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MINISTRY OF AGRICULTURE AND FISHERIES

Directorate of Economics

Research Paper Series

Smallholder Cash-Cropping, Food-Cropping and Food
Security in Northern Mozambique: Summary, Conclusions,
and Policy Recommendations

By

MAP/MSU Research Team

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DIRECTORATE OF AGRICULTURAL ECONOMICS

Research Paper Series

Through its Food Security Project, the Directorate of Economics of the Ministry of Agriculture and Fisheries maintains two publication series for results of research on food security issues. Publications under the *Flash* series are short (3-4 pages), carefully focused reports designed to provide timely research results on issues of great interest. Publications under the Research Paper series are designed to provide longer, more in-depth treatment of food security issues. The preparation of *Flash* reports and Research Reports, and their discussion with those who design and influence programs and policies in Mozambique, is an important step in the Directorate's overall analysis and planning mission.

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Executive Summary

As Mozambique recovers from war and undergoes economic reform, given its favorable agro-ecological endowment and its highly rural population, improved agricultural performance is essential to three Government policy objectives: 1) smallholder income growth; 2) improved rural food security; and 3) reducing the balance of payments deficit. In the context of near complete input and credit market failure in rural areas, policy-makers are faced with the challenge of how to achieve these micro- and macroeconomic goals. In the north, the Government formed Joint Venture Companies (JVCs) with three multi-national agro-industrial firms to rehabilitate cotton infrastructure in 1990 with the hope that this would contribute toward achieving these goals. In return for monopsony cotton-buying rights in their respective areas of influence, the JVCs agreed to provide participating smallholders with reliable input supplies and extension services for cotton and food crops and to purchase seed cotton from farmers at official price levels. The firms also agreed to invest in the rehabilitation of cotton ginneries and rural road networks in their areas of influence. The desire to understand the effects of smallholder:JVC cash-cropping with respect to Government policy goals was the motivation of a socio-economic study conducted in Nampula and Cabo Delgado Provinces by the Ministry of Agriculture and Fisheries / Michigan State University Food Security Project (MAP/MSU FSP) from 1994 to 1996.

Key conclusions from the study include:

■ **In both principal study zones (Montepuez and Monapo/Meconta), cotton producers grew greater quantities of maize than households with no cotton production.** Empirical evidence thus shows that cash-cropping can have a positive effect on smallholder food production. Further, households who grew cotton with the high-input package but who grew low-input maize had significantly **greater maize yields** per hectare than their neighbors in low-input cotton schemes.

■ **Low-input cotton production raised smallholder per capita income by between 25 and 36 percent in the zones of significant JVC investment,** based on econometric analyses of the determinants of per capita income. Cotton's effect on an indicator of smallholder food security - hungry season cereal reserves - was positive and significant among low-input growers in Montepuez, and positive but statistically insignificant among households in other cotton production categories in Montepuez and Monapo/Meconta. In other parts of Nampula Province, with very minor private sector investment in input distribution and extension services, low-input cotton had a negative effect on income and little effect on hungry season cereal reserves. The finding that, holding constant other factors, low-input cotton contributes positively to smallholder income in areas of significant JVC investment, though less so to food availability is a key result. This suggests the importance of a significant JVC investment in a given zone for smallholder cotton to deliver these benefits in the current policy environment.

■ The benefits to smallholders, the country and private sector firms supporting smallholder cotton increase dramatically where smallholders grow cotton with fertilizer and herbicide. **The same econometric estimation technique showed that high-input cotton increased per capita income by between 97 and 138 percent relative to non-cotton growers.**

Intensification was also shown to be positively associated with greater smallholder food production and hungry season cereal reserves.

■ **Within the two principal study zones and across cotton production categories, cotton and maize yields varied significantly.** Yield equations identified early seeding, sufficient weeding labor, and adequate insecticide applications (for cotton) as key factors related to productivity.

■ **For smallholder:JVC relationships to be sustainable, the JVCs must be financially profitable enterprises.** In both principal study zones, low-input and high-input cotton were profitable to the JVCs, generating returns from \$56 to \$127 per hectare under current yield and world market conditions.

■ **Cotton domestic resource cost ratios ranged from 0.42 to 0.65, indicating a comparative advantage for the cotton belt in both low-input and high-input packages.** Sensitivity analysis showed that these estimates were robust to variation in world cotton prices experienced over the past ten years.

■ **The cotton belt is currently an inefficient producer of maize for markets outside the region such as Maputo.** Even assuming improved yields and lower per unit production costs, the high costs of coastal shipping, inefficient port operations and a poor domestic highway network result in the north **currently** having a comparative disadvantage in maize. **However, the fact that the north's rainfall patterns are not correlated with those in the rest of the Southern Africa region and the potential, with appropriate investments, to develop its strategic position vis-a-vis ports and rail lines suggests that it could become an important supplier of maize (and other food crops) to the region.**

Policy Recommendations and Priorities for Future Research

■ Smallholder cotton can have important micro- and macroeconomic benefits if it is promoted with a sufficient level of inputs, extension and marketing infrastructure. **Intensification** of cotton has even greater benefits for each of the actors in the system. **The GOM should promote smallholder cotton production in the cotton belt through strategies which effectively balance smallholder and private sector interests in pursuing vertical coordination of the subsector.**

■ Improving smallholder capacity to represent their own interests vis-a-vis private sector firms in the cotton subsector can be an important mechanism to improve the effect of cash-cropping on smallholder welfare. In a zone similar to Mozambique's cotton belt in Mali, farmer associations have represented an important way for farmers to achieve greater power and gain access to fertilizers and other key inputs. Farmer associations have the potential to play a similar role in Mozambique. **The GOM and donors should promote the formation of farmer associations to promote smallholder's bargaining power with private sector firms.**

■ **The process by which the GOM determines minimum producer prices for cotton should be reviewed.** Yearly changes in the GOM cotton price have not reflected changes in

world market conditions. For example, the official price jumped from \$0.16 to \$0.34 per kg from 1994/95 to 1995/96 while FOB Northern Mozambique prices for cotton fiber dropped from \$1,715 to \$1,438. Such erratic price policies make long range investment planning by the JVCs and other private sector firms difficult and create unsustainable price expectations and uncertainty for smallholders.

- The Mozambique Cotton Institute lacks the institutional capacity and resources to represent smallholder interests effectively. However, governmental oversight to encourage JVC behavior to benefit smallholders throughout their areas of influence is important. **The GOM should seek new and innovative mechanisms to bring this about such as having Institute representation in the decision-making structure of the JVCs, given that the Government is in fact a partner in these schemes.**

- If the GOM wishes to encourage JVC involvement in smallholder food crop intensification, establishing a minimum producer price at recently observed levels may be counter-productive. **The GOM should seek policies designed to increase rural incomes through productivity enhancing technology packages rather than through an unsustainable minimum price policy.** JVCs have an important stake in improving rural food security and innovative mechanisms should be sought to encourage their participation.

- Development of cotton varieties with enhanced ginning outturn ratios is the subject of research attention by the national agricultural research system. **The Government and donors should place renewed focus on this effort.**

I. Introduction

As Mozambique recovers from war and undergoes economic reform, given its favorable agro-ecological endowment and its highly rural population, improved agricultural performance is essential to three Government policy objectives: 1) smallholder income growth; 2) improved rural food security; and 3) reducing the balance of payments deficit. In the context of near complete input and credit market failure in rural areas, policy-makers are faced with the challenge of how to achieve these micro- and macroeconomic goals. In the north of the country, the Government formed Joint Venture Companies (JVCs) with three multi-national agro-industrial firms to rehabilitate cotton infrastructure in 1990 with the hope that this would contribute toward achieving these goals. In return for monopsony cotton-buying rights in their respective areas of influence, the JVCs agreed to provide participating smallholders with reliable input supplies and extension services for cotton and food crops and to purchase seed cotton from farmers at official price levels. The firms also agreed to invest in the rehabilitation of cotton ginneries and rural road networks in their areas of influence. The desire to understand the effects of smallholder:JVC cash-cropping with respect to Government policy goals was the motivation of a socio-economic study conducted in Nampula and Cabo Delgado Provinces by the Ministry of Agriculture and Fisheries / Michigan State University Food Security Project (MAP/MSU FSP) from 1994 to 1996. This document highlights key study findings and their implications for formulating strategies to promote rural economic growth and food security. To place the study's findings into context, there is a brief review of the study's background, objectives and methodology.¹

A. Background and Objectives

There is a controversy over whether cash-cropping improves smallholder welfare in Sub-Saharan Africa (SSA). This is despite results from a range of SSA experience showing that cash-cropping typically has a strongly positive effect on smallholder incomes and a smaller but still positive effect on food consumption. A key finding from much of the SSA cash-cropping literature is that the effects on participating families depend critically on the organizational details of the scheme. The three JVCs that have operated in the cotton belt since 1990 have provided smallholders with a variety of cash- and food-cropping packages. Details about the three JVCs are provided in Table 1. Figure 1 shows those parts of the three JVCs' areas of influence included in the FSP sample in Nampula and Cabo Delgado Provinces, as well as the "CARE-OPEN" project area which was also included in the sample frame.²

¹ Readers interested in more detail concerning analytical techniques used and a more complete reporting of study results should see Smallholder Cash-Cropping, Food-Cropping and Food Security, unpublished Ph.D. dissertation by Paul J. Strasberg (1997), a reprint of which was published as MAP/MSU FSP Research Report No. 24.

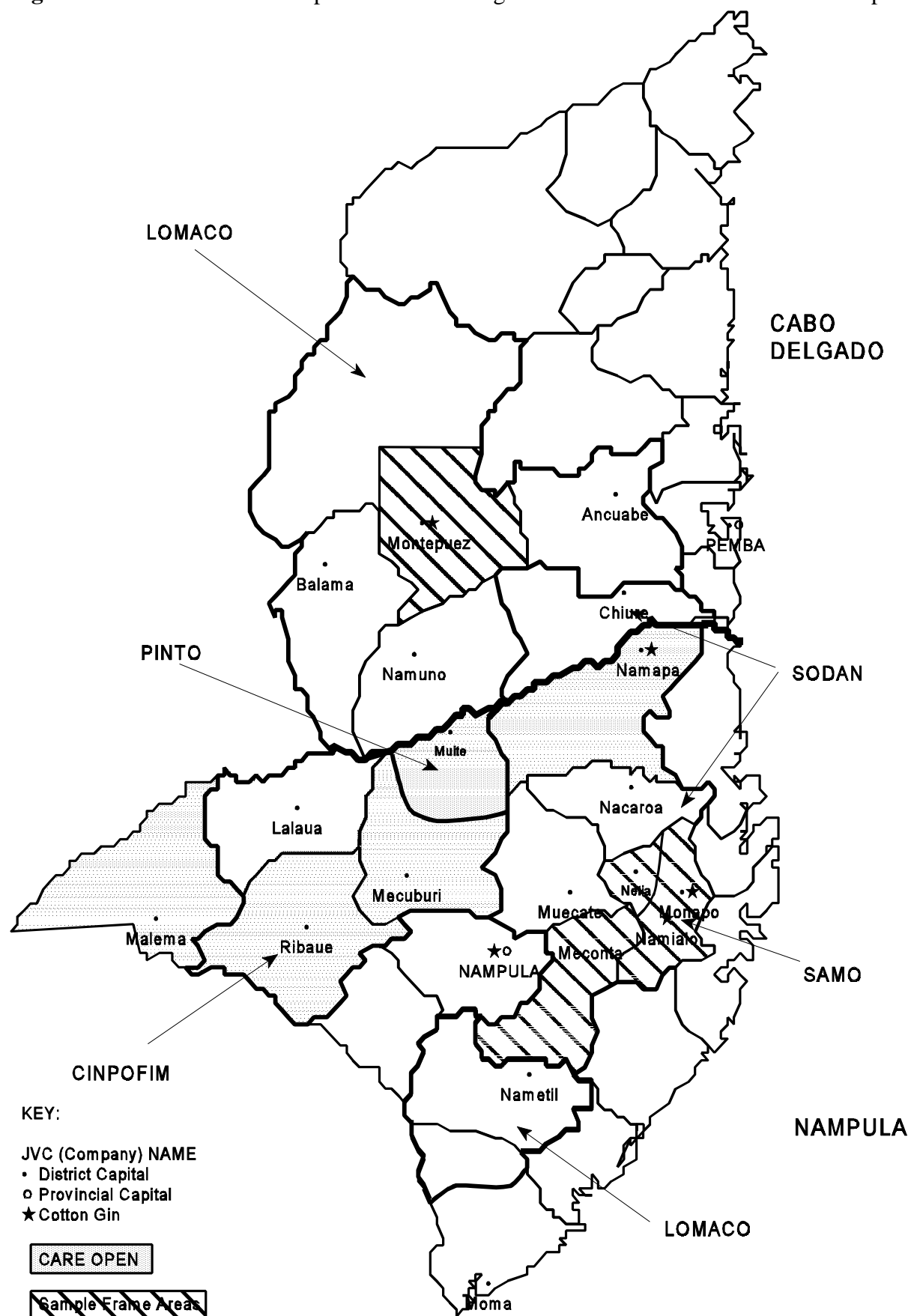
² For a more complete discussion of sampling strategies used in this study, see MAP/MSU FSP Working Paper No. 22 (1996).

Table 1. JVCs Supporting Smallholder Cotton Production in Nampula and Cabo Delgado, 1994/95

Joint Venture Companies ¹			
	LOMACO-Montepuez (Lorrho Mozambique Agro-Industrial Company)	SODAN (Sociedade de Desenvolvimento Algodoeira de Namialo)	SAMO (Sociedade Algodoeira de Monapo)
International Firm (where based)	Lorrho (United Kingdom)	Grupo Comercial João Ferreira dos Santos (Portugal)	Grupo Entrepósito (Portugal)
Date of Formation of Joint Venture Company	1990	1990	1990
Location of Cotton Processing Factories	Montepuez (Cabo Delgado) Nametil (Nampula)	Namialo Namapa	Monapo
Location of Smallholder Concessionary Area	<u>Cabo Delgado</u> districts of: Ancuabe, Balama, Montepuez, Namuno	<u>Cabo Delgado</u> district of: Chiure	<u>Nampula</u> district of: Monapo
	<u>Nampula</u> districts of: Angoche, Mogovolas, Moma	<u>Nampula</u> districts of: Meconta, Monapo (Netia only), Muecate, Nacaroa, Namapa	
Crops Supported	Cotton, maize, small amounts of tobacco, peanuts, and beans	Cotton only	Cotton only
Participating Smallholders 1994/95	16,180	57,896	7,105
Seed Cotton Production 1993/94 (MT)	6,117	11,543	2,423

Source: Unpublished materials obtained from Mozambique Cotton Institute, Interviews with Company officials
¹ CINPOFIM operated as a private company in CARE-OPEN area during study, and has since become a JVC under the name CANAM

Figure 1. Districts of Nampula and Cabo Delgado Provinces in FSP and CARE Samples



In the areas of influence of SODAN and SAMO, in Monapo and Meconta Districts, the smallholder:JVC relationship has been limited to "low-input cotton," where insecticide and improved seed are the only modern inputs used. Here farmers cultivate cotton either on their own "dispersed" fields or on "block" fields established during the colonial era.³

Approximately 80 percent of smallholders in this zone grew low-input cotton during the 1994/95 season. According to smallholder surveys, these JVCs provided no support to smallholders for food crop production or marketing.

In Montepuez, where 27 percent of rural households grew cotton in 1994/95, "high-" and "low-" input packages were available to smallholders from Lomaco. Most cotton-growing households used a low-input package similar to that in Monapo/Meconta. A pilot group of farmers used an innovative "high-input" package that included herbicide, fertilizer and insecticide (and in some cases tractorization) for cotton. A subset of these high-input cotton growers also participated in a high-input maize scheme with Lomaco. This high-input group was unique at the time the study began in rural Mozambique for two reasons. These were the only smallholders 1) using either herbicide or fertilizer or receiving tractorization services; and 2) receiving JVC support to produce and market maize. In a nearby region with no significant JVC presence (CARE-OPEN), one-third of rural households grew cotton in 1994/95..

The considerable variation found in smallholder:JVC relationships represented an attractive quasi-experimental design upon which this study was based. Specifically, the research was designed to achieve the following objectives:

- 1) Describe the food security strategies of smallholders in the cotton belt;
- 2) Analyze the determinants of agricultural productivity in cotton and maize;
- 3) Compare the financial profitability of cotton, maize and manioc from the smallholder and JVC perspectives at varying levels of agricultural intensification;
- 4) Determine the extent to which the region enjoys a comparative advantage in smallholder cotton, maize and manioc based on the range of existing technologies;
- 5) Determine the extent to which households enjoy differential levels of income and food security based on their cotton production category, and the role of the JVC-schemes in causing this differential; and
- 6) Recommend key policy changes, investments, project initiatives and additional research necessary to improve the contribution of cash-cropping to smallholder food security, income and macroeconomic goals.

³ Blocks are relatively large tracts of land on which a number of smallholders each work 0.5 - 3.0 ha parcels. Smallholders typically do not consider themselves to have any tenure security on these blocks.

To address these research questions, 521 rural households across the cotton belt were surveyed at four month intervals between June 1994 and February 1996. A stratified random sample within the areas of influence of the three principal JVCs was drawn in order to include households involved in the range of cotton production categories (high-input block, high-input dispersed, low-input block, low-input dispersed) present in each zone. Table 2 shows the number of rural households interviewed in each zone broken down by the

Table 2. Final Sample Design, Rounds 2-5 (January 1995 - January 1996)

Household Production Category ¹	Area of Influence / CARE Mozambique			Total
	LOMACO	SODAN /SAMO	CARE OPEN	
Number of Villages Sampled	(7)	(9)	(5)	(21)
	----- Number of Households -----			
High-input block cotton and maize	39	n.a.	n.a.	39
High-input dispersed cotton	27	n.a.	n.a.	27
Low-input block cotton only	n.a.	47	n.a.	47
Low-input dispersed cotton	78	86	48	212
No cotton	57	42	97	196
Total	201	175	145	521

¹ Household Production Category as of December, 1994.

Source: 1994/96 MAP/MSU Smallholder Survey

household production category. In the CARE-OPEN zone, a sample of cotton growers was drawn allowing a comparison of the effects of growing cotton with much less JVC support than in Montepuez or Monapo/Meconta. Also, non-cotton growers were sampled in each zone to represent a control group as part of the quasi-experimental design. For each survey round, questionnaires were devised with the objective of computing annual estimates of agricultural production and sales, income, labor use and food consumption for each sampled household.

While the smallholder survey represents the centerpiece of the overall research design, key informant interviews were also conducted with officials from the JVCs, agricultural research

institutions, the Ministry of Agriculture and Fisheries and non-governmental organizations. Information from these interviews was useful toward understanding the broader economic environment in which cotton belt households operate.

B. Analytical Techniques

To address the research objectives outlined above, four complementary analytical methods were used. First, plot-level regression models of the determinants of cotton and maize yields among sampled households were estimated, allowing quantification of the effects of key inputs and practices on productivity in the two crops. Second, financial profitability of cotton, maize and manioc to farmers was analyzed through the use of enterprise budgets. Budgets were computed for high-input cotton and maize schemes in Montepuez, low-input cotton schemes in both Montepuez and Monapo/Meconta and traditional low-input maize and manioc enterprises in both zones. Due a high degree of variation in yield and input use within groups, budgets were broken out by yield tercile. Financial outcomes of the various schemes from the JVC perspective were also analyzed.

Third, parameters generated in the financial budgets were used to investigate under what conditions Mozambique enjoys comparative advantage in the set of cotton, maize and manioc enterprises and technology packages discussed above. Thus, incorporating all economic costs of production, transformation and marketing, this macroeconomic analysis compared the production alternatives most attractive to the country in terms of its trade balance to those found most financially profitable to smallholders and the JVCs. The attractiveness of the various cropping choices to smallholders, the JVCs and the macroeconomy depend on assumptions regarding key parameters (e.g., input level, the ginning outturn rate for cotton and producer and world prices); sensitivity analysis was conducted to determine how variation in these parameters affect each group.

Finally, econometric models of annual household income and food security were developed to estimate the overall effect of the various JVC cash-cropping schemes while holding other factors constant.

II. Conclusions

This section discusses key conclusions from the study. Likewise, Tables 3 and 4 display selected results by study zone and cotton production category.

■ **Cotton belt households depend on retained production to meet more than 80 percent of their calorie consumption needs, though the role of food markets has increased from war-time levels.** Households that must buy food in the hungry season face cereal prices two to three times greater than harvest season levels, suggesting that food markets still represent an unreliable option for many food insecure households with limited effective demand. With the vast majority of smallholders using unimproved local varieties of maize and other cereals, determining how to increase smallholder access to improved varieties and other modern inputs for food production represents a priority for improving rural food security.

■ **Reliance on the market for food purchases increased substantially during the hungry season for most farmers.** This tendency was especially strong in Nampula and less strong but still apparent for low input and non- cotton growers in Montepuez. High input cotton growers in Montepuez did not increase their reliance on the market during the hungry season.

■ **In both principal study zones (Montepuez and Monapo/Meconta), cotton producers grew greater quantities of maize than households with no cotton production.** Empirical evidence thus contradicts the claim that cash-cropping has a negative effect on food production in this case. Further, households who grew cotton with the high-input package but who grew low-input maize had significantly **greater maize yields** per hectare than their neighbors in low-input cotton schemes.

■ **Within the two principal study zones and across cotton production categories, cotton and maize yields varied significantly.** With respect to cotton, yield equations identified early seeding, sufficient weeding labor, and adequate insecticide applications as key factors related to productivity. A benefit:cost ratio of 1.8:1 indicated the profitability of increasing the number of insecticide applications above current mean levels. For those households in low-input cotton schemes in the lowest yield tercile, returns to family labor were very low compared to wage rates paid for unskilled agricultural labor. Poor results were associated with late planting, insufficient insecticide and inadequate weeding labor.

■ **The highest returns to labor were in high-input cotton and maize schemes in Montepuez.** An attractive benefit:cost ratio (of 1.5 to 2.5:1) of the high input cotton package suggests that effective application of herbicide and fertilizer is profitable for smallholders. The high-input maize scheme had a private benefit:cost ratio of 1.3:1 on average. However, the riskiness of these schemes, from both the smallholder and JVC perspectives was highlighted by extreme yield variation in maize, where nearly one-third of participants suffered financial losses. An attractive attribute of high-input cotton production, from both the smallholder and JVC perspectives, is that it is generally less risky than high-input maize for two reasons. First, cotton is relatively more drought resistant than maize. Second, Mozambique produces a small amount of cotton relative to

Table 3. Selected Household Level Results by Study Zone and Cotton Production Category

Indicators	Montepuez				Monapo/Meconta			
	Cotton Production Category				Cotton Production Category			
	High-Input Block	High-Input Dispersed	Low-Input Dispersed	No Cotton	Low-Input Block	Low-Input Dispersed	No Cotton	No Cotton
% calories from purchases								
May	13	9	11	8	3	5	8	
September	17	13	7	11	6	6	13	
January	16	15	16	22	25	23	12	
Total maize production (kgs)	2159	2295	592	424	391	338	277	
Maize yield (kg/ha)								
Upper tercile	3185	1610	1188	1190	918	657	593	
Lower tercile	871	328	238	194	218	181	162	
Cotton yields (kg/ha)								
Upper tercile	1796	1661	1010		1080	917		
Lower tercile	1045	649	200		337	155		
Returns to labor (\$/day)								
Maize	1.82	1.82	0.92	0.71	0.64	0.39	0.36	
Cotton	2.41	1.91	0.78		0.93	0.62		
Net household income (\$)	669	650	255	192	371	238	151	
Net per capita income (\$)	191	199	82	58	101	83	61	
Hungry season cereal reserves ('000s calories per capita)	150	121	101	63	220	106	90	

Source: 1994/96 MAP/MSU FSP Smallholder Survey

Table 4. Selected Macroeconomic- and JVC-Level Measures of Profitability, Cotton and Maize

Indicators	Cotton Production Category		
	High-Input Block	High-Input Dispersed	Low-Input
Joint Venture Company (per hectare)			
Profit from cotton, current yield & GOR	127	115	56
Profit from maize, current yield	(44)	--	--
Macroeconomy			
Resource cost ratio, cotton	0.42	0.60	0.55-0.68
Net social profitability, cotton (\$/ha)	204	188	42-97
Resource cost ratio, maize	1.95	--	1.52
Net social profitability, maize (\$/ha)	(16)	--	0-26

Source: 1994/96 MAP/MSU FSP Smallholder Survey

the world market and is therefore a price taker. On the other hand, domestic and regional maize market conditions are more volatile. For both crops, however, intensification increases the potential value of production for credit-constrained farmers as it also raises costs and risk. This increased risk for Lomaco in high-input maize has translated into significant financial losses due to lack of credit repayment. Developing mechanisms for dealing with intra-annual risk that simultaneously promote intensification are critical to the long-run sustainability of these schemes. The role that farmer-based associations may play in this effort is discussed below.

■ **Low-input cotton production raised smallholder per capita income by between 25 and 36 percent in the zones of significant JVC investment**, based on econometric analyses of the determinants of per capita income. Cotton's effect as an indicator of smallholder food security - hungry season cereal reserves - was positive and significant among low-input growers in Montepuez, and positive but statistically insignificant among households in other cotton production categories in Montepuez and Monapo/Meconta. In CARE-OPEN, with very minor private sector investment in input distribution and extension services, low-input cotton had a negative effect on income and little effect on hungry season cereal reserves. The finding that, holding constant other factors, low-input cotton contributes positively to smallholder income in areas of significant JVC investment, though less so to food availability is a key result. Contrasting this finding with the results in CARE-OPEN suggests the *importance of a significant JVC investment in a given zone for smallholder cotton to deliver these benefits in the current policy environment.*

■ **High-input cotton increased per capita income by between 97 and 138 percent relative to non-cotton growers**, based on the same econometric analyses. Households in the high-input (or PUPI) category in Montepuez also enjoyed relatively greater hungry season cereal reserves. It is likely that those households with relatively greater management and farming skills were more likely to be chosen to participate in the high-input schemes than their neighbors. The study controlled for these pre-program differences between high-input cotton households and the rest of the sample and still found that intensification more than doubled smallholder incomes.

■ **For smallholder: JVC relationships to be sustainable, the JVCs must be financially profitable enterprises.** In both principal study zones, low-input and high-input cotton were profitable to the JVCs, generating returns from \$56 to \$127 per hectare under current yield and world market conditions.

■ **Sensitivity analysis showed that increasing the cotton ginning outturn rate from its current 34 percent to 40 percent or greater through varietal improvements such as those which have occurred in Francophone West Africa would significantly contribute toward achieving macroeconomic goals as well as JVC profits.** Smallholders would also benefit from this technology improvement, as JVCs would be in a position to pay higher producer prices.

■ **Financial analysis showed that if JVCs had to operate under current maize market conditions, they would suffer financial losses in high-input block maize, attributable largely to high costs of shipping grain to major markets.** JVC involvement in smallholder food production in Mozambique was limited to Lomaco's high-input block maize scheme in Montepuez when this study began. Lomaco ended this program in 1995/96, coinciding with the end of donor-driven emergency-related maize demand from elsewhere in the country.

■ **Cotton domestic resource cost ratios ranged from 0.42 to 0.65, indicating a comparative advantage for the cotton belt in both low-input and high-input packages.** Sensitivity analysis showed that these estimates were robust to variation in world cotton prices experienced over the past ten years.

■ **The cotton belt is currently an inefficient producer of maize for markets outside the region such as Maputo.** Even assuming improved yields and lower per unit production costs, the high costs of coastal shipping, inefficient port operations and a poor domestic highway network result in the north **currently** having a comparative disadvantage in maize. However, the fact that the north's rainfall patterns are not correlated with those in the rest of the Southern Africa region and its strategic position close to ports suggests that, with appropriate investments, it could become an important supplier of maize (and other food crops) to the region.

III. Implications for Strategies to Promote Economic Growth and Food Security

This study shows clearly that cotton production **can** and frequently **does** benefit northern Mozambican smallholders and the national economy. Smallholders in the areas of influence of the three principal JVCs operating in the cotton belt have substantially higher incomes than their non-cotton growing neighbors **because** they choose to produce this cash crop. Income gains accrue to smallholders who grow cotton without compromising, and sometimes improving their food security. These findings are significant, given the frequent criticism that smallholder cash-cropping in Sub-Saharan Africa jeopardizes food security.

Mozambique urgently needs strategies to increase the export of products in which it has a comparative advantage. This study shows that Mozambique has a comparative advantage in smallholder cotton using the range of input packages currently promoted by the JVCs.

Prior to the agreements between the Government of Mozambique and Lonrho, João Ferreira dos Santos and Grupo Entrepoto, a much smaller proportion of rural households in the cotton belt were growing cotton than at present. Those who were producing cotton had little access to agricultural inputs or credit because market mechanisms were not available, state companies charged with developing cotton production had largely collapsed, and no private firms had yet filled this role. Cotton yields were very low, its effect on household income was negligible and its impact at the macroeconomic level was insignificant. In recent years, this poor performance has been reversed in the regions which have been the focus of GOM and private investment. In regions without this level of investment but with similar agro-ecological conditions and colonial histories (e.g., CARE-OPEN), relatively small proportions of farmers grow cotton and those who do so show no higher incomes than non-cotton growers. Key factors instrumental in cotton's resurgence as an important cash crop have been the revitalization of input distribution and extension networks and improvements in rural roads. The region's three JVCs have been important players in this process.

The benefits to smallholders, the country and private sector firms supporting smallholder cotton increase dramatically where smallholders grow cotton with fertilizer and herbicide. Among households who produced cotton with the PUPI package, some used a similar package for maize while others used a traditional approach to this food crop. It is noteworthy that both groups obtained significantly greater maize yields than households who did not intensify cotton production. This suggests that cotton intensification can have a substantial effect on improving smallholder maize productivity and improving household food security. It is likely that a portion of the differences in maize yield between high-input cotton/low-input maize households compared to low-input cotton/low-input maize households is related to residual fertilizer and rotation effects from cotton to maize. Given the reluctance of private sector firms to support maize intensification directly due to its relatively high level of risk compared to cotton, (and the probable reluctance of smallholders to independently intensify their maize production for the same reasons) cotton intensification may represent a useful indirect means to intensify maize production and increase yields. The intersection of smallholder and JVC interests here is important. As smallholder productivity in food crops increases, farmers are able to devote more resources to producing cotton. The

increased cotton production is attractive to the JVCs, given that existing cotton gins are operating well below capacity.

In short, investments made by private firms in providing inputs, credit and extension services to smallholders, as well as investing in rural road development have made important contributions to the cotton belt's economic recovery. Given the potential for improving smallholder incomes and food security in the north through cash-cropping, the GOM needs to give priority to determining an appropriate policy environment for such development to move forward. In so doing, the GOM needs to address three questions:

- 1) Does the fact that benefits to smallholders are greatest in areas of significant JVC investment imply that the "JVC model" has been successful and should be replicated elsewhere?
- 2) What alternative models are possible and would they provide greater benefits for smallholders?
- 3) What more can be done by government and the private sector to improve smallholder cash-cropping performance?

In the next sections, we will consider what the results from this study and other Sub-Saharan Africa experience imply about the steps that the GOM, donors, private sector actors and smallholders should take to answer these questions and ensure that cash-cropping continues to contribute to rural development in Mozambique.

A. The JVC Model: Its Rationale, Advantages and Disadvantages

The JVCs have had legal geographic monopsonies with respect to smallholder cotton since their inception. This model, which attempts to ensure effective vertical coordination⁴ of the subsector by granting buying rights to a single firm, is an unusual policy in Southern Africa today; the trend is clearly toward not providing monopsony protection to companies involved in promoting smallholder cash-cropping.

Major donors including both USAID and the World Bank have voiced criticism of the legal monopsony model for promoting smallholder cotton in Sub-Saharan Africa. The two principal arguments against this model is that it retards development of private input markets

⁴ The term "vertical coordination" refers to the process of coordinating the actions of participants at different levels in a subsector with the objective of maximizing benefits for all concerned. In the cotton subsector, participants include farmers, JVCs, and various government agencies. In a less vertically-**integrated** subsector, other participants would include input dealers and traders of the output. The actions of all these participants need to be coordinated in order to ensure timely delivery of inputs, effective research and extension assistance, appropriate production practices by farmers, and efficient processing and marketing of output, among other activities.

and limits price competition for smallholder outputs. Yet there were solid reasons why the GOM chose this model.

The standard economic argument - though only part of the GOM rationale - for granting a JVC exclusive cotton buying rights is that the economics of transport and processing cotton in a given zone give rise to a natural monopsony. That is, given the economies of scale in the ginning process, the quantity of cotton produced in each zone is insufficient to achieve efficiency in ginning costs. If this were the case, economic theory would imply that the state has a role in limiting the number of gins operating in a region. The extent to which natural monopsony conditions are present in specific regions of the cotton belt is a complex empirical question and was an area beyond the scope of this study. However, this issue was only one, albeit important factor in motivating the GOM to grant JVCs geographic monopsonies. Of equal or greater importance to the GOM was developing a private sector-based policy mechanism to spark a resurgence in smallholder cotton by facilitating vertical coordination in the subsector. To generate growth in production, it was necessary to develop an input distribution and extension network. Another important barrier with respect to economic growth in this region was the investment needed to repair and maintain the rural road network after much neglect and damage from the war. The GOM lacked the capital to make such investments and was faced with the dilemma of how to attract private capital to this region.

To any private firm, an investment in roads and cotton ginning infrastructure to develop smallholder cotton represented a long-term endeavor. A key factor in the decision of such a firm whether or not to invest would be its ability to ensure adequate capacity utilization in its cotton gin. Aware of the region's input market failure and the need for increased access by smallholders to inputs to jumpstart cotton production, the vertically-integrated approach built around JVCs represented an attractive option. As this model has functioned since its inception, each cropping season the JVCs distribute inputs to smallholders on credit. Intra-annual financing costs and risk of repayment have been largely borne by the JVCs (though the KR-II pesticide subsidy has lowered JVC exposure). In this context, government granted monopsony rights to the JVCs to encourage their investment by protecting them from other buyers who neither bear the production and credit risks during the growing season, nor the upstream investments in rural infrastructure.

Would competition for smallholder production improve smallholder welfare and the system's performance more broadly? Insights from an analogous situation in Zambia where Lonrho is supporting smallholder cotton highlight the limitations of competition and the importance of effective contract enforcement for cash-cropping schemes to be sustainable:

"From the farmer's perspective, competition among buyers is positive. But where this competition undermines existing contracts between buyers and producers, outgrower type arrangements which involve pre-financing are likely to disappear...For commodities with minimal extension and input requirements, the impact on the producer may be limited if he/she is able to finance and manage his/her own production. But where these requirements are considerable (e.g., cotton), the smallholder is likely to find that he/she can no longer...(effectively) produce the commodity (due to the lack of input availability and financing)." (Stringfellow, 1996)

Stringfellow's analysis of the Zambia case suggests that as the GOM approaches policy issues related to the cotton subsector, it is important to implement arrangements which will lead to effective vertical coordination among key actors. Applying the lessons from Zambia to the Mozambican case, the GOM may observe that encouraging competition by eliminating the JVCs' geographic monopsonies, in isolation from other key steps, is not likely to result in effective vertical coordination in the face of input and credit market failure. While it may be useful to promote competition for smallholder cotton, complementary investments in the subsector (e.g., in input distribution, extension, human capital and rural infrastructure) will be required to promote meaningful development of smallholder cash-cropping opportunities outside of the JVC framework.

B. How to Improve Government Regulation

When the state grants monopsony rights to a firm, it must regulate the firm's behavior to guard against potentially abusive practices. In the context of the cotton belt and the JVCs, examples of potentially abusive practices include failure of the JVCs to provide inputs, credit or extension services to smallholders in a timely manner or offering an unreasonably low producer price for cotton. The GOM uses two regulatory mechanisms for this purpose. First, and most importantly, the GOM establishes a minimum producer price each year. Recent experience suggests that the use of price policy has been unsuccessful in fixing the farmgate price at levels which balance JVC and smallholder interests given world market conditions. For example, in 1994/95 when world price levels were historically high (\$1,715 per ton, FOB Nacala) the official producer price was quite low (\$0.16 per kg seed cotton). To compensate smallholders for this disparity in the following year, the GOM more than doubled the official price (to \$0.34 per kg seed cotton) even though world cotton prices had fallen to \$1,438 per ton, FOB Nacala.

The second mechanism by which the GOM attempts to protect smallholders is through the Mozambique Cotton Institute. A central purpose of the Institute is to ensure that all smallholders within a given JVC's area of influence receive reasonable access to inputs and extension services. For example, it may be more profitable from the JVC's perspective to concentrate its input distribution on smallholders whose fields are relatively close to a road. However, the JVC is also required to support production for smallholders in more remote locations within its area of influence, even if this is more costly. Without such support, smallholders in relatively remote locations have no other option to obtain inputs and market their cotton, given the monopsony granted to the JVC and the lack of private sector firms to provide these services. What has been the experience of the Institute in regulating JVC performance in this regard?

To gain insight into this question, we draw an important distinction between two empirical results from the study: 1) that cotton, on average, has benefited smallholders in the JVC-intensive zones; and 2) that a significant group of smallholders in each JVC zone had very low cotton yields and hence very low returns to labor in cotton. For example, seed cotton yields among the lowest tercile of producers were only 200 kg/ha (Montepuez) and 155 kg/ha (Monapo/Meconta), compared to mean yields well above 500 kg/ha in both zones. Returns to family labor for households in the lowest yield tercile were at or below \$0.22 per

day, compared to mean returns above \$0.60 per day and local wage labor rates of \$0.48 per day.

The most important factors associated with cotton's relatively poor performance among households in the lowest cotton yield tercile were the lack of insecticide, late planting and a shortage of labor for weeding. Households in the lowest yield tercile typically sprayed insecticide two times or less, against a recommended application rate of approximately four sprays per season. This suggests that JVC input distribution has essentially not corrected the market failure for this significant group of households. The Mozambique Cotton Institute, to date, has lacked the resources to effectively monitor and encourage JVC compliance with their agreements with the GOM. Given both the need for **effective** GOM involvement in the subsector and the current limitations of the Institute, how should the GOM approach this issue?

The Institute as it is currently structured operates largely as an administrative body in areas of JVC activity (Fok, 1995). Actions by the Institute to encourage smallholder cotton production have been limited to areas where JVCs do not operate.⁵ The GOM should consider how to transform the Institute into a body which acts as a catalyst to promote the interests of key subsector actors, including smallholders, JVCs and other private sector firms (e.g., input suppliers and gin operators). Further, the GOM should consider how its representatives could become active participants in the leadership of the JVCs to represent smallholder interests, given that Government is part owner in each JVC.

The Institute could also play an important role in promoting a dialogue among key public and private actors at the national, regional and local levels on how to improve subsector performance. Improving the Institute's data collection and analysis capacity would be strategic in this regard. For example, regular published reports about performance at various levels of the subsector could serve an important role in providing solid empirical information upon which to base the policy dialogue.

C. What Can Be Done to Increase JVC Support to Smallholder Food Crops?

The JVCs' contracts call for extension systems to be developed for both cotton and food crops. Study results found that the JVC extension systems, with few exceptions, have been singularly focused on cotton. The only significant JVC entry into supporting smallholder food production was the now defunct high-input block maize scheme in Montepuez and surrounding districts. Results from this study suggest that both smallholders and the JVCs may benefit from JVC support of smallholder food-cropping. Recall that late planting and a shortage of labor for weeding were two key factors in reducing cotton yields. The study also found a positive relationship between household hungry season cereal reserves and household ability to allocate labor to cotton, thus improving cotton yields. The implication is that cotton production may increase substantially as smallholder food security improves;

⁵ These actions have been criticized for promoting cotton production in marginal areas where it is not likely to be profitable.

there is the potential for private sector firms to be important actors in this process (e.g., recent experiments by Lomaco in intensified smallholder groundnut and cowpea production). Once again the mutuality of interests between smallholders and JVCs is apparent: improved food security for smallholders may result in increased smallholder cotton production, generating higher ginning capacity utilization rates and higher profits for the JVCs.

To date, the GOM has not taken significant steps to encourage JVC support to smallholder food crop production and/or marketing. Past minimum price policy on maize was counter-productive in this regard, in the sense that Government established price levels which Lomaco could not pay to smallholders and still earn a profit within the current maize market environment. Support to smallholder food cropping could be profitable to the JVCs and generate attractive returns to smallholder labor if mean yields could be increased to the level of current upper tercile yields and if the JVCs were allowed to pay a market price consistent with marketing costs. In this regard, the recent move to a reference price policy, as opposed to a minimum price policy, is a positive development⁶. It needs to be complemented by other decisions to create a policy environment conducive to increasing food production (and improving regional food security) through productivity-enhancing technology packages with an attractive set of incentives for both producers and private sector firms.

D. Lessons from Experience in Zambia, Zimbabwe and Mali

As the GOM and private actors search for ways of improving the performance of food and cash crops in northern Mozambique, it would be useful to consider what lessons can be drawn from alternative approaches to this challenge in Zambia, Zimbabwe and Mali.

In Zambia, Lonrho's outgrower scheme now incorporates 65,000 growers with no legal monopsony. Despite its success in managing the scheme, Lonrho is gradually withdrawing from direct managerial involvement, hoping to pass this responsibility to smaller intermediary companies which it will finance and from which it will purchase seed cotton. The company believes that its comparative advantage lies not in managing smallholders but in research and development, financing and trading. It seeks smaller operators with greater familiarity with local growing conditions to manage smallholders. This is a recent policy change by Lonrho, and to date only a few firms have established such a relationship with the firm.

How is the freedom of choice in selecting a buyer for their cotton likely to affect prices smallholders receive for their output and vertical coordination more broadly? Stringfellow's analysis suggests that while no legal monopsony is in place, the dominance of Lonrho in Southern and Central Zambia

"...sets the prevailing into mill (seed cotton) price...A South African firm purchased a ginnery in Chipata, but the distance between this and the Lonrho ginneries (and the

⁶ The key difference between the new reference price policy and the old minimum price policy is that the former makes it clear that no one is legally obligated to pay the reference price; there will be no legal sanctions against anyone paying less than this price.

producing area) is likely to eliminate any incentive for traders to take advantage of price differentials. This will limit the degree to which traders at the farmgate can adjust their prices to compete for purchases."

The Zambia case has an important implication for the question of the effect of a legal monopsony. Although there is a *de jure* freedom for smallholders in marketing their cotton, the economics of transporting the product and the scale economies of ginning result in a *de facto* monopsony. The effect of eliminating the monopsony in isolation from other actions to promote vertical coordination has done little to improve smallholder welfare.

In Zimbabwe, liberalization of smallholder cotton marketing has also occurred recently. Cotco, the newly commercialized former Cotton Marketing Board provides credit for cotton production to groups of smallholders. The capital for mounting this credit system was secured through government funding, a key difference between this system and the JVC model in Mozambique. There is now significant pressure to end the subsidies implicit in the operation of this system. Smallholders who receive credit from Cotco are supposed to market all their cotton through Cotco, but this is not occurring. Rather, producers only repay their credit obligations with Cotco and sell the larger portion of their production to other buyers that pay a higher price. While Cotco has its credit repaid in this way, it does not achieve a key related objective: maximizing its capacity utilization to reduce ginning costs. Cargill, which now leases two ginning facilities in Zimbabwe, feels that smallholders will require increased access to credit if they are to further expand their cotton production and that without government subsidies Cotco may not represent a viable solution. The problem of how to extend credit in a free market environment and make sure that smallholders repay these obligations, particularly in a year of poor production and financial losses, is critically important. A possible solution suggested by Cargill management is for Cargill to act as a facilitator of loan repayment by deducting input costs from cotton payments made to smallholders and transferring these funds to the creditor. The critical problem with such an approach is that it begs the question of who will bear the risk of financing smallholder production when no government-backed credit scheme is available. In brief, the Zimbabwe experience points again to the need for policy mechanisms that improve vertical coordination in the cotton subsector in order to ensure sustainability of smallholder production and intensification. Simply ending the JVCs' geographic monopsonies where private input and credit markets continue to fail has little probability of solving the system's more fundamental problems.

E. Mali and the Empowerment of Farmers through Village Associations

Smallholder cotton production in the *Compagnie Malienne pour le Développement des Textiles* (CMDT) zone of Mali is characterized by a highly vertically-integrated system whereby CMDT has responsibility for supporting smallholder production through input distribution and tied credit and purchasing output in a manner similar to the design of the JVC model in Mozambique. In the past twenty years, intensification of input use and dramatically improved smallholder cotton yields have improved the profitability of cotton to producers in Mali. The model has proven successful from a macroeconomic perspective as well, as cotton now accounts for almost one-half of Mali's export earnings. Bingen (1997) shows that the role of farmer organizations (or *associations villageoises* (AVs)) has been

fundamental in this process. He traces the history of the emergence of the Avs to 1974 when a CMDT extensionist:

"...helped villagers organize a protest against dishonest cotton grading and weighing practices. Responding to the villagers' demands, the CMDT gradually transferred responsibility for cotton grading and weighing, equipment and supply orders and credit management to designated village groups. After several years of fairly informal agreements with these groups, the CMDT formalized the relationship by setting out a series of criteria for establishment of Avs. In collaboration with the government, the CMDT also secured World Bank financing to support the development of management skills within the Avs, especially through a functional literacy program to ensure the level of literacy and numeracy skills required to fulfill credit and marketing tasks and the preparation of account books in the Bambara language." (Bingen, 1997)

Farmer associations have the potential to represent smallholder concerns effectively *vis-a-vis* large firms operating in the cotton subsector in Mozambique as well. In addition to having benefitted smallholder incomes, smallholder cotton has played a key role in promoting food security in Mali. Consider the analysis offered by Dione:

"...the success of CMDT in promoting foodgrain production was achieved through a strategy centered on a vertically coordinated set of activities (research, extension, input and credit distribution, and output processing and marketing) for the long-term growth of cotton production and income. This income served as an engine to support gradually the development of food crop production and non-crop activities...(The promotion of cotton represents) a strategic approach to rural development and significantly diverges from the approach followed by most rural development agencies and the traditional food crop - cash crop dichotomy, which is almost irrelevant in the CMDT case where there was growth in cereals production mainly **because of the growth in farmers' income from cotton production.**" (emphasis added) (Dione, 1989)

Cotton-led agricultural growth in Mali's CMDT zone has had additional indirect benefits such as improving rural literacy and stimulating broader democratization. (Bingen, 1997)

With respect to Mozambique, it is important to recall the mutual interest that the JVCs and smallholders have in cooperation. The JVC approach, as it has been implemented, attempts to control the outgrower and/or limit the risk facing the JVC. Stringfellow suggests a more "consensual" approach would be for the firm to develop relationships of increased trust with producers in which both parties recognize the mutual benefits of cooperation. If experience from Mali and elsewhere concerning the positive force of farmer associations in giving farmers voice is a guide to the Mozambican case, encouraging the growth of such organizational structures among smallholder cotton producers may be an important part of the policy solution for cotton to increase its already important role in Mozambique's rural development.

IV. Policy Recommendations and Priorities for Future Research

■ Smallholder cotton can have important micro- and macroeconomic benefits if it is promoted with a sufficient level of inputs, extension and marketing infrastructure. Intensification of cotton has even greater benefits for each of the actors in the system. **The GOM should promote smallholder cotton production in the cotton belt through strategies which effectively balance smallholder and private sector interests in pursuing vertical coordination of the subsector.**

■ Improving smallholder capacity to represent their own interests *vis-a-vis* private sector firms in the cotton subsector can be an important mechanism to improve the effect of cash-cropping on smallholder welfare. In Mali, farmer associations have represented an important way for farmers to achieve greater power and gain access to fertilizers and other key inputs. Village associations have the potential to play a similar role in Mozambique. NGOs such as the Cooperative League of the USA (CLUSA) have been active recently in Nampula in encouraging the formation and training of village associations. CLUSA-supported associations have begun to deal with the JVCs and other private sector firms to improve input availability and access to tractor services (Personal communication, Alexandre Serrano). Note that the current cotton "Regulamento" of the GOM provides for economic agents with greater than 20 ha of cotton production to sell their cotton freely. To the extent that associations could organize farmers with at least this area of cotton production, this could not only circumvent the problem of monopsony but provide other benefits to participating smallholders as well. **The GOM and donors should promote the formation of farmer associations to promote smallholders' bargaining power with private sector firms.** Donor support in this area may help build a bridge between the farmer organizations, the JVCs and formal sector financial institutions in the design of financing systems which promote intensification and spread the risk associated with smallholder cotton and food crop production.

■ **The process by which the GOM determines minimum producer prices for cotton should be reviewed.** Yearly changes in the GOM cotton price have not reflected changes in world market conditions. For example, the official price jumped from \$0.16 to \$0.34 per kg from 1994/95 to 1995/96 while FOB Northern Mozambique prices for cotton fiber dropped from \$1,715 to \$1,438 per ton. Such erratic price policies make long range investment planning by the JVCs and other private sector firms difficult and create unsustainable price expectations and uncertainty for smallholders. A two-stage process whereby a minimum producer price is announced at the beginning of the agricultural season (September 1) with the possibility for upward revisions based on prevailing world market conditions at the time of export is one alternative which should be considered.

■ The Mozambique Cotton Institute currently lacks the institutional capacity and resources to represent smallholder interests effectively in JVC zones. However, governmental oversight to encourage JVC behavior to benefit smallholders throughout their areas of influence is important. **The GOM should seek new and innovative mechanisms to bring this about such as having Institute representation in the decision-making structure of the JVCs, given that the Government is in fact a partner in these schemes.**

■ If the GOM wishes to encourage JVC involvement in smallholder food crop intensification, it should maintain its commitment to abolishing the policy of legal minimum producer price. High-input block maize schemes could be profitable to JVCs and generate attractive returns to smallholder labor if current upper tercile yields could be achieved and a lower price paid to farmers than the GOM minimum. **The GOM should seek policies designed to increase rural incomes through productivity enhancing technology packages (e.g. the high-input block maize scheme or other food crop opportunities) rather than through unsustainable minimum price policy.** JVCs have an important stake in improving rural food security and innovative mechanisms should be sought to encourage their participation.

■ **The development of suitable cotton varieties with improved ginning outturn ratios is the subject of on-going research both by CIMSAN (Centro de Investigacao e Multiplicacao de Sementes de Algodao de Namialo) and Lomaco with support from the French *Caisse Centrale de Cooperation Economique* in Montepuez. The Government and donors should place renewed focus on this effort.** Improving ginning outturn ratios from their current levels of approximately 34 percent to levels achieved in West Africa of 40 to 43 percent could dramatically increase the cotton's impact on smallholder income, the attractiveness of smallholder cotton to private sector firms and Mozambican export earnings. Recall that exporters pay a 3.5 percent tax on cotton fiber exports. This tax was established by the GOM for the purpose of supporting activities to promote the cotton subsector including varietal research. JVCs have recently questioned what benefits they derive from this tax. The GOM should consider using a substantial portion of the revenue from this tax to support varietal research in collaboration with the national agricultural research system and the JVCs. An important longer term issue is developing a mechanism for allocating these funds which incorporates the perspectives of key cotton subsector participants, including farmers, in a meaningful way. The Mozambique Cotton Institute could play an important role in developing this process.

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