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Factors Determining the Level of Maize Production among Small Scale Farmers in Chisamba District, Zambia

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ABSTRACT
The majority of small-scale farmers in Zambia ispoor and experiences numerous hardships due to decreasing land productivity (Mwale, 2002). The decrease in land productivity has been attributed to several factors including soil degradation due to long term practice of low input agriculture and poor farming systems associated with government policy of subsidizing chemical fertilizers for maize production. Chisamba district has a potential number of small-scale maize farmers but produce less maize due to several factors.

KEYWORDS: Maize Production, Small Scale Farmer, Farming Methods, Farming Inputs

INTRODUCTION

Maize is the most important crop in Zambia and has great potential to improve the living standards of the majority of the rural population. Smallholder farmers face a number of problems in marketing their maize and it is this gap that this paper intends to address.

The majority of small-scale farmers in Zambia is poor and experiences numerous hardships due to decreasing land productivity (Mwale, 2002). The decrease in land productivity has been attributed to several factors including soil degradation due to long term practice of low input agriculture and poor farming systems associated with government policy of subsidizing chemical fertilizers for maize production. This has resulted in low fertile and fragile soils due to organic matter and carbon depletion leading to increased land desertification, declining or stagnant crop yields, poverty, and food insecurity and malnutrition. As a result of continuous heavy application of chemical fertilizers and unsustainable extensive land plowing systems, agriculture in Zambia entered the 1990s with significantly declining land quality and productivity (Haggblade&Tembo, 2003).

The agricultural sector in Zambia is vital to the economy for incomes, employment and food security. In 2011the sector accounted for 20% of Zambia's gross domestic product and 9 percent of total exports (World Bank,

2013). The sector is the largest employer in Zambia, absorbing some two-thirds of the labor force, making it the main source of income and employment for the majority of Zambians in rural and peri-urban areas. Attainment of food security in Zambia has been constrained by low agricultural productivity of smallholder maize farming. Since independence the Zambian government has made many attempts to improve productivity of smallholder agriculture in the country.

For maize this has involved the development of high yielding varieties, subsidizationof improved seed varieties and fertilizer, credit provision, liberalization of agricultural product prices and produce marketing, including encouraging private sector participation in agricultural marketing.

Despite the various past efforts, food security continues to be a challenge in Zambia as is the situation in anumber of Sub-Saharan African countries. This is so because of low and stagnant agricultural productivity growth associated with major crops like maize which are predominantly produced by smallholder farmers under rain-fed conditions.

Maize is the most important crop in Zambia and has great potential to improve the living standards of the majority of the rural population. Maize is not generally traded in international markets or even in local markets in many countries. Therefore, smallholder farmers seldom have an assured market in the event of surplus production (Chilundika, 2011). In Zambia, maize has traditionally provided a livelihood for a large segment of the population, particularly small-scale farmers.

In addition, to enhance farmer market participation, it is necessary to increase the productivity of maize and thus, enable smallholder farmers to produce adequate marketable surplus. Maize will continue to be the major food crop in Zambia, which account for about 63 percent of maize production among small scale producers (ZNFU, 2017).Therefore there is need to look into the factors determining the level of maize production among small scale farmers in chisamba district.

MAIN BODY

According to the Ministry of Agriculture and Cooperatives (2004) market development in Zambia was hampered by several factors such as institutional, policy and legal framework, investment, finance and infrastructure services. There was lack of capacity for small scale producers and traders to form an effective linkage and also there was lack of comprehensive agriculture legal framework to guide the function of agriculture sector.

Maize yield for example during 2000 to 2010, fluctuated between 1,037 Kg/ha and2,250kg/ha (FAOSTAT, 2012) with no clear upward trend in yield per hectare. Total maize production had a similar trend to maize yield, with production varying between the lowest amount of 600,000 tonnes in 2002 and highest amount of 2,500,000 metric tonnes in 2010 (FAOSTAT, 2012). The wider fluctuations of maize yield and total production, reveals a presence of food insecurity over time, particularly in years of low production even when the country had favorable weather conditions. The low maize productivity and production in Zambia has been attributed to many factors, including: vulnerability to climate change; poor road infrastructure; inadequate access of support services and low maize productivity (see Jayne et al., 2006 Hanjra and Calus (2011), MACO (2006) and Chizuni (1994).

The less than optimal performance of the agricultural sector implies that a need exists for studies to examineefficiency of agricultural production in Zambia particularly the smallholder maize farming sector since it involves the majority of Zambian farmers and for food security reasons. One key to increasing food production in Zambia lies in raising agricultural productivity by improving technical efficiency of resource use in agriculture. Efficiency concerns relative performance of the processes used in transforming given input into output.

the majority of Zambian maize could be sold at a profit competitively in regional markets. At the beginning of the 2010 harvest season, the export parity price (the landed cost of maize in Lubumbashi, Democratic Republic of Congo (DRC), minus transfer costs from Kabwe to Lubumbashi) was roughly ZMK 59,000. Meanwhile, 1.8 million metric tons of Zambian maize was produced at costs lower than

50,000 ZMK/bag. It was found that smallholder households selling or expecting to sell maize produced maize at somewhat lower costs than the average (roughly 38,000 ZMK/bag). Among this group, 76-82% of the maize produced could have been competitive in regional export markets.

There is a strong correlation between higher yields and lower costs of production. This is not surprising. Clearly, a key factor in increasing Zambian maize producers' comparative advantage in the region will be the promotion of productivity enhancing technologies and agronomic practices.Rural smallholder production remains highly labor-intensive. On average, family labor accounts for 62% of the total cost of maize production in Zambia's small- and medium-scale farm sector. Promoting the identification and adoption of practices and technologies that save labor and /or identifying labor-productivity-enhancing technologies through research and development will therefore help to make Zambian maize more competitive and allow farmers to maintain profitability even at lower producer prices.

Despite the fact that the subject is frequently at the center of the national development and policy debates, the cost of maize production is rural Zambia is poorly understood. At the front of these debates, for example, is the price offered to farmers by the Zambian Food Reserve Agency (FRA) each year, which is set to provide an adequate return for farmers and incentives to continue producing, based partially on some estimate of the costs of production. Hence, efforts to ensure that FRA maize prices are set after consideration of maize production costs would assist government in achieving and balancing its various national policy objectives.

For example, setting high FRA producer prices far above the production costs of most farmers would encourage greater maize production and support farmer income growth among maize selling households, but it would raise the cost of maize for consumers and may impose major financial costs of the Zambian treasury, as is likely to be the case in the 2010/11 marketing season. By contrast, setting a FRA producer price at or below production costs of most producers would put downward pressure on maize prices for the benefit of consumers, and it might impose fewer costs on the treasury, but it would do little to promote the interests of maize selling farmers and could eventually lead to a substitution out of maize into other crops.

These policy debates have unfortunately never benefitted from empirical analysis of maize production costs by smallholder farmers based on nationally representative farm surveys. This lack of accurate production cost information can contribute to the types of problems experienced in the 2010/11 marketing season: the accumulation of massive FRA surpluses that cannot be sold except at a major financial cost to the Zambian treasury.

According to Nyoro J.K (2000) Machinery costs includes costs of ploughing harrowing, chiseling, planting, spraying, harvesting, shelling and transport to stores.

Machinery costs are generally high particularly in maize. Farmers have also complained that the ownership of farm machinery has reduced in the last 10 years due to lack of financing mechanism for procurements of farm machinery. High costs of farm machinery thus have affected the quality and timeliness of farm operations such as the land preparation in the key maize production zones.

The cost of hired labor and traction equipment was collected at the field level. Household-owned animals, equipment, and household labor are valued at opportunity cost rates (that is rates that could be obtained in alternative employment if they were not employed at home, and if such employment were available). Specifically, based on information gathered from households that did hire these inputs, we establish a local market rate for equipment and labor, and assign these values to the use of household assets. For animal and machine equipment, this is accomplished by computing the local2 median cost of

employing such a resource per hectare for each activity. Similarly, for labor we find the local median hourly wage for each activity and assign that to the amount of time household labor is employed. Contributions from household members are also weighted according to the adult equivalents of the members working, based on their age and gender.3 This is to account for the fact that one would not expect the labor contribution of, for example, a 12 year old boy or girl to be the same as that of a 30 year old man or woman. The median of hourly wages used in computation can be found in Appendix A by province and type of labor activity.

The Sustainable Development Goals to eradicate poverty (Goal 1), hunger (Goal 2) and improve human health and well-being (Goal 3) will require a 60% to 110% increase in global agricultural production. FAO's State of the World series , and IFPRI's visionary 2050 policy documents have identified food security as the global concern of the 21st Century. Bridging the large yield gaps in smallholder farms of Asia and Africa, with significant regional and interpersonal variations, is necessary to reduce global food insecurity. The intensively cultivated eastern part of India is characterized by smallholder farms. Inherently, the smallholder farming systems function under a broad array of biophysical, climatic, and socio-economic settings, and their improvement is often hindered by inadequate access to land, fertile soil, capital, and labor.

The interactions among these factors affect resource use efficacy and the ability to produce optimal yield. Tittonell et al. concluded that biophysical and socio-economic factors, linked to diverse local climates, soil types, access to markets, and socio-cultural and ethnic characteristics govern soil fertility and crop yield variation. In fact, yield-gap analyses have recently taken adequate account of smallholder heterogeneity to identify local/regional factors of yield.

Fertilizer application rates in the two specific years were often unprofitable, given observed price conditions and the yield response to fertilizer. However, there was substantial variability in yield response to fertilizer based upon the rate of application, the timeliness of fertilizer availability, the use of animal draught power during land preparation, and whether the household incurred the death of an adult member in the past three years. These modifying factors, as well as variations in input and output prices due to proximity to roads and markets, substantially affected the profitability of fertilizer use on maize.

Global climate change can harm the food production globally by varying intensity and frequency of rainfall, occurrence of extreme weather and increment in greenhouse gases. Increased occurrence of extreme climate events results in greater variability of agricultural production.

Maize is thus particularly vulnerable to breaks, or dry spells, in the rainy season that occur during silking. The Department of Climate Change and Meteorology and farmers in chisamba have noticed an increase in the length and frequency of dry spells in mid-season, and this could threaten maize yields, especially when the dry spell coincides with the flowering stage. Other changes in precipitation, particularly in rainy season amounts and length, would also affect maize growth and yield in the country since the drier zones depend on rain-fed maize for their food security. Rising temperatures contribute to more rapid growth and thus evapotranspiration and water requirements. These factors, combined with declining precipitation, could significantly affect maize yields.

Farmer field yield gap can be attributed to the following:

1. Tillage.
2. Spacing. Farmers may plant fewer seeds, and plant randomly.
3. Weeding can be a big problem.
4. Inadequate fertilizer application and soil management

5. Pests and diseases.
6. Soil degradation and erosion.

A major topical issue that can be informed with accurate production cost estimates is the price offered to farmers by the Zambian Food Reserve Agency (FRA) each year. The FRA sets its maize buying price each year to compensate farmers for the costs incurred during production and provide a reasonable return to their own land, labor, mechanical, and animal inputs. However, the setting of FRA's producer price has never benefitted from national farm survey evidence on production costs. Rather, illustrative figures are provided by various stakeholder groups to lobby and influence the setting of FRA purchase price levels. For the 2009 and 2010 marketing

Seasons, this price had been set at Zambian Kwacha (ZMK) 65,000 per 50 kg bag of maize grain.

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CONCLCUSION

Finally, it has been concluded many productivity-enhancing technologies are in use in Zambia and in many cases, they are cost effective. We demonstrate that, rather than driving up cost of production per bag, fertilizer use is profitable under the right conditions. That said, there is also evidence of fertilizer users who do not see positive returns, indicating either poor management practices, late availability of fertilizer, and/or application in areas that contribute little to maize yields, such as under highly acidic soil conditions. Furthermore, there is evidence of several other technologies being employed in Zambia that also may enhance productivity. For example, regression analysis suggests numerous tillage methods (including plowing, ripping, zero tillage, basin planting, and ridging) show signs of raising gross margins and/or reducing production cost per bag. Herbicides, which are currently applied to roughly only 3% of maize fields, significantly contributed to higher gross margins per hectare planted, despite the additional cash investment added to production cost per hectare. Extending knowledge of tillage practices and their benefits as well as appropriate input use to smallholders may be a relatively high-return policy option.

variation. Understanding these determinants of yield variability in smallholder systems is important to formulate informed policies to close the yield gap for major food crops.

Many agricultural policy discussions in Zambia revolve around the cost of producing maize. Despite the importance of having accurate estimates of production costs, smallholders' cost of maize production in

Zambia remain poorly understood. Various estimates are provided by interested parties, but these are rarely based on representative farm surveys that take into account the variations in agro-ecological conditions, input intensities, and rainfall, which can profoundly affect maize production costs.

To provide a better empirical foundation for the derivation of maize production costs in Zambia, the 2010 Crop Forecast Survey (CFS), conducted by the Central Statistics Office and Ministry of Agriculture and Cooperatives, was modified to include specific questions relating to the smallholder's land, labor, and capital costs associated with producing and marketing maize. The 2010 CFS therefore provides the first opportunity to provide estimates of maize production costs for over 10,000 smallholder farmers in Zambia.

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