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## **POLICY SYNTHESIS**

### **FOOD SECURITY RESEARCH PROJECT - ZAMBIA**

Ministry of Agriculture & Cooperatives, Agricultural Consultative Forum, Michigan State University - Lusaka Zambia  
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## **FARM YIELDS AND RETURNS TO FARMERS FROM SEED COTTON: DOES ZAMBIA MEASURE UP?**

**\*Stephen Kabwe and David Tschirley**

### **Main Points**

1. Farm yields are one key indicator of the productivity of a cotton sector, and an important determinant of returns to farmers (and thus of cotton's ability to reduce poverty)
2. Zambia's relatively good performance on input credit provision means that it has been able to raise yields since reforms in 1994; yet the rate of increase has been slow, and yields remain well below those found in countries of West and Central Africa.
3. Average returns to farmers do not appear to be any higher in Zambia, with good performance on input credit provision, than in Tanzania, where input use and yields are low.
4. Zambia's concentrated structure gives it the potential to substantially increase farm productivity, and for cotton to make but relatively little of this potential has yet been realized. The key challenge for sector stakeholders, once the Cotton Act is passed, is to agree on a coordinated approach to address this problem

**INTRODUCTION:** Increasing productivity at the farm level is the foundation of a productive cotton sector, and is a necessary condition for cotton to make a significant contribution to reducing rural poverty.

**OBJECTIVE:** This Policy Synthesis draws on recent comparative work across nine countries of sub-Saharan Africa (Zambia, Mozambique, Zimbabwe, Tanzania, Uganda, Cameroon, Mali, Burkina Faso, and Benin) to provide background on how Zambia measures on cotton productivity and return to farmers. Specifically, the paper focuses on 1) yield trends in East and Southern Africa (ESA) and West- and Central Africa (WCA), 2) variability in yields across countries of ESA and WCA and across types of farmers within each country, and 3) how these yield levels play out in terms of returns to farmer labor. The paper also draws key policy implication for Zambia.

**DATA AND METHODS:** Data on yield trends in ESA, WCA and the world come from ICAC. Data on yield variability across countries, and across types of farmers within countries, come from field work conducted by the research team.

Structured focus group discussions were undertaken in seven of the nine study countries (all except Cameroon and Benin). In each country, 4-8 villages were visited in the main cotton production zones. Respondents were asked to group farmers in their area according to volumes of production, and were then questioned about production practices and costs of each group. Four groups emerged: Group 1 (large), Group 2 (medium), Group 3 (small), and Group 4 (very small). The exact characteristics of each category vary by country, but strong commonalities emerge<sup>1</sup>.

**YIELD TRENDS:** World cotton yields expressed in lint equivalent have increased 1.9% per year since the early 1960s, from an average of 300 kg/ha to more than 700 kg/ha in 2005 (Figure 1). These averages hide large differences between irrigated cotton, with accounts for 55% of all cotton production and has a mean yields of

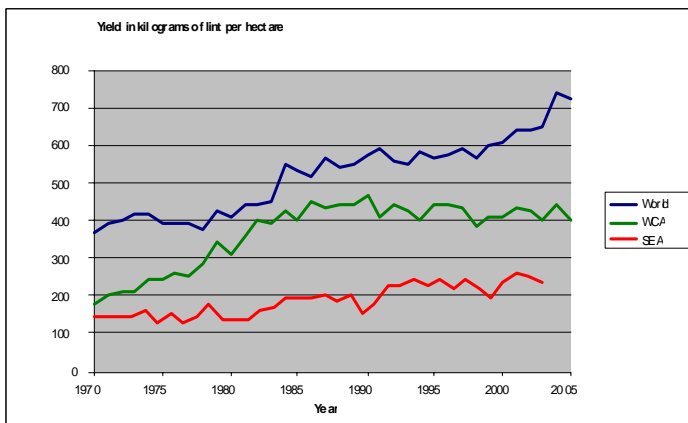
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<sup>1</sup> Ideally, each country would have detailed farm level data available that allow the construction of crop budgets. Unfortunately, such data are not always available, and in the few countries where it is, data collection methods can vary substantially. More definitive assessment of the levels and causes of productivity across countries and farmers requires detailed field surveys following a common methodology.

about 950 kg/ha, and rainfed cotton, where yield is only about 450 kg/ha. Yet yield growth over the past 25 years has been much greater under rainfed systems: average yield in rainfed cultivation has more than doubled, growing 3.9 percent per year, while yield in irrigated systems has increased by only 60 percent, or 1.8 percent per year. Africa, where all cotton is rainfed, has not seen this kind of growth in yields.

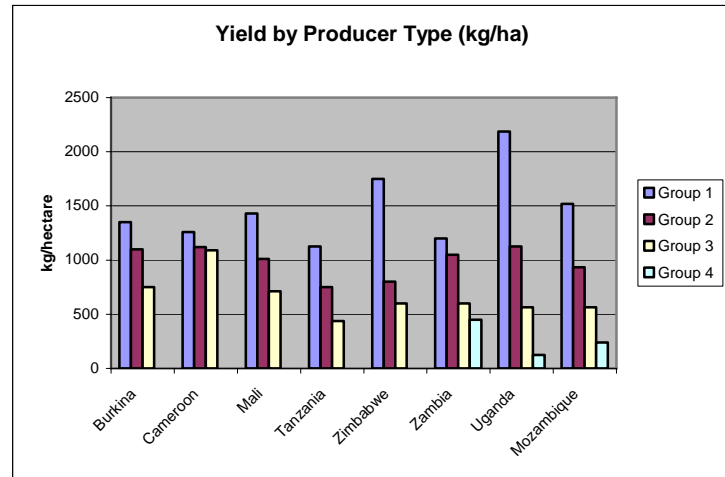
Yields in WCA increased by 5% per year until the early 1980s, but have stagnated or even declined slowly since that time. As a result, while WCA yields were well above world average rainfed yields in 1980/81, the rest of the world's rainfed cotton production systems have now slightly overtaken WCA. ESA yields have risen only about 2.1 percent per year, and average yields in the region today are slightly more than one-half the WCA average.

**Figure 1: Cotton Yield Trends in World, WCA and ESA (1970-2005)**



**YIELD BY FARMER TYPE:** Figure 2 shows estimated yield of seed cotton in kg/ha across the different groups. A key point to keep in mind in reviewing this figure is that different proportions of farmers fall into each of these groups, depending on the country. In the three WCA countries, 30%-40% of farmers are in the top group; this reflects many years of heavy investment in varietal research, input provision, and extension. In ESA, Tanzania, Uganda, and Mozambique have only about 5% of their farmers in the top group, Zambia has perhaps 8%-10%, and Zimbabwe has about 20%. The generally low level of farmers in the top group in ESA reflects their differing history compared to WCA; Zambia's slightly better performance is a result of effective input provision, while Zimbabwe's both input provision and greater investment over the years than in Zambia.

**Figure 2: Variation in Yields Across Farmer Groups**



A key insight emerging from the figure concerns the variation in yields across groups within individual countries, which are at least as great as the variations across countries. There are two main causes of this inter-group variation. First, differential access to inputs is an important factor in ESA, but much less so in WCA, where nearly all farmers receive a high intensity input package. Largely as a result, the variation in yields across groups is less pronounced in WCA than in ESA. In the three WCA cotton sectors, the top group of farmers achieves average yields about 65% above the bottom group; in ESA, yields among the top group are nearly 5.5 times higher than in the bottom group.

The second key factor explaining yield variation is differential ownership of assets, of which the most important are arguably oxen and plowing equipment. Households that own their own animals and ploughs can prepare their land as soon as the rains begin, permitting both timely planting (a prerequisite for good yields) and the cultivation of larger areas of land. We also note that larger farmers tend to have either the family labor or the working capital to hire labor in a timely fashion. The poorest farmers must often prioritise hiring out their labor for immediate cash income over the timely performing of cultural practices on their cotton plots.

Yield levels and trends at the regional and country level are correlated with cotton sector organization. The national monopolies established in the Francophone countries of WCA delivered impressive and sustained yield

growth over a period of three decades, from very low yields in the 1950s to well above the world rainfed average in the 1980s (around 1,200 to 1,400 kg/ha of seed cotton). This achievement was due to a reliable system for varietal development, input supply and credit, quality extension services, and logistical organization provided by the cotton companies. Since the mid-1980s, this trend has not been sustained and the productivity gap has started to widen. The system has not adapted well to changing technical and economic circumstances, particularly in regard to making improved technical packages available to farmers.

In ESA countries, the trend has been slow but steady increases in yields based on low input/low output production systems, reaching around half of the world average for rainfed cotton today. Yields in ESA are higher in the more concentrated systems (Zambia and Zimbabwe) than in the more competitive models (Tanzania) which have found it very difficult to raise yields (Figure 2).

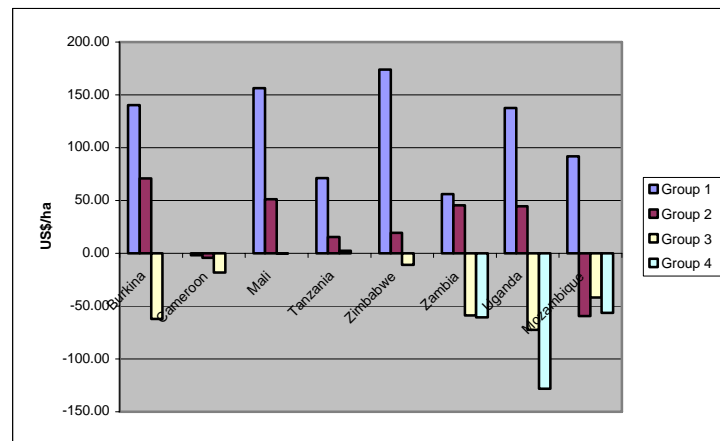
**RETURNS TO FARMERS:** Yield is only one factor determining the returns a farmer earns from cotton. Other factors include the cost inputs, the amount of labor they need to apply, and the price they receive for their output. The cross-country analysis has shown that cotton sectors such as Tanzania and Uganda with competitive structures (many firms competing for seed cotton) tend to pay farmers a higher share of world lint prices, but are less effective at delivering support services that help them raise yields. More coordinated sectors, such as the national monopolies in WCA or the concentrated sectors of Zambia and Zimbabwe (few ginners competing for seed cotton) deliver reasonable support services but tend to pay lower seed cotton prices.

Factors beyond company services also influence net returns to farmers. Examples include historical investment by cotton sector stakeholders, especially investments by companies to promote effective varietal research, farmers' adoption of technologies (especially animal traction), and differences in soil fertility across cotton growing regions and countries. Which type of system allows farmers to achieve higher returns to their labor thus

becomes an empirical issue. How does Zambia compare to its African neighbors?

To address this question, we examine returns to family labor and to all labor (family and hired). In Zambia's case, the results are based on average prices and input costs during the 2004/05 through 2006/07 seasons. We first calculate returns for each farmer group, then use estimates of the share of farmer in each group (discussed above) to calculate a weighted average return. After valuing family labor at the going casual wage rate in rural areas, group 1 households make a profit in all countries (Figure 3), while group 2 households make a profit in all countries except Cameroon and Mozambique. In Tanzania and Zimbabwe the size of the profit achieved by group 2 households means that, under current conditions, cotton production can only make a modest contribution to household income and poverty reduction objectives.

**Figure3 Net Margins after all Costs (inc. Labor),US\$/kg**



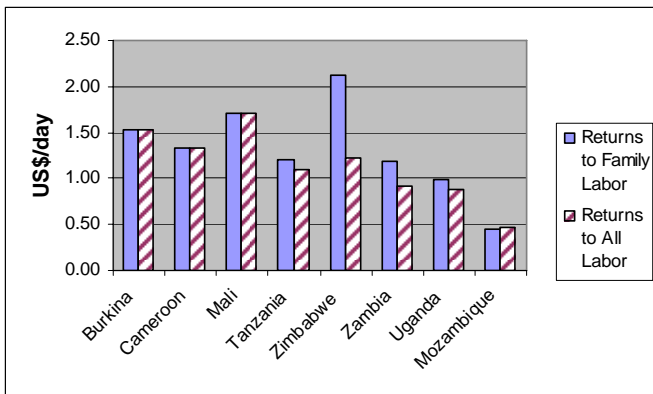
Tanzania is the only country where group 3 households make a profit, as defined here, though it is very small. This means that the household obtains a higher income from applying its own labor to its cotton plot than it could from selling the same quantity of labor at the assumed casual wage labor rate. In Mali the return to labor achieved by group 3 households is identical to the assumed casual wage labor rate.

The stark finding from these figures is that between 25% (Burkina Faso) and 75% (Zambia, Uganda, Mozambique) of cotton producing households would be better off hiring out their labor than applying it to their own cotton plots. Why do they persist in producing cotton? Two

main answers emerged from the focus group discussions. First, many group 3 and 4 households prioritize the hiring out of their labor, then fit in cultivation of their own cotton farms when they are not working elsewhere. This is a major reason why these groups perform many of their critical cultural practices late and hence why they achieve such low yields.

Second, focus group participants argued that cotton is the most remunerative cropping activity available in their areas. A critical factor here is the reliable market provided by cotton companies, which means that farmers can be sure of obtaining at least some cash income (a scarce commodity in group 3 and 4 households) from cotton production.

**Figure 4: Weighted Average Returns to Family Labor and All Labor in Study Countries**



Weighted average returns to family labor and to all labor are presented in Figure 4, with the weightings being the proportion of farmers in each group. The two figures are identical for the WCA countries, since all labor was recorded as family labor (and, in fact, very little hired labor is used). As a group, the WCA countries stand out, with three of the four highest returns to family labor, and the three highest returns to all labor. This result is driven by the success of these systems in moving farmers into groups 1 and 2 over time. Zimbabwe delivers the highest return to family labor, again in part reflecting the efforts made on research, then first by Cotton Marketing Board and then by Cottco and Cargill in supporting producers with extension support and input access over a sustained period.

Returns to labor for Zambia are higher than Uganda and Mozambique because it has more farmers in group 1 than those two countries and the efforts made by Dunavant and Cargill and others in supporting farmers with extension and

input access (PS#25). Mozambique performs especially poorly, reflecting the small share of households in group 1 and the very low prices paid to farmers. Notably, average returns in Zambia are no higher than in Tanzania, despite the very low level of input use in that country.

**POLICY IMPLICATIONS:** Results from the comparative study show that, despite Zambia’s relatively good performance in input credit provision, average returns to farmers do not appear any higher than in Tanzania, where input use and yield are low. Returns to farmers in Zambia are also far below those in WCA. In short, while Zambia’s concentrated structure creates the potential for high returns to farmers (by facilitating provision of input credit and some extension), little of this potential has yet been realized.

Passage of the revised Cotton Act, and continued development of the recent cooperation between ginners and farmers, are both needed to consolidate a policy environment in which firms can continue to provide important services to farmers, but this will not be sufficient, by itself, to turn cotton into an engine of rural poverty reduction. It is imperative that all stakeholders, including farmers, ginners, government, donors, and NGOs dedicated to increasing farmer incomes, work together to define a coordinated approach that will allow sustained increases in yield and profits for the country’s smallholder cotton farmers.

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This Policy Synthesis draws directly from Tschirley et al (2007). “Comparative Analysis of Organization and Performance of African Cotton Sector: Learning from Experience of Cotton Sector Reform in Africa”, forthcoming from World Bank

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