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Improving Yields and Profitability for Small-scale Farmers through Conservation Agriculture in Zambia

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Farming can be unattractive to small-scale Zambian producers owing to low yields and profits. The Zambian government and partners have promoted conservation agriculture (CA) for more than 10 years to improve yields. This paper evaluates the potential of CA to improve the yields and profitability of small-scale farmers in Lusaka Province. Although one study found that yield and profit differences between CA and conventional agriculture were key factors in technology adoption, most studies found no significant short-term yield, production cost, or profit differences between CA and conventional agriculture. Mean maize yield under CA increased from 1.57 t/ha in 2009-10 to 1.76 t/ha in 2010-11. Although 56.8% of the small-scale farmers had practiced CA for at least 3 years, their field sizes were smaller than 1 ha. Of the CA farmers, 18.9% wanted to increase yields and profits by increasing the area under CA. In addition, 53.1% of the conventional farmers wanted to do the same by adopting CA. On the basis of the results, I recommend the promotion of CA by building the capacity of farmers and extension workers and by teaching farmers effective business and organizational skills. I also recommend increased mechanization of CA, addressing gender imbalances among farmers, increasing youth participation in CA programs, and improving CA policy in Zambia.

Key words: conservation agriculture, crop yield, profitability, small-scale farmer, Zambia

Introduction

Zambia is famous as a copper-producing country, but is increasingly known as a success story for conservation agriculture (CA) (Baudron et al., 2007). Zambia’s small-scale farmers have widely adopted CA practices. CA involves farming practices that protect the soil to prevent soil erosion and nutrient depletion, and is an important approach in the world’s arid and semi-arid regions, which are highly vulnerable to erosion of soils by wind and water and soil degradation caused by unsustainable farming. These practices involve the planting of cover crops such as legumes to ensure that the soil is covered even in the dry season, use of these crops as green mulches, the use of no-till planting, and crop rotation combined with fallowing every 1 to 3 years to avoid depleting soil nutrients. Zambia is a large country that lies between 8°S and 18°S and between 22°E and 33°E. Its climate ranges from semi-arid to semi-humid. During the 20th century, mechanization, the introduction of synthetic fertilizers and pesticides, and plant breeding greatly increased productivity and made crop production possible on previously uncultivated land in Zambia (Chanda, 2008). Between 70,000 and 120,000 farmers had adopted some form of CA by 2003 (Haggblade and Tembo, 2003) in Zambia; this amounts to about 10% of the country’s small-scale farmers. According to recent annual reports from the Ministry of Agriculture and Livestock, eight provinces of the country’s 10 provinces have actively supported CA: Eastern, Central, Lusaka, and Southern provinces in agroeco-
logical regions I, which receives between 500 to 800 mm of rain, and IIa, which receives between 800 to 1000 mm of rain, and Northern, Muchinga, Luapula, and Copperbelt provinces in agroecological region III, which receives above 1000 mm of rain. Adoption of CA has been strongest in the semi-arid parts of Zambia, where annual rainfall ranges from 650 to 1000 mm. Farmers in these areas depend on mixed crop and livestock systems, and cultivate mainly maize, groundnut, and cotton.

The challenge for Zambia is to identify the best methods of conserving land, water, and habitats while simultaneously increasing crop yields and profits (Lungu, 2012). Small-scale farmers have faced the problem of low crop yields combined with low profitability for decades. Government initiatives by the Ministry of Agriculture and Livestock, in cooperation with several partners, have attempted to solve this problem for more than 10 years. The proposed improvements have been targeted at increasing yields and profits for small-scale farmers who use CA (Lungu, 2012).

In the present study, my goal was to evaluate the potential contribution of CA to improving the yield and profitability of small-scale farmers in Lusaka Province. This is important because most people in this province have regarded farming as an undertaking for rural people and retirees, not an essential activity to provide income and food security for residents of the province. Lungu (2012) observed that CA can increase crop yields from current average of about 1.8 t/ha to over 3 t/ha, reduce production costs, improve food availability and nutrition, minimize the risk of crop failure during droughts, and improve soil fertility in the long term. In this paper, my goal was to assess the role of CA in improving the crop yields and profitability of small-scale farmers in Lusaka Province.

1. Crop Production

The main crops grown in Lusaka Province are cereals, legumes, vegetables, oilcrops, cotton and other fiber crops, sugarcane, fruits, tobacco, coffee, and root and tuber crops (Lungu, 2012). Improved crop production is a major requirement for socioeconomic development of developing countries such as Zambia and in impoverished regions such as Lusaka Province. Zambia is among the many developing countries that are striving to improve their economies through agriculture; here, this depends mostly on small-scale farmers, who make up 80% of the farming community (Kasuba, 2003). In the context of this paper, a “small-scale farmer” is defined as any farmer who cultivates less than 1 ha of land.

Friedrich et al. (2007) stressed that there is no alternative to increased agricultural productivity. Globally, the total population is predicted to increase by more than 30% by 2050, from the current 7 billion to approximately 9.1 billion (FAO, 2009). FAO projects that global agricultural production will need to increase by 70% by 2050 to feed this population. Thus, crop production must be intensified and optimized by cultivating new land and increasing yields. Unfortunately, crop production in Africa is not keeping pace with the region’s population growth (FAO, 2009). SADC (2004) noted that yields are low and that the major cause of this decline is declining soil fertility, often caused by unsustainable farming activities. Food insecurity is increasing in many countries in southern Africa, and is a particular issue in rural areas where agriculture is the main economic activity.

Farmers who are resource-poor need low-cost and readily available technologies and practices to increase food production and income. At the same time, land degradation and decreasing water availability are increasingly threatening the food security and livelihoods of poor rural small-scale farmers (Uphoff, 2008). Many rural areas are characterized by poor market access, combined with high transportation costs that result from low infrastructural development. In Lusaka Province, six of the eight districts face this problem, although considerable effort is being expended to change this situation.

Zambia has identified agriculture as the leading sector for economic growth and specifically for meeting the first of the Millennium Development Goals of the United Nations, aimed at eradicating extreme poverty and hunger, as the rural population is extremely impoverished (Lungu, 2012). Farmers who rely on conventional ways of farming can experience low crop yields, decreasing profits, and sometimes total crop failure. CA has been proposed as a solution. In 2009–10, the national average maize crop yield in Zambia was 1.20 t/ha, versus 2.26 t/ha in Lusaka Province. In 2013–14, yield increased nationally, reaching 1.93 t/ha, but remained static in Lusaka Province, at 2.22 t/ha. Some studies done at the research station level to compare crop production between CA and conventional farming practices have revealed that crop
production is higher under CA. However, other studies have revealed that the difference in yield varies between seasons; in years with good rainfall, there is little difference in yields between CA and conventional agriculture (Mutiro et al., 2005). CA results in higher crop yields: the yield of maize grown under CA in 2008–09 was about 3.00 t/ha in Zambia and 1.78 t/ha in Zimbabwe (FAO, 2011).

2. Conservation Agriculture in Zambia

Baudron et al. (2007) defined CA as a crop production system that strives to achieve acceptable profits through high and sustained production levels, while concurrently conserving key resources (e.g., soil, water, soil fertility) and the environment. CA is based on enhancing natural biological processes above the soil and below the ground.

Lungu (2012) outlines the principles and practices of CA that are promoted in Zambia. In summary, CA promotes the concept of optimizing yields and profits while maintaining the ecosystem’s ability to provide local and global environmental benefits and services. The combination of no-till cultivation with other soil conservation practices such as pot-holling, ripping, green manuring, mulching and crop rotation is the cornerstone of CA, and is based on three main principles: minimizing soil disturbance, maintaining vegetation cover throughout the year, and improving crop rotation. Minimizing soil disturbance requires that rather than tilling, farmers use hoes to create planting holes or use ox-drawn or tractor-drawn drills to plant seeds directly into the soil (Lungu, 2012). A permanent organic soil cover is obtained by leaving crop residues in the fields or growing cover crops such as velvet beans (GART, 2006).

3. Crop Production Costs and Profits

Hobbs et al. (2004) found that in South Asia no-till wheat significantly reduced production costs. Farmers estimated this cost saving at about 2500 rupees/ha (US$60/ha), mostly due to reduced consumption of diesel fuel and decreased labor. Since planting can be accomplished in one pass with a seed drill, planting time is also reduced, freeing farmers to do other operations. Other associated benefits include increased water-use efficiency, increased rice and wheat yields because of more timely planting, and better establishment of seedling. Yield increases of 0.2 to 0.5 t/ha were found with no-till wheat. Hobbs et al. (2004) also reported that no-till cultivation used less diesel and thus resulted in less carbon dioxide emission, thereby decreasing the global warming impact of farming. Farmers saved 40 to 60 L of diesel fuel per ha by eliminating the practice of repeated plowing to produce a good seed bed after harvesting puddled rice, which can increase soil compaction and create a hardpan.

4. Conservation Agriculture Practices

Zambia’s government is promoting several CA practices for adoption by small-scale farmers. These practices include water harvesting technologies to mitigate drought (digging of water-retention basins, ripping), mulching by maintaining at least 30% vegetation cover, and crop rotation, intercropping, and agro-forestry. The major challenge has been the low level of adoption of CA. Unreliable and highly localized rainfall, weed management problems, a lack of suitable equipment, invasion of fields by livestock and wildlife, and pests and diseases are often cited as reasons for the low adoption (Kaumbutho and Kienzle, 2007). Most farmers in Zambia reported that the high labor demand to create planting holes and the additional labor for weeding are major factors that hinder adoption (Baudron et al., 2007). Some farmers who have not adopted CA practices consider it to be an “ancient way (primitive form) of farming” and are calling on the Ministry of Agriculture and Livestock to develop other technologies that make work easier for farmers and that enable cultivation of large areas rather than continuing to promote CA (Lungu, 2012).

Some field results have been contradictory in Zambia (Haggblade and Tembo, 2003). For instance, some studies showed that conventional farming performed better than CA. A recent presentation at the International Conservation Agriculture Course for Extension Workers held in Lusaka in 2011 indicated that on virgin land, conventional farming produced a better maize yield than CA (Lungu, 2012).

5. Conclusions

In conventional farming, tilling the land is expensive for undertaking tillage operations with mechanical power and tractors. Fuels, fertilizer, seed, and labor costs rise continuously, while market prices for farm produce are falling. Thus, many farmers cannot recover their production costs by selling what they produce (Hobbs et al., 2004). In contrast, CA helps
farmers cut their costs and improve profits through the use of practices that include water harvesting technologies to mitigate drought, mulching to retain 30% vegetation cover, and crop rotation (Lungu, 2012).

Crop yields in many parts of Africa are falling owing to declining soil fertility caused by conventional farming practices (Lungu, 2012). CA enables farmers to reverse this trend because it prevents the formation of hardpans, protects the soil, increases soil moisture, and restores soil fertility, thereby stabilizing yields or improving crop production in the long term (Hobbs et al., 2004).

Experience in many regions shows that smallholders rarely adopt complete packages of improved technologies; more commonly they adopt, test, and adapt the improved practices in a stepwise fashion. Training is therefore necessary to accelerate this process, and this will require more extension workers and more inputs, such as funding to purchase more suitable equipment that will make planting and weeding more efficient.

Farmers face several challenges that must be overcome to practice CA. These include difficulties in leaving sufficient vegetation cover owing to the common practice of grazing livestock in and around fields, especially during periods when forage is scarce; the unavailability of appropriate equipment and inputs such as tillers and fertilizer; and reliance on hand-held implements, which are tedious to use and discourage farmers from cultivating larger areas to increase production and profits. Infrastructural challenges and poor market access for primary agricultural products discourages investments in agriculture, and particularly in CA.

On the basis of these problems, I recommend that the government help farmers to organize themselves into groups and cooperatives so they can pool their investments for the common good, thereby making certain ventures (e.g., the purchase of equipment such as motorized seed drills) more feasible. The government should also increase access to public goods such as improved rural roads, storage systems, and access to markets.

The government is also realizing that young people are Zambia’s future farmers, but they currently have no motivation to learn how to farm. Young people have skill, energy, and creativity, and are quick to learn and are open to new ideas. There should be deliberate interventions to encourage Zambia’s youth to consider agriculture as a viable career and to help agriculture to prosper. Education, funding, and ongoing support will be required to encourage those who try farming to remain as farmers.

In Zambia, gender equality will play a role in increasing the adoption of CA, since women are highly involved in smallholder agriculture. Ensuring that both men and women are involved in planning, designing, and implementing CA activities will increase the likelihood of sustainable improvement of crop yields and profits among small-scale farmers.

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References


