production totals by 5-10% above those shown here.

³ While some of the data discrepancies derive from the exclusion of large-scale farmers (cultivating over 20 hectares) in the PHS survey, there are some years in which PHS production estimates exceed CF estimates. Also, if it is correct that 90% of Zambia's cotton production comes from small-scale farmers as stated by Haantuba (1997), the magnitude of the production estimate discrepancies cannot be reconciled simply from the exclusion of large-scale farmers in the PHS surveys.

However, the production picture can be clarified somewhat from industry figures on the amount of cotton lint ginned, as provided by ginners. Based on these figures and an average ginning outturn ratio of 0.38, these industry figures imply that cotton production rose steadily from roughly 61,000 tons in harvest year 1996 to 80,000 tons in 1997 to 105,000 tons in 1998, before declining to 84,000 tons in 1999. These figures are most consistent with the CF estimates, and to a lesser extent, the PHS estimates. Together, these data suggest that there has, in fact, been substantial growth in Zambia's cotton production since the mid-1990s.

The growth in Zambian cotton is mirrored by an increase in the number of small and medium scale farmers growing the crop. According to PHS estimates, just over 50,000 farmers grew cotton in the 1995/96 season, but this increased to 85,000 farmers in 1996/97, and 86,000 in 1997/98. About 60,000 of these cotton farmers are in Eastern Province.

Eastern Province also appears to have accounted for most of the growth in cotton area and production during the 1990s. PHS estimates indicate that the share of total cropped area devoted to cotton (by small and medium-scale farms) rose from 6% in 1993 to 17% in 1998. The other two main cotton growing provinces, Central and Southern, have also experienced some shift in cropped area toward cotton. Nationally, the share of cropped area in cotton has risen from 3% to 7% between 1993 and 1998.

Table 2. Share of Cotton Area in Total Cropped Area for Selected Cotton-Producing Provinces

Harvest year	Province				Zambia
	Central	Eastern	Southern		
1993	9%	6%	3%		3%
1994	7%	5%	5%		3%
1995	10%	7%	1%		4%
1996	9%	14%	4%		6%
1997	16%	15%	6%		6%
1998	13%	17%	7%		7%

Source: Post-Harvest Surveys, Ministry of Agriculture, Food & Fisheries, Database Management Unit, Central Statistical Office.

2.2. Policy Environment

From 1977 to 1994, the Lint Company of Zambia (Lintco), on behalf of government, purchased seed cotton from farmers at a fixed price, provided certified seed, pesticides, sprayers, bags and extension advice to farmers. Lintco had a near monopsony in buying seed cotton and a monopoly in distributing cotton inputs on credit. In 1994, Lintco was sold to Lonrho Cotton as part of Zambia's efforts to liberalize its agricultural sector. By 1996, there were several private ginners buying seed cotton from farmers, including Swarp Textiles and Clark Cotton, but Lonrho was and continues to be the largest buyer. During 1995 and 1996, competition in cotton buying and

ginning was minimal as the three firms operated in different areas of the country. To expand the production base and benefit from the significant scale economies that exist in cotton ginning, Lonrho and Clark initiated outgrower programs to provide participating farmers with extension services and inputs on loan. The cost of the inputs were then deducted from the revenue paid to farmers when they sold their seed cotton to the ginners or their designated assemblers. Repayment rates were high (roughly 86% of the value of loans disbursed by the industry) and cotton production increased dramatically, according to the CF and PHS production estimates, and industry ginning data. The viability of the sector was also helped by relatively high world market prices during this period.

However, since 1997 the expansion of the cotton production base has attracted many new entrants onto the scene, both in ginning and in assembly.⁴ Contrary to the situation in some other African countries where ginning firms enjoyed localized monopsonies, existing firms started competing against each other in many districts. As the number of ginners and assemblers has expanded, several key problems have come to the fore. First, ginning capacity has expanded to over 150 000 metric tonnes per annum, while production appeared to be no higher than 110,000 mt. This created a competitive “scramble for cotton” among ginners to increase their throughput and minimize unit ginning costs. Relatedly, firms operating outgrower schemes have experienced increased loan default rates as competing firms, some of which do not operate outgrower schemes and hence can afford to offer higher prices, purchase cotton from farmers participating in other firms’ outgrower programs. These problems have been exacerbated by a severe slump in world market prices since 1995, which has been passed on to farmers. Farmers had grown accustomed over several years to increasing prices, and with limited information on world market conditions, they find it difficult to understand the reasons for the recent declines in prices they receive. This, together with a lack of transparency in how each buyer determines its prices and how they deduct input costs, has lead many farmers and their representatives to conclude that they are being exploited. This environment of lack of information and mistrust has in all likelihood contributed to the increasing rate at which farmers are defaulting on their loans and side selling to other firms.

At the same time, increased default rates have created incentives for outgrower firms to capitalize their bad loans into the cost of inputs for those farmers who do repay.⁵ This compels the outgrower firms to offer a lower net price for cotton after deducting the cost of inputs on credit, forcing some of the costs of loan default onto those farmers who remain loyal and do repay their loans. But imposing the costs of loan defaults on loyal farmers fuels a potential vicious cycle of further loan defaults or exit from participation in outgrower programs.

Events in 1999 have come to a head at the same time that Lonrho, the largest outgrower buyer, has put itself up for sale as an ongoing concern. This decision is believed to be based primarily on complex corporate headquarters investment strategies throughout Africa, but Lonrho also cites \$2 million per year in Zambia in unpaid loans as a major barrier to be overcome by new investors.

⁴Amaka Holdings opened a ginnery in Kabwe District in 1997; Textiles also opened a ginnery in Kabwe District in 1999 and Northern Growers acquired a ginnery built in Sinazeze District in 1986. Continental Textiles established a ginnery in Kalomo District in 1997.

⁵ One outgrower company states that in 1999 it has attempted to offset its loan defaults by adding a 50% mark up to the price of inputs.

Other ginning/outgrower firms have cut back on the number of farmers they will support with production loans in 1999/2000. Since roughly 90% of the seed cotton ginned up to 1997 was produced by farmers participating in outgrower schemes (Kahkonen & Leathers 1999), the problem of outgrower loan default clearly threatens the entire sector.

The following section uses PHS data to present a descriptive overview of the characteristics of cotton farmers and the country's cotton production base. This information provides a context for the rest of the paper, which addresses several key challenges facing the cotton industry and proposes concrete actions for further consideration toward addressing these challenges.

3. ATTRIBUTES OF SMALLHOLDER COTTON FARMERS IN ZAMBIA

In evaluating the current situation and developing strategies for improving the performance of the cotton sector, we need to know who the Zambian smallholder cotton producers are and where they are located, as well as how they are operating. FSRP is in the process of analyzing data from the Central Statistical Office (CSO) Post-Harvest Survey (PHS) of 1997/98 to identify attributes of smallholder cotton farmers that may provide strategic insights.⁶ In this section, we use preliminary results to examine the characteristics of cotton producers in comparison with other smallholders in the same regions. We then present information about differences among smallholder cotton producers, including size of farm, productivity, and use of production inputs. Given these differences, we discuss emerging insights that might assist farmers, industry and government in designing cost effective and high potential strategies for increasing smallholder as well as agri-business cotton production and productivity in Zambia.

3.1. Differences and Similarities Between Smallholder Cotton and Non-Cotton Producers

The significant expansion of cotton production in Zambia over the past few years has affected a wide range of smallholders. As shown in Table 3 (column a) some 85,700 smallholders grew cotton in 1997/98, concentrated in Central, Eastern, and Southern provinces. To make an appropriate comparison we examine characteristics of cotton and non-cotton producers in these three provinces only.⁷

Smallholder cotton producers on average cultivated a larger land area (about 0.9 ha more) than non-cotton producers (Table 3, column b.) This difference is slightly less in Eastern Province where almost one third of the smallholders grew cotton during the survey year, but even here cotton farmers cultivate almost 0.75 ha. more than non-cotton farmers. Maize is an important crop in these 3 provinces, both to ensure household food supplies and to earn income. Most significantly we do not find that household-level maize production goes down with the introduction of cotton in a farmers cropping system. Smallholder cotton producers allocated an average 1.1 hectares to maize, compared to 1.0 hectares on average by non-cotton smallholders (Table 3, column h.). Maize yields and total household production of maize are similar between cotton and non-cotton households, as shown in columns i and j in Table 3, although a few cases in Southern Province make yield differences appear significant.

⁶ As noted earlier, the staff of CSO have collected, cleaned and maintained the PHS data used here, based on a survey of over 6,000 rural smallholder households cultivating less than 20 hectares each for the agricultural year 1997/98. Of the final sample of 6,034 households, 625 were cotton farmers. This database excluded large farmers (those cultivating 20 hectares or more), so the statistics reported here reflect only those of smallholders.

⁷ Table 3 includes information on smallholders for all nine provinces of Zambia.

Table 3: Farm Household Average Area, Production and Yield for Maize and Cotton and Other Statistics, Comparing Cotton and Non-Cotton Farmers, by Province in Zambia 1997/98 (Preliminary Estimates)

Province	Type of Farmer	Number of Farmers	Total Cultivated Area (ha)	Use of Animal Traction (% of farmers)	Use of Fertilizer on Maize	Cotton Area (ha)	Cotton Production (kgs)	Cotton Yield (kg/ha)	Maize Area (ha)	Maize Production (kgs)	Maize Yield (kg/ha)	Emergent Farmers (% of farmers)
<i>Column</i>		<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>e</i>	<i>f</i>	<i>g</i>	<i>h</i>	<i>i</i>	<i>j</i>	<i>k</i>
Central	Non-cotton	66,700	1.38	24	31	...	...	...	0.95	1,548	1,774	1.4
	Cotton	13,300	2.96	59	29	1.26	920	812	1.46	1,885	1,422	8.1
	All	80,100	1.65	30	31	1.26	920	812	1.04	1,608	1,711	2.5
Eastern	Non-cotton	131,900	1.26	22	16	...	...	...	0.87	991	1,212	1.1
	Cotton	60,900	2.09	37	22	0.81	823	1010	0.93	1,175	1,346	2.3
	All	192,700	1.52	26	18	0.81	823	1010	0.89	1,050	1,255	1.5
Southern	Non-cotton	100,400	1.50	78	21	...	...	...	1.21	1,674	1,460	4.9
	Cotton	9,600	3.51	100	26	1.20	864	894	1.92	2,788	1,693	21.8
	All	110,000	1.68	80	22	1.20	864	894	1.27	1,774	1,481	6.4
Regional	Non-cotton	299,000	1.37	41	21	...	...	...	1.00	1,323	1,409	2.5
Total	Cotton	83,800	2.39	48	24	0.92	843	965	1.12	1,452	1,394	5.5
	All	382,800	1.59	42	22	0.92	843	965	1.02	1,353	1,406	3.1
Copperbelt	Non-cotton	38,600	1.06	5	19	...	...	...	0.79	922	1,244	1.0
Luapula	Non-cotton	120,300	1.04	0	5	...	...	...	0.32	516	1,802	0.3
Lusaka	Non-cotton	15,000	0.93	19	26	...	...	...	0.83	1,131	1,476	2.6
Northern	Non-cotton	161,200	1.41	2	12	...	...	...	0.47	621	1,411	1.6
Nwestern	Non-cotton	55,700	0.99	4	5	...	...	...	0.45	511	1,199	0.2
Western	Non-cotton	101,900	1.07	46	2	...	...	...	0.66	448	752	0.3
Total	Non-cotton	791,600	1.24	23	13	...	...	...	0.59	1,008	1,310	1.5
	Cotton	85,700	2.41	47	24	0.92	843	966	1.46	1,530	1,410	5.4
	All Farmers	877,300	1.35	25	14	0.92	843	966	0.59	1,083	1,325	1.8

Notes: All results use the household weights. “...” indicates not applicable or not available. Due to small sample size, no results are reported for cotton farmers in Northern, Copperbelt, Lusaka, and Western Provinces.

Source: Central Statistical Office, Zambia, Post-Harvest Survey 1997/98 data.

Fertilizer use in Zambia is concentrated on maize and specialty crops, even in the cotton growing areas of the country. About the same percentage of cotton and non-cotton producers (21% vs. 24%) use fertilizers on maize (Table 3, column d.) Use of fertilizer on maize in other provinces is less common, dropping to as low as 2% of smallholders in Northern Province. This raises an important question: does cotton production in a region contribute to the development of markets and household income which benefit other agricultural activities? For example, cotton producers may be more likely to have the cash income to pay for inputs for maize and other crops, creating a market demand that the private sector would respond to in these regions. This response by the private sector would benefit all farmers wanting inputs, regardless of whether they grow cotton.

As indicated by analysis of these data, there is considerable development of private input markets in these three provinces. The underlying factors that have generated this development are also influential in explaining cotton area expansion in these areas.⁸ In these three provinces, 76% of the non-cotton farmers using fertilizer and 79% of cotton farmers using fertilizer in the survey year indicated that they purchased top dressing fertilizer from a private trader, and most of these were cash purchases, not on credit. Results are similar for basal fertilizer. Looking only at Eastern Province, 87% of cotton farmers purchasing fertilizer did so from private traders; only 3% got their fertilizer from cotton companies, despite these companies being the main source for the cotton seed and pesticides.

Animal traction appears to play a key role in enabling smallholder producers to expand their cultivated area, where land is available. The PHS data for this production year show that smallholder cotton producers are somewhat more likely than non-cotton producers to use animal traction in their production systems for cotton, maize, or other crops (Table 3, column c). Yet with this panel dataset we cannot determine if cotton production enabled access to animal traction or vice versa. Are those without animal traction interested in obtaining it? Among cotton farmers who did not use animal traction in 1997/98, PHS survey results show that 52% chose livestock as their top investment choice when given a list of 9 investment options, including additional land, implements, and fish ponds. Prior analysis of agricultural sector performance by Deininger, et. al., using PHS data from 1995/96 and 1996/97 found a significant and positive effect of cattle ownership on household income directly, and a positive impact on the area of land cultivated, as well as access to credit and fertilizer markets (Deininger, 1998.)

Credit use is much more common among cotton producers than among non-producers. In the three cotton provinces, 70% of smallholder cotton producers received credit, while only 3% of non-cotton farmers did so. This credit is almost entirely in-kind credit used for cotton seeds and pesticides, provided through the cotton outgrower schemes. There is very little credit given for fertilizers. Only 3% of cotton farmers used fertilizer on cotton. While 22% of all smallholders in the cotton zone put fertilizer on maize, there is little credit available for it, and so smallholder producers used their own resources to finance fertilizers. The lack of credit for fertilizer is not an insurmountable problem for some smallholders. Research findings from other countries (e.g., Zimbabwe, Kenya, and Mozambique) have shown that

⁸ These provinces are well positioned near the line of rail, and have traditionally been the most productive and developed agricultural areas of the country.

production credit for cotton and other cash crops can help farmers intensify and improve the productivity of their food crop activities (Govereh, Jayne and Nyoro 1999).

Overall we find that both cotton producers and non-cotton producers show great variability in size, production assets, and use of inputs. Cotton producers are generally larger and somewhat more likely to use production inputs such as animal traction than non-cotton producers. As we will see below, there are many important differences among the group of smallholder cotton producers.

3.2. Differences Among Smallholder Cotton Producers

As indicated in Table 3, the average Zambian smallholder cotton producer cultivates just less than one hectare of cotton, achieving a yield of 966 kg per hectare. However, there is considerable variation in yields across smallholder producers.

To examine variation in behavior, Table 4 divides cotton smallholders into three equal groups (terciles) based on cotton area cultivated for the entire cotton region.⁹ These terciles are calculated by ranking the cotton producers by cotton area and then splitting the producers into three equal groups. Table 4 shows the average position on selected variables for farmers in each tercile (See columns b-k of Table 4.) Over all three provinces, the lowest tercile has farmers with 0.4 hectare or less of cotton; the second tercile has smallholders with more than 0.4 hectare but less than 1 hectare of cotton; and the top tercile has farmers with 1 hectare or more of cotton. Consider the details of Eastern Province, where there are a total of 60,900 smallholder cotton farmers. The bottom cotton area tercile has 23,100 smallholders cultivating an average of 0.3 hectares of cotton, the middle tercile has 19,600 producers cultivating an average of 0.7 hectares, and the top tercile has 18,100 farmers cultivating an average of 1.5 hectares.

Given the differences in area and yield among smallholders, a relatively small group of producers is responsible for a very significant share of total output. This is illustrated in Figure 1, which shows the percentage of Zambia's total cotton production in 1997/98 accounted for by the three cotton area terciles in Table 4. The groupings represent approximately the same number of farmers, but the top tercile is responsible for over 62 % of total production, while the bottom tercile accounts for just 16 % of the total crop.

⁹ The numbers of farmers in the terciles are not exactly equal due to ties at the cut-off points. Since the terciles are calculated over the full sample of cotton farmers, the number of farmers in each tercile in each province will not be equal. For example, producers in Southern Province tend to have larger land areas and are thus more likely to fall into the third (highest) tercile.

Table 4: Basic Statistics Comparing Cotton Farmers by Cotton Area Cultivated Terciles for Three Provinces in Zambia 1997/98 (Preliminary Est.)

Province	Type of Farmer (By cotton area terciles)	Number of Farmers	Cotton Cultivated Area (ha/hh)	Total Area Cropped (ha/hh)	Use of Animal Traction	Use of Fertilizer on Maize	Cotton Production (k/hh)	Cotton Yield (kg/ha)	Maize Cultivated Area (ha/hh)	Maize Production (ha/hh)	Maize Yield (kg)	Emergent Farmers (% of total)
					% of Farmers							
<i>Column</i>		<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>e</i>	<i>f</i>	<i>g</i>	<i>h</i>	<i>i</i>	<i>j</i>	<i>k</i>
Central												
	All Cotton Farms	13,300	1.26	2.96	59	29	920	812	1.46	1,885	1,422	8
	1 st tercile	3,400	0.37	1.17	42	4	308	806	0.82	1,092	1,219	0
	2 nd tercile	3,700	0.74	1.84	49	31	621	833	0.93	1,269	1,512	0
	3 rd tercile	6,300	2.05	4.60	74	41	1,428	804	2.07	2,636	1,476	17
Eastern												
	All Cotton Farms	60,900	0.81	2.09	37	22	823	1,010	0.93	1,175	1,346	2
	1 st tercile	23,100	0.34	1.31	29	11	398	1,179	0.71	911	1,356	1
	2 nd tercile	19,600	0.71	1.99	39	23	597	850	0.92	1,155	1,388	1
	3 rd tercile	18,100	1.51	3.19	44	37	1,596	974	1.25	1,543	1,341	6
Southern												
	All Cotton Farms	9,600	1.20	3.51	100	26	864	894	1.92	2,788	1,693	22
	1 st tercile	2,900	0.38	1.76	100	12	417	1,060	1.37	2,189	1,723	10
	2 nd tercile	2,000	0.73	2.71	100	44	738	987	1.49	2,572	2,039	3
	3 rd tercile	4,700	1.91	4.94	100	28	1,182	755	2.33	3,120	1,531	37
Over all 3 Provinces												
	All Cotton Farms	83,800	0.92	2.39	48	24	843	965	1.12	1,452	1,394	6
	1 st tercile	29,400	0.35	1.34	37	10	389	1,123	0.77	1,015	1,365	2
	2 nd tercile	25,300	0.71	2.02	45	26	612	859	0.97	1,283	1,417	1
	3 rd tercile	29,000	1.69	3.77	60	36	1,493	902	1.60	2,034	1,401	13
National Sample of Cotton Farmers												
	All Cotton Farms	85,700	0.92	2.41	47	24	843	966	1.13	1,530	1,410	5
	1 st tercile	30,000	0.35	1.33	38	10	391	1,129	0.76	1,022	1,377	2
	2 nd tercile	25,800	0.71	2.01	45	25	606	850	0.96	1,269	1,414	1
	3 rd tercile	29,900	1.69	3.84	59	38	1,485	909	1.63	2,253	1,438	13

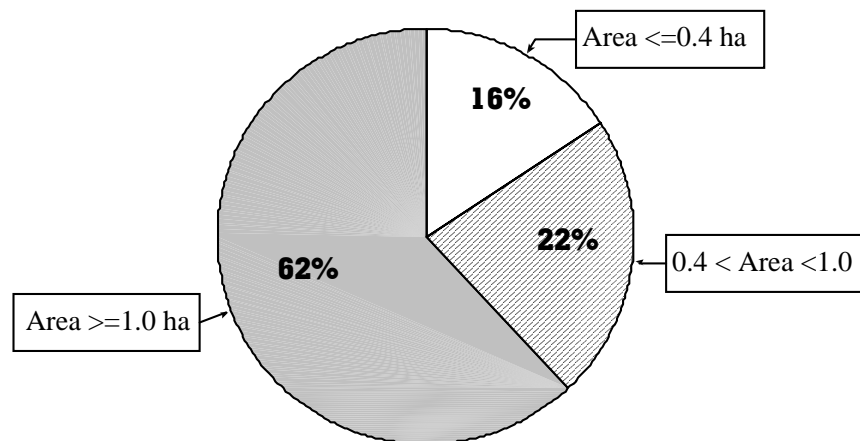
Notes: "kg/hh" indicates kilograms per household; "ha/hh" indicates hectares per household, with household as defined by the Central Statistical Office. Cotton farmers were grouped into terciles based on cultivated cotton area: 1st tercile ≤ 0.40 ha; 2nd tercile > 0.4 and < 1.0 ha; 3rd tercile ≥ 1.00 ha. Due to small sample size, no results are reported for cotton farmers in Northern, Copperbelt, Lusaka, and Western Provinces.

Source: Central Statistical Office, Zambia, Post-Harvest Survey 1997/98 data.

It is important to understand the variation within the top cotton area tercile. It can be further divided into three groups: 1) farmers with cotton area between 1 and 2 ha, responsible for 34% of national production; 2) farmers with cotton area between 2 and 5 ha, responsible for 26% of production; and 3) cotton area greater than 5 ha, responsible for only 2 % of production. Clearly this shows that the bulk of Zambia’s cotton is coming from smallholders who cultivate between 1 and 5 ha; due to their extremely small numbers, farmers with more than 5 ha of cotton are relatively unimportant in total production.

Over 73% of all cotton farmers in Zambia are based in Eastern Province. Within the three provinces, growers are concentrated in districts near the cotton gins, as in Eastern Province, where Chipata and Katete account for 54% of the farmers. We will return to this point later in the discussion of industry strategies for increasing production.

Figure 1: Total Cotton Production by Cotton Area Terciles



Source: CSO Post Harvest Survey data, 1997/98.

Yields found among smallholder cotton producers vary greatly around the mean of 966 kg per hectare. Table 4 shows cotton yields (column g) by cotton area tercile for each of the cotton provinces. Pesticides were used by 84% of cotton farmers overall, with the lowest use occurring in Southern Province. Table 5, columns f, g and h, show that fertilizer applications to maize increase rather significantly with cotton area cultivated, suggesting that the larger cotton smallholders have access to more resources, and that they are willing to invest some of those resources to raise output of maize.

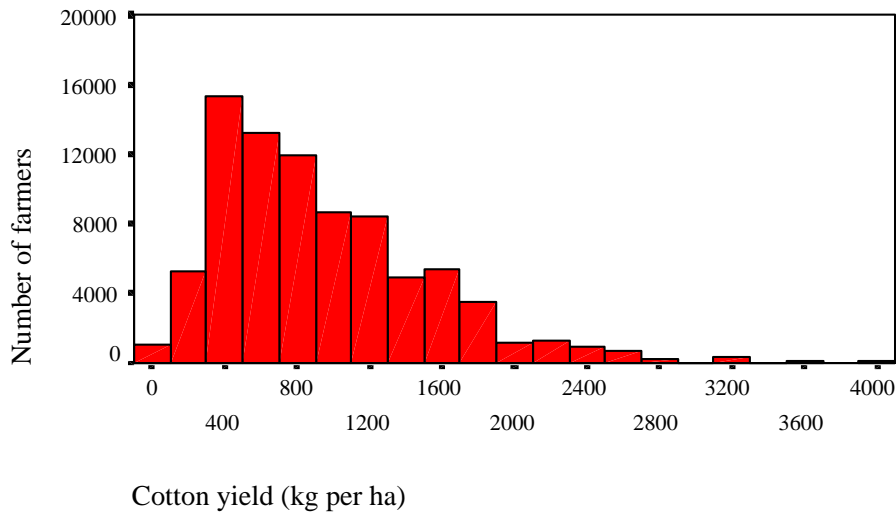
Use of animal traction varies by region. All cotton producers in Southern Province use animal traction, yet only 37% of the cotton farmers in Eastern Province do so (Table 4, column d). Larger smallholders are more likely to have animal traction, which is logical because animal traction supplements manual labor and allows the household to cultivate more land with the

Table 5: Cotton and Non-cotton Farmer Use of Credit, Fertilizers and Pesticides/Herbicides, Zambia 1997/98 (Preliminary Estimates)

Province	Type of Farmer (By cotton area terciles)	Number of Farmers	Formal and Informal Credit % of farmers using	Fertilizer Use On Cotton			Fertilizer Use On Maize			Value of Products Purchased	
				% of Farmers	Total Quantity (kg)	Per Hectare (kg/ha)	% of Farmers	Total Quantity (kg)	Per Hectare (kg/ha)	Pesticide/ herbicide (K/ha)	Basal fertilizer (K/ha)
<i>Column</i>		<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>e</i>	<i>f</i>	<i>g</i>	<i>h</i>	<i>i</i>	<i>j</i>
Cotton Region											
Central	Non-cotton Farms	66,700	1	...	...	...	31	260	272	20,800	56,900
	Cotton Farms	13,300	55	2.6	75	61	29	469	269	29,000	20,900
	1 st tercile	3,400	55	0	0	...	4	100	250	45,300	37,000
	2 nd tercile	3,700	56	0	0	...	31	155	178	25,700	23,200
	3 rd tercile	6,300	55	5.6	75	61	41	627	310	21,300	18,300
Eastern	Non-cotton Farms	131,900	3	...	...	...	16	290	202	22,900	45,100
	Cotton Farms	60,900	75	3.3	a	a	22	190	174	33,200	26,000
	1 st tercile	23,100	81	3.8	a	a	11	89	106	41,700	35,900
	2 nd tercile	19,600	76	2.7	a	a	23	220	215	29,600	24,300
	3 rd tercile	18,100	65	2.4	a	a	37	207	172	24,300	23,700
Southern	Non-cotton Farms	100,400	3	...	...	...	21	225	190	68,600	42,600
	Cotton Farms	9,600	69	0	...	...	26	395	233	23,800	30,000
	1 st tercile	2,900	69	0	0	...	12	111	80	33,300	14,100
	2 nd tercile	2,000	82	0	0	...	44	608	475	16,700	69,200
	3 rd tercile	4,700	63	0	0	...	28	324	107	19,900	14,300
Regional	Non-cotton Farms	299,000	3	...	...	...	21	259	221	17,200	48,000
Total	Cotton Farms	83,800	71	3	75	61	24	270	200	31,600	25,200
	1 st tercile	29,400	77	3	0	...	10	92	110	41,300	35,500
	2 nd tercile	25,300	73	3	0	...	26	262	244	27,900	28,300
	3 rd tercile	29,000	63	3	75	61	36	325	198	23,000	20,900
Non-cotton Region											
Copperbelt	Non-cotton Farms	38,600	4	...	...	...	19	199	204	12,400	55,000
Luapula	Non-cotton Farms	120,300	1	...	...	...	5	141	317	11,300	46,400
Lusaka	Non-cotton Farms	15,000	3	...	...	...	26	146	192	14,300	56,300
Northern	Non-cotton Farms	161,200	2	...	...	...	12	196	363	16,200	50,500
Nwestern	Non-cotton Farms	55,700	0	...	...	...	5	92	198	34,200	67,500
Western	Non-cotton Farms	101,900	1	...	...	...	2	139	125	1,500	32,400
National	Non-cotton Farms	791,600	2	...	...	...	13	225	247	15,000	49,300
	Cotton Farms	85,700	70	0.03	75	61	24	286	203	31,600	26,000
	Total Overall	877,300	9	...	75	61	14	235	239	27,600	46,100

Notes: Using the household weights. For input application quantities and rates per hectare, the mean was estimated using positive only. "..." indicates a lack of information on units in Eastern Province. Cotton farmers were grouped into terciles based on cultivated cotton area: 1st tercile <=0.40 ha; 2nd tercile >0.4 and <1.0 ha; 3rd tercile >= 1.00 ha.
Source: Central Statistical Office, Zambia, Post-Harvest Survey 1997/98 data.

Figure 2: Cotton yields for smallholders in Eastern, Southern and Central Provinces, 1997/98



Source: Central Statistical Office unpublished Post Harvest Survey data, 1997/98, estimated by Food Security Research Project.

same labor input. For the farmers in Eastern and Central Province who do not use animal traction, research is needed to determine what is happening with household labor supply, local markets for labor and animal traction services, and other aspects.

Over 73% of all cotton farmers in Zambia are based in Eastern Province. Within the three provinces, growers are concentrated in districts near the cotton gins, as in Eastern Province, where Chipata and Katete account for 54% of the farmers. We will return to this point later in the discussion of industry strategies for increasing production.

Yields found among smallholder cotton producers vary greatly around the mean of 966 kg per hectare. Figure 2 shows the distribution of cotton yields in the cotton provinces. While there are many farmers producing less than 800 kilograms per hectare, a substantial number of smallholder producer have cotton yields of 1200 kgs per hectare or higher. Table 4 shows cotton yields (column g) by cotton area tercile for each of the cotton provinces. Preliminary results for Eastern Province suggest that farmers with smaller cotton cultivated areas tend to have slightly higher yields, but this rule does not always hold. There are large farmers with high yields and small farmer with low yields. What is clear is that many Zambian farmers have the potential to obtain yields above one ton. Identifying high yield farmer characteristics is one direction of current research, to understand the relationship among yield, use of animal traction, pesticide use, fertilizer use, cultivated area, and other factors. It is also important to obtain industry experience in working with different types of cotton

growing smallholders to try to understand their perspective on critical factors helping to explain how to obtain higher yields.

3.3. Implications of Variation Among Smallholders for the Design of Strategies to Stimulate Production and Productivity Growth in Cotton and Related Crops

The cotton industry and policy makers are searching for feasible strategies to reach the different types of households growing cotton to benefit cotton ginneries and a broad mix of farmers. Given the differences among smallholders in Zambia, industry and government may need to adapt a variety of strategies that target different types of smallholders in different parts of the country. To help inform this process, one of the first questions to ask is why some smallholders get significantly higher yields than others. Some farmers may be more familiar with growing the crop, and thus better at detecting pests and deciding how and when to use pesticides (Lonrho 2000). Extension messages or extension visits may vary across producing households, potentially causing big differences in farmers' ability to efficiently manage resources in cotton production. Smallholders with relatively higher yields may reach these yields because they had access to production inputs in a timely fashion, while others did not. The cotton industry may want to target programs towards assets or inputs where farmers indicate problems, thereby increasing yields and total output without land expansion.

Due to changing agroecological conditions, yields should vary systematically over space. Thus, spatial analysis of cotton yields could have a high payoff. Integrating information from soil maps will be useful to show areas in which the agronomic conditions are good for increased cotton production and where there is room for growth in cotton production. Combining that with information on access to transport and market facilities will assist in identifying high potential regions. The cotton industry would benefit from evaluating where the farmers are located that obtain the highest yields. This geographic analysis can then be tied to information on fertilizer responses to evaluate where efforts to promote fertilizer use in cotton might have the highest profitability and therefore most likely application.

With the PHS data base, we can show that in the 1997/98 crop year about 13,800 smallholders cultivated more than one hectare of cotton and obtained yields *below* one ton/ha. Increasing their productivity to 2 tons per hectare would increase Zambian cotton production by 20,000 tons. At the same time, there were an estimated 6,500 farmers with cotton areas above one hectare and yields above one ton/ha, indicating that it is possible for smallholders with relatively large cotton areas to obtain higher yields. This same yield variability is present among smallholders cultivating 0.5 ha or less of cotton.

Animal traction may be one of the key factors in obtaining good yields when cultivating a larger land area. The data show that in the three provinces in 1997/98, 120,000 farmers with animal traction did not cultivate cotton. As these smallholders already have relatively high cultivated areas of other crops, they may be an attractive target group for cotton expansion. Evaluating the relationship between yield, resource use and management practices will assist in determining the key factors for enhancing productivity across a broad mix of smallholders and increasing participation by new producers. The cotton industry, with government and other agents, may want to develop programs to target smallholder use of highly productive assets for cotton

production, including animal traction and fertilizers, to enhance the profitability of cotton farmers, while increasing the total production of cotton.

3.4. Important Topics for Further Research

In the previous sections, we presented preliminary results regarding who the cotton farmers are, where they are, and some characteristics of their production. FSRP continues to analyze the 1997/98 PHS data base, and will use the 1998/99 production year data when they become available. Important questions remain to be answered. We highlight six of them in this section, and hope that they help facilitate dialogue with industry and government leaders about other important questions to consider in the future analysis.

1. While many smallholders repay their in-kind loans to ginners, there is a substantial (and growing) number who do not. This is a significant threat to the industry overall, and imposes costs to farmers who do repay loans. It will be important to identify the key characteristics of defaulting smallholders and evaluate the strategies that might overcome the problem. NGO, Government and Donor programs may also influence both positively and negatively the expectations that farmers have to become dependable clients for cash and in-kind credit.
2. Fertilizer use in maize can be observed both among cotton and non-cotton smallholders, in spite of the lack of credit mechanisms in place for fertilizers. Clearly a significant group of smallholders are self-financing these inputs. Industry and Government programs that subsidize input use need to be very careful to not create disincentives for sustainable self financing and repayment expectations. The fact that some smallholders are self-financing use of fertilizers on maize in spite of constraints on availability and credit suggests that fertilizers are profitable under some conditions. And the fact that private traders were selling fertilizer to these farmers in selected locations in every province of Zambia indicates an important private sector response to effective demand for fertilizer. Finding sustainable ways to further increase private traders' participation in fertilizer markets would enhance the availability of fertilizers and improve productivity in maize, and possibly other crops like cotton. At the same time, there is a need for agronomic research on cotton, particularly its responsiveness to fertilizer application, so that economic analysis of fertilizer on cotton can be undertaken.
3. As we indicated above, further analysis is needed of the smallholders who obtain higher yields, particularly those that combine high yields with substantial area planted. Geographical considerations are critical here, as soils, climate, physical infrastructure, and cropping alternatives influence farmer options.
4. Rural labor markets may be constraining the development of cotton cultivation in areas where animal traction is not easily available. The role of illness, particularly HIV/AIDS, may be critical in determining expansion possibilities for some smallholders. At the same time some of the smallholders with relatively larger cultivated areas of cotton (and other crops) are not using animal traction. How are these households able to get sufficient labor? What role, if any, is conservation farming playing, and how might it

be enhanced? Learning from what they do may develop insights for designing production promotion efforts.

5. Although land is considered abundant in Zambia, it is important to evaluate whether smallholders have access to land if they wish to increase area planted in cotton. An important place to begin this analysis is to determine the location of smallholders who cultivate relatively small and relatively larger areas of cotton. In the three most important cotton growing provinces, are the smallest smallholders (say those cultivating less than 1 hectare of cotton) located in the same districts and camps as those cultivating 2-4 hectares of cotton? Or are there sub-areas in these provinces where there is a high concentration of very small cotton farmers? Costs of trying to reach a mix of smallholders will vary greatly as a function of the answer to this geographical location question. Viability and costs of extension activities by ginners and farmer associations will also be affected by the mix of smallholders involved. Smallholders currently using their own resources to finance fertilizer use and/or those using and repaying outgrower in-kind loans are likely to be reluctant to participate in farmer associations with farmers who intentionally default on loans.

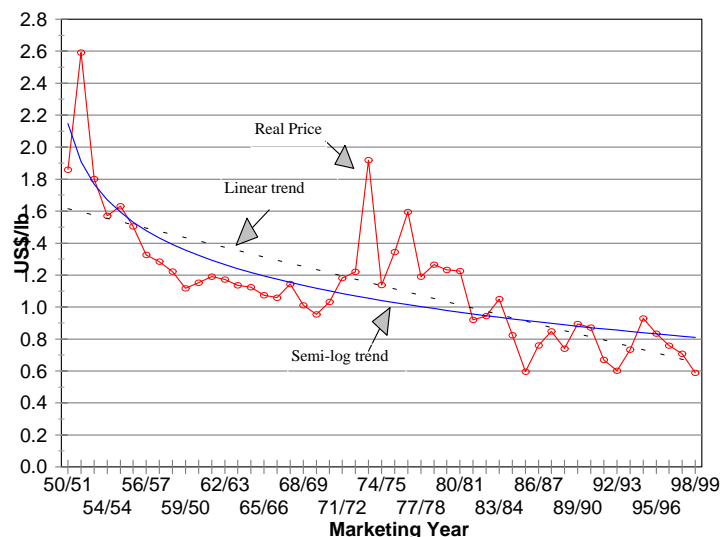
6. Another important part of the land question is to better understand how easy it is for different kinds of smallholders to gain access to additional land. The PHS data base does not permit longitudinal analysis of the same household. But it is important to find other ways to determine the extent to which success with cotton and related crops has allowed some smallholders to expand their farm size. If access to additional land is constrained in a given region, investing in animal traction to expand planted area may not be viable. Evaluating both labor and land constraints together thus becomes important.

4. KEY CHALLENGES FACING ZAMBIA'S COTTON INDUSTRY

4.1. Key Challenge 1: How Can Zambia's Cotton Sector Remain Competitive in the Face of Projected Falling Prices in World Markets over the Long-term as well as Medium-term Cycles?

The world cotton market from 1950 shows a strong downward trend in real prices, and cyclical price behavior with long periods of more severe price declines during which prices fall well below trend (Figure 3). From 1950 to 1998, the linear trend price for yearly average Index A¹⁰ cotton fell nearly 60% in real terms, from approximately US\$1.60/lb in 1950 to about US\$0.65/lb.¹¹ During this time, prices have fallen during five consecutive years only twice, from 1955/56-59/60, and from 1962/63-66/67. Currently, prices have progressively fallen every year since 1995/96, and season average prices during 1999/2000 are expected to be below those of 1998/99.

Figure 3. Yearly Average Real Index A Cotton Prices, 1950/51-98/99, with Linear and Semi-log Trends



¹⁰ Index A is an index of the prices of eight classes of cotton of various origins traded in northern Europe. It is widely used as the best indicator of world price levels for this crop. The Index is calculated daily by Cotlook, based in Liverpool, UK. Note that there is no “Liverpool” price quote on cotton separate from Index A.

¹¹ Prices are deflated using the U.S. Producer Price Index, All Commodities. Other indices, such as the MUV used by the World Bank, have only become available over the past 10 to 20 years.

Thus, the current downturn is likely to match in duration the longest downturns since 1950. There are indications that this price fall may be ending. After reaching historic lows, the Index A prices began to rise in January and February, and analysts expect that the price recovery could be rapid, as all exporting countries except the U.S. are forecasting reduced production this year (World Bank, 2000). However, this recovery should be seen as an upward variation around a continuing downward trend, not as a change that fundamentally alters the challenges facing Zambia and other producing countries to raise their productivity to compensate for long-term declining world prices.

The magnitude of the real price decrease in cotton is not unusual when compared to other commodities: according to World Bank data, average real prices from 1970-75 to 1994-99 have fallen approximately 45% for cocoa and coffee, over 50% for maize, and nearly 70% for sugar. During this same period real cotton prices fell by approximately 50%. These downward trends in real commodity prices reflect productivity growth and declining costs of production in other parts of the world.¹²

The projected long-term decline in world cotton prices indicates the need for Zambia (and all countries in the world) to focus on how to achieve continuous reductions in the cost of production, ginning, and marketing over time. This focuses attention on agricultural research and extension systems, improvements in road and rail infrastructure, and coordinating the supply channel for credit and inputs in a way that makes cotton profitable for both farmers and firms over the long run. West Africa, which now accounts for about 20% of the world's cotton exports, provides some key insights. In countries such as Benin, Mali, Burkina Faso, and Cote d'Ivoire, farmers produce an average of 1.2 tons of seed cotton per hectare, thanks to longstanding government investments in agricultural research and extension, as well as both public and private sector investments in input delivery, credit disbursement and recovery, and output marketing arrangements. Similar investments will be required in Zambia for the industry to remain competitive over the long run; Such efforts will also make both farmers and the industry better able to cope with the frequent cyclical price downturns that affect the world market. It is very unlikely that a low-input, low-yield approach to cotton production will allow the industry to flourish. This conclusion applies equally to most other crops grown in Zambia.

4.2. Key Challenge 2: Supporting Transparency in Domestic Pricing of Cotton and Inputs: How can Price Determination be Made More Transparent and Less Uncertain for Farmers?

There are two distinct but related aspects of cotton pricing that discourage farmers and indirectly contribute to the loan default problem: price transparency and price uncertainty. Smallholder farmers see a wide range of prices being offered by competing firms for their cotton. The practice of deducting input costs from farmers' gross revenue to arrive at a net payment for farmers' cotton is not always fully understood. For example, since the three main cotton ginning firms obtain finance for procuring pesticides at different interest rates and from different firms, they charge different prices for inputs and handling services. Moreover, firms offer

¹² World Bank, 1999. *Global commodity markets: a comprehensive review and price forecast*, Volume 7 Number 4. October.

different complementary services. Some firms may offer input delivery and farmer training services while others may not. The method for determining the final cost to the farmer of the loaned inputs and complementary support services is not transparent, and has contributed to misunderstandings between farmers and outgrower companies.¹³

In addition to problems of price transparency, most smallholder farmers have only a hazy understanding of why world market prices go up and down, and why prices at planting time can diverge substantially from prices at harvest. Furthermore, farmers have little access to market information and price projections to better anticipate what future harvest prices are likely to be. All of these may be termed “marketing extension” problems that contribute to many farmers’ perception that they are being exploited, which in turn exacerbates the credit recovery and input intensification efforts of outgrower schemes.

To resolve these problems, the industry and government may want to consider two pricing principles:

1. **An industry-wide procedure for calculating and making transparent to farmers the price of seed cotton and the charges deducted from the total value of their cotton receipts** as payment for in-kind credit and related services they received from the company. Ginners, buying agents, and farmers may consider negotiating a transparent and streamlined approach to the pricing of seed cotton and inputs. At a minimum, this approach needs to (a) reduce confusion among farmers as to how prices are calculated, including the price on the seed cotton and the deductions applied to cover input costs, and (b) ensure that farmers are informed of current and expected world market prices in advance of planting time so that they can develop a better estimate of the prices that they might receive at harvest, and to see how prices offered to them are directly tied to world market conditions. Ginners would need to take the lead in such a campaign, working in collaboration with buying agents and the public extension system. Both of these steps may help protect ginners and assemblers from allegations that they are cheating farmers and would put more responsibility on the farmer for determining whether the expected range of prices at harvest are sufficient to justify his/her planting of the crop.
2. **An industry-wide "indicative" pricing system, announced prior to planting along with the world market price** to which the indicative prices are referenced would be a desirable feature of any pricing approach. The indicative price could be adjusted several times leading up to planting time as conditions change and through the growing season as world market conditions change. The indicative pricing system would serve two purposes: first to help farmers with their crop production decisions by providing timely market information on world and local market conditions, and second to be more transparent in the way that local prices are determined and their relationship to world market conditions. As the name suggests, indicative prices are not the same as fixed or

¹³Some outgrower firms have indicated that they add additional mark-ups on the cost at which they charge farmers for inputs both due to exchange rate depreciation (loans are provided using hard currency borrowings) and due to non-recovered loans to other farmers. Neither of these additional costs is made explicit to farmers.

guaranteed prices. Indicative prices are likely to change through the growing season and partly serve to consolidate the calculating procedures mentioned above under (a).

In addition to these two principles, cotton companies could improve relationships with farmers (and thereby indirectly reduce the loan repayment problem) through investments in extension and outreach communication to (a) explain to farmers how harvest prices are linked to world market conditions, not only for farmers but for ginners as well, and (b) provide more market extension information on expected future price conditions. Selected traders already implement some of these practices. How these practices could or should be implemented or modified requires more detailed analysis. But many of these are educational activities that have major public-good characteristics which agri-business firms will find it difficult to totally recover. So they may underinvest in providing them, notwithstanding their potential contribution to long-run success of the industry. Government and Donors could potentially play important complementary roles in helping to facilitate and perhaps finance such extension activities.

4.3. Key Challenge 3: Ensuring Input Provision and Minimizing Loan Default: How can the Industry Facilitate Input Use Among Smallholder Farmers to Achieve Productivity Growth While Addressing Ginners' Problems with "Pirating" and Loan Repayment?

The future competitiveness of Zambia's cotton sector requires cost reduction on the farm (i.e., raising yields through input intensification) and in the downstream stages of marketing and processing. With the entry of new ginners, the cotton industry's processing capacity has grown substantially, and cost reductions in processing and marketing will require sufficient volumes to capture scale economies in processing. Industry-provided data indicate that raising capacity utilization from 20% to 60% can cut average ginning costs in half, constituting a reduction of \$50 per ton or more in the ex-factory lint prices, which ultimately affects price levels paid to farmers. So clearly Zambian farmers and ginners are in a symbiotic relationship: Farmers will gain from cost reductions in ginning, and ginners will gain from increased farm production and productivity.

There are many potential ways in which fertilizers, improved seed, pesticides, sprayers, and extension support can be provided to farmers to support farm productivity growth. Ultimately with a more conducive policy environment, rural financial markets, and progress in developing and extending sound extension messages, the retailing of inputs to cotton farmers on a cash basis by private dealers may represent an important source of farm input intensification in the future. In the short-run, however, farmers' cash demand for fertilizer, pesticides, and other inputs for use on cotton is limited, although there is already evidence of the beginning of self-sustaining effective demand and supply for fertilizer use on maize. There may be important lessons to learn for strategies in the cotton sector from examining carefully the empirical evidence on input use on maize.

To stimulate cotton production quickly, ginners have taken it upon themselves to support cotton farmers through outgrower programs. Currently, Lonrho provides pre-harvest finance to an estimated 70,000 small farmers. Clark Cotton is also active in Eastern Province, and Amaka has set a target to support over 5,000 outgrowers. In 1998/99, cotton ginning firms spent \$8.8 million on pre-financed seeds, pesticides and sprayers for outgrowers (Table 6). Packaging

materials are provided free of charge to outgrowers. Outgrower firms also provide selected extension and training services to participating farmers.

The sustainability of these outgrower arrangements depends on reliable loan recovery and a productivity-enhancing mix of inputs and support services to farmers. Redressing the loan recovery problem would facilitate the inclusion of fertilizer in cotton input packages. Thus far, outgrower firms generally do not include fertilizer in the cotton input package because this would expose the firms to even greater loss in the event of farmer default, even though fertilizer is believed to appreciably increase cotton yield (although as mentioned previously, there is very little agronomic data from Zambia to draw from). Interestingly, a representative from one ginning company stressed that small-scale farmers should not be viewed as the culprit of loan defaults. Because small farmers' first priority is to provide for their family's sustenance, it is the "pirate buyers" that should be held responsible for illegally buying goods on which another party has a claim. By contrast, the Agricultural Credit Act, which was enacted in 1995 to deal with such problems, targets the farmer for potential punishment for loan default. But because the costs of pursuing individual farmers through the court system almost always exceed the value of the cotton loans (around \$50 per farmer), the Credit Act has proven unable to address the default problem.

Table 6. Loan Disbursements (Real ZK 1999=100) and Cotton Recoveries in the Main Cotton Producing Provinces of Zambia, 1995/96 - 1998/99

Year	Southern Prov		Eastern Prov		Central Prov		National	
	US\$'000 Loaned	% Repaid	US\$'000 Loaned	% Repaid	US\$'000 Loaned	% Repaid	US\$'000 loaned	% Repaid
1995/6	117.5	64.1	433.1	91.0			550.8	85.3
1996/7	449.0	75.5	984.4	84.7	886.4	50.0	2319.9	69.6
1997/8	780.3	90.3	2634.5	77.7	1700.4	68.0	5115.2	76.4
1998/9	953.2	70.6	5897.3	64.7	1952.8	63.9	8803.4	65.2

Source: Cotton Ginners Association, Zambia, 1999

Most ginning firms have now embarked on a survival strategy which includes reducing extension efforts, having extension agents also act as loan policing agent, restricting access to inputs on credit to a smaller set of farmers identified by trusted agents, reducing the cost of the input package, and increasing cooperation with farmer groups. While companies anticipate that this strategy will eventually result in a group of farmers and farmer groups who can be trusted to repay their loans, they generally recognize that it will result in reduced cotton production, at least in the short-run. Since the industry already has excess ginning capacity at current production levels, this strategy may simply replace losses from loan default with higher processing costs. The ultimate solution to the problem will involve arrangements that stimulate cotton production and productivity while at the same time minimizing loan defaults.

There are several possible routes by which these twin objectives could be pursued. Addressing the loan default problem will involve imposing agreed-upon industry sanctions on cotton buyers that poach other firms' outgrowers. With government playing a regulatory and licensing role, the industry could prepare legislation that (a) defines the conditions to be met for firms to be a legal buyer of cotton; (b) imposes costs on illegal or unlicensed buyers, and (c) imposes costs on firms that buy cotton from or provide cotton financing to farmers with outstanding debts to other cotton firms. Such legislation would require that firms make available information on individual households and/or farmer groups with whom they have contracted. The modalities for implementing such a database would require careful further analysis.

A potentially important hurdle to overcome in developing such legislation is that the government of Zambia (GRZ) is not an impartial bystander in the cotton industry. In 1999, GRZ together with the Government of China (Mainland) invested in Mulungushi Textiles, a cotton ginning and spinning operation. It is not clear to what extent this commercial involvement by government in the industry will affect its ability or willingness to develop and pass legislation that benefits the industry as a whole. At the very least, this situation reinforces one of the main emphases in this paper, which is that the cotton industry needs to work out arrangements with government (both legal/regulatory and for financing strategic public investments) to resolve its pressing problems if smallholder farmers as well as agri-business firms are to really benefit from cotton production. There are already established fora for doing this (e.g., ACF).

Implementation of such industry legislation would be helped by current initiatives to form farmer organizations. Farmer organizations are being proposed and experimented with to improve farmer bargaining power with buyers and to help coordinate loan procurement, input delivery, and loan repayment. By transferring the outgrower companies' relationship from the individual farmer to the group, the companies could substantially reduce the costs of input delivery, extension, and purchase of cotton, shift the burden of enforcing loan repayment from the company to the farmer group, and improve overall repayment rates.

A key decision in designing a legal framework to help resolve the seasonal credit problem is on whom the legal burden will fall. While not entering into this issue in detail, we note that the experience with producer organizations in Mozambique and Zambia suggests "that (the problems associated with seasonal credit) could not be overcome unless the producers themselves were willing to take responsibility for ensuring the integrity of the entire process."¹⁴ This suggests that farmers as well as farmer organizations must be made in some way to pay a cost if they violate credit agreements.

Farmer organizations could also make important contributions to increasing farm level productivity. In neighboring Mozambique, associations have begun entering into performance contracts with the public extension service to assist them with maize intensification. These arrangements have improved communication among the extension service and farmers, and seem to have improved the quality of assistance that farmers receive. A similar approach could be followed with the cotton companies in Zambia to reduce companies' extension costs,

¹⁴ CLUSA report entitled "Case Study: Developing Self-Managed Outgrower Capacity in Zambia and Mozambique".

improve communication, and thereby increase productivity. Other farmer organizations have signed contracts with cotton companies which, among other things, give the organization a greater role in input distribution. More timely distribution of inputs (seed and pesticides) results in higher cotton yields.

In promoting producer organizations, lessons should be learned from the positive experience in northern Mozambique since 1997, where dozens of groups have contracted with cotton companies to manage input distribution and product delivery in exchange for improved prices to their members, and in Zambia itself since 1998. A fundamental lesson from these experiences is that the organizations must be **self-governed** and **self-selected**, must not be too large (ideally around 25 farmers)¹⁵, and must have (or develop) basic literacy among their members. “**Responsibilization**” is also a key tenet of emerging from the experience. While of questionable grammar, the term is meant to stress that producer organizations must take responsibility -- and be held accountable -- for the integrity of the processes they are involved in.

4.4. Key Challenge 4: Financing Research and Extension: How can the Industry Finance Needed Investments in Productive Agricultural Research and Extension Systems in an Environment Where the Public Sector Has Serious Difficulties to Provide Such Support?

The long-term trend of decreasing real prices for cotton shows clearly the need for all producing countries to obtain regular and substantial increases in productivity throughout the cotton chain, from input marketing through to ginning and output marketing. The challenge is especially daunting in a country like Zambia, because it currently lacks the financial resources that can be devoted by governments in some other cotton-producing countries to support the industry. However, the Zambian government can still play a key supportive role to help the private sector develop and enforce industry agreements to generate needed funds while making strategic use of available public resources and aggressively accessing and adapting promising technologies from outside of Zambia. After briefly reviewing the current state of technology in the industry, we will turn to a consideration of mechanisms to ensure the needed investments in productivity enhancing technology.

4.4.1. Current Technology in the Cotton Industry

Before independence, cotton research was consistently supported by the Central Africa Research Institute based in Kadoma, Zimbabwe. However, since independence, cotton research suffered several lapses due to inadequate capacity and limited GRZ funding even when the economy was buoyant. A British technical assistance program lasted from 1965 to 1975 and produced local varieties including Chureza. This was followed by a short-lived FAO program which lasted only up to 1979. The French through CIRAD had a program from 1980 to 1992 which donated the F135 variety. Since 1992, technology development in Zambia has stagnated. Whenever a

¹⁵ These individual groups can and often do join forces for specific activities, but maintain their self-governing autonomy.

technical assistance program ended, there was no arrangement for the local agricultural research system to take over. In the absence of cotton breeders and a seed multiplication system, there was no source for obtaining pure seed. This caused complaints from local commercial cotton producers, textiles and international lint buyers. From 1996, GRZ set on a course to hive off responsibility for cotton research to commercial interests to attract private investment in the cotton industry. Under ASIP and in collaboration with the rest of the cotton industry stakeholders, GRZ established the Cotton Development Trust in November 1999.

In at least three key dimensions, technology development in the Zambian cotton industry is lagging critically and threatens the ability of the industry to survive. First, development of new germplasm has nearly come to a halt. There is currently no publically-funded varietal research program in the country, and cotton varieties currently available to outgrowers from the ginning firms were produced in the mid-1980s (Chureza) or early 1990s (F135). Farmers not supported by ginners mostly grow varieties that have been officially withdrawn by public agencies (Haantuba 1997).

Second, there is currently very little use of fertilizer on cotton, yet about 25% of the cotton farmers, particularly those cultivating the most cotton, self-finance the application of fertilizer on maize. Much of the increase in cotton production in Zambia is due to the recruitment drive by outgrower firms rather than by productivity-driven increases in yield. There appears to be scope to appreciably raise cotton yields through the use of fertilizer, but there is very little available to assess the profitability of fertilizer use at various levels in different parts of the country where cotton is grown. No conclusive work has been done to date to ascertain primary and micro-nutrient deficiency levels, application methods and timing of application. Most cropped soils especially the areas into which cotton is expanding are typically deficient in nitrogen, phosphorus, potassium and organic matter. The extension message not to apply fertilizer on cotton was developed in the 1980s when different input-output price ratios made fertilizer more profitable on maize than cotton. This message is yet to be reviewed under the existing economic environment.

Existing evidence show that cotton varieties (Chureza and F135) response ratios at Magoye were in the range of 9.1 - 12.2 and an assessment of farm level fertilizer profitability revealed that based on 1998/99 fertilizer and cotton prices, there is economic potential to applying urea on cotton with value-cost ratios ranging from 3.6 - 4.8 (Samazaka 1996). This preliminary evidence suggests that current conventional wisdom on cotton and fertilizer is not well grounded in agronomic and related microeconomic research, and the extension message should be revised. But even assuming that fertilizer use on cotton was profitable and farmers were made aware of this through modified extension messages, the inclusion of fertilizer in outgrower input packages might not be in the interests of outgrower firms until the "poaching" and loan repayment problems can be overcome. With clear information on the likely economic payoff to use of fertilizer and other inputs on cotton, some smallholders may be willing to self-finance cotton inputs, and this might help provide incentives and opportunities for expanded private input retailing in important cotton areas.

Zambia's cotton industry also faces the challenge of reversing its international reputation for delivering poor quality lint. One reason for the low quality is the industry's reliance on Quality Declared Seeds (QDS) for producing the commercial crop. The Seed Control and Certification Institute (SCCI) uses stringent inspection measures for all other seed classes except QDS. In

addition, some cotton outgrower firms are reputed to recycle QDS. The key to ensuring quality seed is to implement geographic isolation of cotton seed with seed cotton and isolation of different cotton seed varieties. Currently there has been a breakdown in the isolation of cotton seed varieties. Beginning this 1999/00 season the cotton industry through SCCI introduced a system of seed zones classified by variety and by purpose at the district level. All the companies have to apply to SCCI to indicate where in each district they want to grow which variety and for what purpose. The zoning system, if implemented correctly, will contribute greatly to improving seed quality. However, this is only a “gentlemen’s agreement” which does not carry any legal sanctions. Cooperation may break down when competition increases within districts. Besides, with outgrower firms buying cotton from farmers that they did not necessarily support, there are no assurances that the buyer will collect seed cotton of one specific variety. Currently there is no enforcement capacity among MAFF extension workers who are understaffed and are immobile to stamp down on the cotton ratoon crop. The presence of ratoon crops also worsens the problem of seed impurities.

Third, the draft animal stock in Zambia is being seriously depleted by disease. PHS data from Southern Province indicate that 78% of the non-cotton farmers and 100% of the cotton farmers used animal traction in 1996/97. Animal traction use in Eastern and Central Province is much lower. Anecdotal evidence indicates that cattle deaths in recent years have reached alarming levels and that livestock dipping and veterinary services in most parts of Zambia have been declining. Lack of access to healthy draft animals harms the industry in at least two ways. First, it makes it very difficult for farmers to adopt many of the cotton husbandry practices emphasized in current extension messages, especially correct methods of planting and early planting and weeding, and therefore hurts yields. Second, area planted to cotton may decline since animal traction is one of the principal mechanisms by which smallholders can increase the area they cultivate.

Finally, pest management practices at the farm level are frequently insufficient to control the sucking pests to which cotton is very susceptible. According to the recommendations, cotton that has been sprayed yields two to four times higher than a crop that has not been sprayed. However, smallholder producers may prefer to apply chemicals only once expecting that the savings in production costs will result in greater farm income compared to the recommended four applications. Typically this results in yield losses greater than the value of the spraying, reduces overall production in the industry, and increases unit costs to ginners. Besides, cotton farmers in Zambia are still on a fixed spraying regime. The returns to spraying may be improved by training farmers in pest scouting.

Other technology issues in the cotton industry include the problem of polypropylene contamination of the cotton fibers. Zambian lint has become recognized for this contamination, which is caused by the polypropylene bags used to transport the seed cotton from the field to the point of transport and/or from the farm to the ginnery. The polypropylene scraps in cotton only appear once the yarn is dyed. Some ginners have reported that the contamination reduces the price offered for Zambian cotton. Some companies are attempting to overcome this major problem by providing farmers with jute or cotton bags from local textile mills for packing the seed cotton. This is an area where private and public sector cooperation is most likely required (especially for educational campaigns) but the potential payoff is strategic for the long-term competitiveness of Zambian cotton lint.

4.4.2. *Alternative Cost Recovery Models to Finance R&D*

Public investments in agronomic and seed breeding research and extension services have been important sources of farm productivity growth all over the world. As a share of GDP, Africa spends only one third the amount of OECD countries, yet agriculture is six times as important to its economies. Investment in agricultural research and infrastructure needs to increase 18-fold to match the investments being made in the developed world and those that were made during the green revolution in the newly industrializing countries of South and South East Asia (Johnston and Gabre-Madhin 1999). In Zambia's case, the public sector is not likely to devote much of its constrained resources to cotton research and extension systems. This will impede the ability of the cotton industry to remain internationally competitive over the long run unless the industry develops mechanisms to self-provision these investments.

To keep the cost of these investments to levels it can bear, the industry must take maximum advantage of existing and emerging cotton technologies from outside of Zambia. By focusing on research that **adapts** these technologies to Zambian conditions, rather than on **creating** new technologies, the industry can keep costs down and substantially reduce the time lag between the beginning of a research program and the release and propagation of a new technology.¹⁶

Self-financing mechanisms typically involve charging a legally mandated levy on transactions at some key point in the system. Evaluation of which point to choose should consider at least four criteria: 1) reduction of the free-rider problem (see below), 2) ease of administration, 3) equity between farmers and ginners, and 4) effects on trust among all participants in the industry.

A "free-rider" problem results when firms make an investment (e.g., research or extension services) but cannot exclude other firms from benefitting from that investment. Under these circumstances, there is a strong incentive for some firms to avoid making the investment and to obtain a "free ride" from the efforts of others. These incentives frequently result in an overall under-provision of the investment, since firms incurring the cost would be at a competitive disadvantage to firms which free ride.

Research and extension are examples in which some firms can free-ride on the investments made by other firms. Firms supporting outgrowers operate their own independent seed certification and distribution programs. However, it would typically be difficult for these firms to recover the full cost of their investment in the seed multiplication and certification, and firms purchasing cotton but not running outgrower schemes surely benefit from these investments made by others.

Similar free-rides are present with extension investments. Following privatization, the ginners established input distribution systems whereby company representatives deliver inputs to

¹⁶ It is possible that some of these technologies may be directly usable in Zambia. Monsanto is currently funding research through the Cotton Development Trust (CDT) to evaluate the suitability of genetically modified (GM) varieties of cotton in Zambia. If found suitable, these varieties could be available to Zambian smallholders by 2003. If further adaptive research is needed, GM varieties would not be available until 3-4 years later. In either case, Zambia is taking advantage, at relatively low cost, of substantial investments in cotton technology made by other countries.

individual farmers, at the same time providing technical advice and user instructions. The physical provision of extension services is a major investment made by the large cotton ginning companies. These extension expenditures benefit the entire industry, including firms that buy cotton from farmers receiving extension support paid by other firms.

One way to cope with the free-rider problem is to design funding mechanisms for research and development that include all or most of those who are likely to benefit. Performance of the system is likely to improve as the point at which the levy is charged moves up towards the point of sale of the cotton lint. Administration of a levy on exports and domestic sales of lint would be simpler than other alternatives because the number of transactions at this level will be far less than the number lower in the system. Administrative tractability would, in turn, make it easier to enforce contributions to the R&D fund, thereby reducing the free rider problem. Charging the levy at the point of sale of the lint will also increase the probability that ginners will bear at least some portion of the final cost, since it is unlikely that they will be able to pass all of the cost down to farmers. Finally, an levy on lint sales will avoid further complicating what is already a very confusing pricing environment for farmers, thus avoiding the creation of yet one more reason for farmers to distrust ginners.

It is suggested that the private sector, rather than government, monitor the enforcement of any levy and administer the funds, but government would need to play a crucial role in creating a legal framework that allows enforcement to be effective. This will require legislation mandating substantial penalties to anyone not complying with the levy agreement, and legal mechanisms (whether arbitration or court proceedings) that reduce the cost of imposing those penalties.

If the private sector needed to cover all the research and development costs for the cotton industry, these costs may make it difficult for them to compete in world markets. Government can help reduce this problem by continuing to cover some variable costs such as salaries to government scientists and routine upkeep of installations, while accessing donor funds to improve the training of current and new scientists. Resources from the private sector R&D fund could be used to improve the quality of research installations and equipment and ensure that scientists have the resources needed to conduct their work in a timely and high quality fashion.

The private sector could also access external funds, both from donors and private companies, to cover some R&D costs. Lonrho Mozambique (Lomaco) has obtained financing from the *Caisse Francais* to finance technical assistance from CIRAD on cotton and food crop varietal development. In Zambia, the CDT is already receiving funding from Monsanto for research evaluating the suitability of existing Bt cotton varieties for Zambia; Lonrho in collaboration with CDT staff are conducting this research on contract at Magoye and GART research stations. Donors would also likely be receptive to well designed proposals from CDT to fund technology development and extension initiatives which would benefit the industry as a whole.

On extension, government through MAFF has a structure, trained manpower and training facilities but lack resources to implement programs. On the other hand, private firms may have the financial resources but employ agents that are inadequately trained. Alternatives being pursued include private firms seconding and augmenting the salaries and conditions of trained government extensions workers through CDT. Another alternative is for the firms to form a partnership with MAFF field services through CDT and provide MAFF with material and resources to train farmers.

5. SUMMARY

This section synthesizes and summarizes the arguments and findings presented in this paper, and provides a backdrop for the final section, which presents a set of strategic questions on how the Zambian cotton industry can best design the way forward. The information and findings in this paper suggest several key points and implications that should frame debate about the cotton industry's future in Zambia.

5.1. Limited Resources

The financial resources of the Zambian government are extremely limited. Their judicial system also suffers from systemic problems that make legal action exceptionally time consuming. This means that the cotton industry — ginners, farmers, and everyone in-between — needs to organize itself to deal with their problems, seeking only strategic facilitating and regulatory assistance from government.. When they request help from government, it should be either to legally sanction strategies that industry actors have already agreed upon, or to use existing state resources in ways that increase the effectiveness and broad-based benefits of agreed upon private strategies. An example of the former is the industry first agreeing on a plan to share information and police itself to reduce poaching, then proposing government legislation that would make it easier for the plan to be enforced. An example of the latter is the industry agreeing to a self-financing plan to fund cotton R&D, then gaining agreement that government will continue to fund key scientists and routine upkeep of installations, while accessing donor funds to improve the training of current and new scientists.

5.2. Ginning Capacity

Excess ginning capacity is simultaneously a key contributor to the current loan recovery debacle, and an opportunity to significantly expand benefits from cotton for all participants in the sector.. Installed ginning capacity is about 150,000 tons of seed cotton, representing a major opportunity to expand output. Yet total ginnings last year were about 84,000 tons, and will probably be even lower during 1999/2000. This creates an almost irresistible incentive for firms to use whatever means at their disposal to increase throughput in order to reduce unit ginning costs. As long as functioning ginning capacity remains so far above production, it seems likely that the industry will continue to suffer from a serious loan recovery problem.

5.3. Increase Productivity

This implies that productivity and total production must increase so that industry-wide unit processing costs can be reduced. Of course from the perspective of an individual firm, the problem could be solved by some firms going out of business, allowing each of the remaining firms to gin more cotton. From a societal perspective, however, it is clearly preferable for installed capacity to be efficiently used; cotton production also has the potential to improve the standard of living of small farmers, so government should have a strong incentive to see overall production increase.

5.4. Importance of Loan Recovery

These productivity and production gains must be achieved in a way that does not exacerbate the loan recovery problem. The loan recovery problem is fundamentally a cost problem: it is prohibitively expensive for cotton companies to monitor the behavior of each and every smallholder producer to whom they are providing production inputs. Distributing more inputs to more farmers will increase costs and stretch company resources beyond the breaking point. Yet reducing the number of farmers without dramatically increasing the productivity of those remaining is also self-defeating, as unit processing costs will rise substantially.

5.5. Reduce Transaction Costs

Reducing the cost of loan recovery requires that companies deal with fewer actors in the production process. A fundamental fact is that the costs of monitoring loan recovery are nearly proportional to the number of actors being monitored. Thus, the cost of monitoring a very small farmer are about equal to those for a very large farmer,¹⁷ and monitoring a farmer organization costs a small fraction of what it would cost to monitor each of the producer members individually.

5.6. Farmer Organization

Reducing the number of actors in the production process, while increasing productivity and total production, can be accomplished in two complementary ways. First, companies can contract an increasing share of their cotton through farmer organizations rather than individual farmers. This process has just begun in Zambia. It is imperative that companies learn lessons from successful experiences in northern Mozambique and some areas of Zambia, especially the concept of “**responsibilization**”. If successful, companies could substantially reduce their loan monitoring costs by working with effective farmer organizations, and collaborating with NGOs to create more such organizations. Yet these organizations take time to form and mature, so they cannot be the only approach to reducing the cost of loan recovery. The second, complementary approach, is for companies to identify a core group of farmers in whom to invest more aggressively to increase their productivity and their area planted. Additional research is clearly needed to identify this core group of target farmers. Available evidence suggests that these farmers may already be larger and more commercialized than the typical smallholder, but have room for substantial improvements in yield and/or area planted. Companies would reach the smaller farmers through effective farmer organizations.

Either one of these approaches to the loan recovery problem will help address the productivity problem. Working with effective farmer organizations can reduce the cost and increase the effectiveness of extension assistance. Effective farmer organizations typically provide members who work closely with extension agents to disseminate extension messages. This can dramatically reduce the unit cost to companies of extension assistance (the cost of reaching an

¹⁷ They may be even higher for the small farmer, since that farmer may be in a more remote area and thus be more difficult to contact.

individual farmer). The increased farmer-to-extensionist communication that results from this arrangement can also help reshape the extension message and lend it credibility in the eyes of fellow farmers, in ways that improve farm level productivity.

5.7. Complimentary Actions

Additional complementary actions must be taken to resolve the loan recovery, and production and productivity problems. These include:

- reducing confusion and uncertainty among farmers regarding the prices they are paid,
- agreeing on information sharing and a self-policing strategy to reduce poaching,
- developing and proposing legislation to reinforce this self-policing strategy,
- agreeing on a self-financing approach to fund cotton R&D,
- gaining government agreement to use existing budgetary resources, complemented by donor funds, in key ways to increase the supply of capable scientists who can contribute to improved cotton technology,
- gaining government agreement and support to educate farmers about the long-run benefit of loan repayment,
- gaining government agreement and support to consistently stimulate/facilitate private sector approaches to input supply
- gaining government agreement and support to improve quality control and classification, particularly with regard to reducing impurities from polypropylene bags at the factory gate or before.

6. KEY QUESTIONS TO BE CONSIDERED AND RESOLVED IN DESIGNING THE WAY FORWARD

On the basis of the synthesis and summary presented in the previous section, this section suggests a series of key questions that the Zambian cotton industry must grapple with as it designs collaborative approaches to resolve its pressing problems. This set of questions is meant to be a starting point for serious debate leading to effective solutions.

1. Should an entity representing private and public sector stakeholders in the agricultural sector constitute a “cotton industry strategic planning subcommittee” for addressing the industry’s problems and attempting to resolve them? How would this subcommittee operate to ensure adherence to agreements made among its members?

2. What should be the key elements in an industry self-policing approach to solving the poaching problem? This paper has proposed:
 - a) That firms within the industry agree to share information on individual households and farmer groups to whom they have extended loans, and the status of those loans, then agree not to purchase cotton from any farmer or organization receiving credit from another firm, or extend production credit to any farmer or organization with debts to another firm, and

 - b) That the industry prepare and propose to government legislation that (i) defines the conditions to be met for firms to be a legal buyer of cotton; (ii) imposes costs on illegal or unlicensed buyers, (iii) imposes costs on firms that buy cotton from or provide cotton financing to farmers with outstanding debts to other cotton firms, and (iv) imposes costs on farmer organizations (but not individual farmers) who default on loans.

We have emphasized that this approach needs to be primarily self-policed, and seek to attract and educate smallholders through the benefits from loan use and repayment, with legal action being a last recourse.

Would the industry modify this basic approach at all? If so, how? What additional actions does industry (or individual firms) need to take for such a strategy to work? For example, do all firms currently maintain good records on all farmers with whom they have current or past loans? Can private penalties be imposed on firms which do not share this information, or who in other ways do not abide by the industry agreement?

3. How can companies reduce the confusion and uncertainty that producers currently feel about the prices they receive for cotton? This paper has proposed that companies agree to two principles:
 - a) An industry-wide procedure, developed in consultation with farmers and widely and frequently explained to them, for calculating discounts to the final price paid

to farmers, based on the type and quantity of inputs the farmer has received on credit.

- b) An industry-wide indicative price to be announced prior to planting and updated as the season progresses. This indicative price will be the price **without** charges for in-kind credit that firms may have provided, and serves as a guidance to actual prices paid to farmers.

What changes would industry propose to this basic approach? If the basic approach is accepted, how can the industry move forward defining the procedure for calculating prices, resolving the many details of an agreed-upon discounting procedure, and establishing indicative prices at various points during the season?

4. How can cotton companies expand the currently very small group of farmers with high cotton yields and relatively large areas devoted to cotton? 1997/98 PHS data indicate that only an estimated 6,500 out of nearly 86,000 farmers cultivated more than 1 ha of cotton and obtained yields of more than 1 mt/ha. Should primary emphasis be on increasing yields among low-yielding farmers with substantial area in cotton? Or can the cotton companies make key investments to help farmers with high yields but relatively small areas increase their area devoted to cotton? Do cotton companies have data at the individual farmer level (area planted, production, amount of credit received, use of animal traction) that would help answer this strategic question?
5. What is the best way to promote effective farmer organizations? How can the cotton industry learn from and apply lessons being learned from northern Mozambique and Zambia itself? A key question is whether cotton firms should create and support farmer organizations themselves, or simply facilitate NGO efforts in the area by working with organizations that the NGOs help create. Many NGOs, especially CLUSA (Cooperative League of the USA), have great expertise in creating sustainable farmer organizations. In Mozambique, other NGOs have been actively learning from CLUSA's approach to improve their own effectiveness in creating farmer organizations. There could be substantial advantages to the cotton companies if they were able to step back from organization development activities themselves, and instead support NGOs initiatives by working seriously with organizations as they emerge.
6. Is a levy on sales of cotton lint the best way to finance private cotton R&D? If not, what alternative mechanisms can the industry propose?
7. Who should manage the R&D fund? Should it be under the auspices of CDT, or of a separate private sector organization created for the purpose?

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