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The Contribution of Conservation Farming towards Sustainable Rural Development and Household Food Security: The Case of Bikita District in Zimbabwe

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Abstract
This paper focuses on conservation farming (CF) with a view to recommending a paradigm shift in Zimbabwe's peasant farming sector. The study comes against the background of declining agricultural productivity on account of a range of factors. Traditional peasant farming typically involves frequent and intensive turning of the soil thus depriving the soil of cover. In addition, it stresses mono-cropping, suggesting that it is unsustainable. In contrast to this, conservation farming entails minimum or nil soil disturbance, soil cover maintenance, and crop rotation, implying that it is sustainable. The research was largely premised on qualitative methodology. Unstructured interviews, focus group discussions, on-site observation and transect walks were employed as techniques for data gathering. Using these methodological techniques, it was revealed that conservation farming was smoothly appreciated by beneficiaries although some laggards took time to appreciate its value towards sustainable and rural development and food security. Adoption in Bikita was tremendous and this has improved household food security. The paper recommends conservation farming adoption countrywide in the communal areas.
Keywords: conservation farming, conventional farming, food security, sustainable development, agriculture

1. Introduction
To date, conservation farming has only been marginally adopted in communal lands of Zimbabwe, particularly in the semi-arid southeast parts of the country, yet the problem of soil and water conservation is rampant in most communal areas of the country. To address the problem of declining fertility and the attendant declining agricultural productivity, this paper examines conservation farming as an alternative to orthodox farming, which should be vigorously promoted. The paper exposes the merits of conservation farming and, on this basis, recommends its adoption countrywide in the communal areas.

2. Orientation
Drought is one of the most common disasters which can undermine livelihoods and well-being despite the use of various mitigation strategies (Mogotsi et al, (2012). It is a creeping phenomenon whose effects accumulate over time before they are felt and lingering on long after the actual event while problems associated with it can have economic, environmental and social impacts. They can cause decline in crop yields resulting in reduction in income for farmers which will cause increase in market prices of products (Dercon et al., 2005). Therefore, it is important to ensure that measures are in place to minimize impacts of drought on human beings and their livelihoods although the strategies also have limitations. Drought impacts and losses can be substantially reduced if authorities, individuals and communities are well prepared, ready to act and equipped with knowledge for effective drought management. Therefore, the goal of mitigation and preparedness is to reduce impacts of drought, reduce vulnerability and foster drought resilient societies (Ncube, 2010). According to Buckland et al (2000), within the agricultural sector drought is arguably the most important climatic challenge and has major impacts on rural livelihoods. In most rural areas in Zimbabwe rain-fed agriculture is the basis of livelihoods such that fluctuations in annual rainfall cause corresponding variations in viability of agriculture.

About 70% of Zimbabwe`s population lives in rural areas and derive their livelihoods from subsistence agriculture and other rural activities (Buckland, et al., 2000). Achieving food security for all people and at all times has always been a challenge for the developing world. Several constraints have been identified as hindering food security and hence aggravating food security and poverty. These factors range from natural phenomena such as drought and climate change to inappropriate policies and technologies that tend to neglect the essential dimensions of the food security puzzle. Persistence of droughts in Zimbabwe's Natural Ecological Region IV and V has left rural people at stake with regards to starvation and endemic poverty. Technology development has been the foundation of impressive productivity gains in the agricultural sector. Lack of appropriate technology or the resources to access it is generally considered as one of the most crucial elements limiting the development of smallholder farmers in developing agricultural economies.

According to Chagonda (2008), in sub- Saharan Africa, crop farming is characterized by frequent soil tillage, removal of waste crop materials from the fields by livestock grazing or burning, and, in many cases, mono-cropping. In addition, conventional tillage entails intensive ploughing and turning of the soil using the plough. This has obvious implications on soil organisms and antecedent moisture. Makwara (2010) espoused that Zimbabwe is divided into five agro-ecological regions. In this realm, Bikita district under Masvingo province lies in region four characterized by unreliable, erratic and insufficient rainfall patterns. This therefore calls for a rational and innovative response to these impediments affecting the local people's livelihoods.

This paper focuses on conservation farming (CF) with a view to recommending a paradigm shift in Zimbabwe's peasant farming sector. The study comes against the background of declining agricultural productivity on account of a range of factors. Traditional peasant farming typically involves frequent and intensive turning of the soil thus depriving the soil of cover. In addition, it stresses mono-cropping, suggesting that it is unsustainable. In contrast to this, conservation farming entails minimum or nil soil disturbance, soil cover maintenance, and crop rotation, implying that it is sustainable.

Ellis (2000) espoused that conservation farming is not a new phenomenon but was introduced in the past three decades and was adopted in more than fifty countries. He further espoused that it is roughly estimated that the area under conservation farming stretched over hundred million hectares of land worldwide. Those that call for the adoption and implementation of conservation farming praised it much on zero tillage or minimized tampering with the soil. The avoidance of tilling the land is considered as advantageous in curbing the purported high rate of soil disturbance which promotes rampant soil erosion, increasing planting lines as well as lengthening harvest timelines. In this line of argument, Gukurume, et al (2010) also espoused that conservation farming has been credited by its prime movers for its ability to increase soil organic matter which implies the creation of better soil structure and increased nutrients sufficient for plant growth.

Conservation farming has also been praised for being economically friendly to the less privileged rural farmers. For instance zero tillage implies zero costs for most of the activities in the farming process. This implies that even the people with no draught power would manage to harness valuable yields for their survival. Despite conservation farming being applauded as the panacea in improving yields in adverse agro-ecological conditions, Makwara (2010) expressed that this initiative is not uniform to every people but they may be the best in mainly disadvantaged populations. For example, soil organisms get exposed to excessive solar radiation, while moisture loss gets accelerated through the exposure of a larger surface area. This means that plants experience moisture stress much earlier than expected. Furthermore, soil inversion enhances the oxidation of soil organic matter. Apart from that, soil turning leads to reduced infiltration and aeration as a consequence of the resultant soil compaction, which, in turn, leads to the exposure of soil to erosion agents. In contrast, conservation farming mitigates, or even cures, the drawbacks associated with orthodox tillage by guaranteeing minimum disturbance of the soil.

Producing adequate food for the country is going to remain a problem as long as a way forward has not been found. Previously, in the 1950s to the early 1970s, African farmers could respond to declining productivity by shifting to new areas. This is no longer feasible, let alone possible, due to increasing population .In consequence, fields are getting not only overused but also smaller. The net effect is declining productivity on account of declining soil quality, soil compaction, and infiltration. At a human level, there is increasing food insecurity and poverty in the region. As Chigonda (2008) contends, only a drastic change of farming systems, from the unsustainable towards more sustainable soil management, can improve the situation or even reverse the trend. In Asia and Latin America, conservation tillage revolutionized farming systems, resulting in an increase in per capita food production there. Sub-Saharan Africa, therefore, needs and has to get a clue from Asia and Latin America, where conservation farming has turned out to be a panacea for many ills in these regions (Steiner, 2002).

Against such a background, a farming method called conservation agriculture is showing promise for the subsistence farmers who are already struggling with poor food security.

3. Statement of the problem

Development of agro-based countries starts in the rural areas and the agricultural sector. Poverty has been in existence for a long time for subsistence farmers in the Bikita district and no serious action to mitigate the effects of the persistent droughts through conservation agriculture has been taken. Conventional and orthodox farming keeps leaving swathes of land utterly depleted, hence the need for sustainable conservation farming. To date, conservation farming has only been marginally adopted in communal lands of Zimbabwe, particularly in the semi-arid southeast parts of the country, yet the problem of soil and water conservation is rampant in most communal areas of the country.

In an effort to address the problem of declining fertility and the attendant declining agricultural productivity, the purpose of this study is to critically examine conservation farming (CF) as an alternative to orthodox farming, which should be vigorously promoted.

4. Research objectives

This study is guided by the following objectives:-

- to evaluate the effectiveness of conservation farming in promoting food security;
- to establish challenges faced by subsistence farmers in the adoption and implementation of conservation farming;
- To establish the prospects for adoption of conservation farming in Bikita district; and
- to evaluate the extent to which conservation farming contributes towards sustainable and profitable farming and food security to subsistence farmers.

5. Research methodology

This research has been grounded on the qualitative and quantitative methodology on account of its efficacy in providing people's own feelings from spoken words and observable phenomena on the benefits of CF. It allowed for obtaining more in-depth information about how people perceive CF. In addition the tools employed in this methodology are flexible in performing data collection, subsequent analysis and interpretation of collected information. The research instruments employed in this research were unstructured interviews, questionnaires, focus group discussions, on-site observations and transect walks. Data will also be collected through online literature. The survey study will sample organizations, communities and individual farmers through a random sampling technique. Case studies will be cited and best practices will be highlighted. Through qualitative and quantitative methods, the study seeks to establish the relevance of conservation farming in poverty alleviation propagated by natural phenomenon such as droughts and climate change. This information collected will then be used in policy change and a promoting a paradigm shift in Zimbabwe's peasant farming sector.

6. Findings

6.1 Conservation farming as understood by respondents

Questions on both CF and conventional farming were asked. Questions were asked on sizes of arable land, area under CF, area under conventional farming, crops grown under both practices and the yields.

As shown in Table 1, it is apparent that farmers adhered to the principles of conservation farming which require use of small pieces of land for the practice. However it is clear that farmers apportioned much of their land to conventional farming. Maize was the major crop in the previous season and very few farmers resorted to small grains. The maize yields show that much of their harvest is from conservation farming. Legume and small grain yields are through conventional farming methods.

Table 1: Area under production, yields and crop types.

	Size of arable land	Maize	Small grain	Legumes
Area under CF	36	23	8	4
Area under conventional farming	70	40	18	12
Yields in KGs under CF		16800	370	236
Yields in KGs under Conventional farming		13100	646	2715

(Source: Primary Data)

Respondents were asked on the principles of CF. Timeliness is the most practised principle and is regarded as the most important by farmers. They were able to articulate in both the questionnaires and focus group discussions that in conventional tillage systems, farmers plough or cultivate repeatedly in order to suppress weeds. With reduced tillage, weeds can be an initial problem and require more effort to eradicate. They indicated that one strategy was to weed timely. That is when weeds are still small, which prevents them from setting seed. They strongly indicated that timely weeding in combination with mulching should lead to effective weed control.

Crop rotation was also highly favoured. Cereal and legume rotations were considered desirable because there is optimum plant nutrient use by synergy between different crop types. The advantages of crop rotation were articulated and these include the improvement of soil fertility and weed, pest and disease control. They were privy to the fact that it produces different types of outputs, which reduces the risk of total crop failure in cases of drought and disease outbreak. Minimum soil disturbance was preferred as the third principle. Minimum soil disturbance was done through digging of plant basins. They managed to describe the planting basins as holes, dug in a weed-free field, into which a crop is planted. They indicated that timeliness has to be considered in this practice for effective implementation and that they are prepared in the dry season from July to October. Recommended dimensions of 15×15×15 cm which is an adult's hand length is approximately were given using knowledge imparted by extension officers. Farmers were able to articulate the advantages of using basins in that they enhance the capture of water from the first rains of the rainy season and also enable precision application of organic and inorganic fertilizers.

From the focus group discussion, mulching was regarded lastly and it was indicated that there was competition for stover from both livestock and CF farmers. Farmers responded by saying that crop residues are applied on the soil surface in the dry season, soon after harvesting. They were privy to the fact that sufficient residues are used to achieve at least 30% soil cover and that this mulch buffers the soil against extreme temperatures thereby reducing soil evaporation, cushions it against traffic, suppresses weeds through shading and improves soil fertility.

6.2 Advantages of conservation farming as understood by respondents

From the focus group discussion and the questionnaires for both farmers and extension staff, the following were established as advantages of CF over conventional farming:

- good yields even if erratic rains prevail;
- timeliness and use of small inputs and resources such as seed, land, labour and time;
- by not tilling the soil, farmers can save time, labour and fuel as compared to conventional farming;
- soils under CF have very high water infiltration capacities reducing surface runoff and soil erosion significantly;
- conservation agriculture is by no means a low output agriculture and allows yields comparable with modern intensive agriculture but in a sustainable way;
- low production costs; and
- mulching promotes moisture conservation;

It was also established that conservation farming mitigates the effects of drought and promote sustainable rural development and household food security. Responses from the respondents indicated that they experienced good yields through CF and managed to sell surplus to the grain marketing board (GMB) and got income to buy food, pay school fees and escape the effects of hunger. One farmer had this to say "*ndakakwanisa kuvaka imba nemari yemakomba*" meaning he managed to build a house from the holes he dug.

When the majority of the rural people have enough food, other developmental projects will be embarked on. Members will be able to maintain their road linkages to markets or other service centres, repair dysfunctional service providing equipment such as boreholes. This in turn promotes self-reliance and sustainable development.

Conservation of natural resources like soil and water promotes sustainable development and future generations will also be able to utilize such resources conserved through CF.

Respondents also felt that for CF to be more effective and easily adopted by people there was need for the following:

- train farmers on CF or hold refresher courses on the importance of CF;
- field days to motivate other farmers and reinforce adoption;
- exchange visits outside Bikita to places where CF is being highly practised and where it has borne fruits; and
- competitions and prizes to winners.

6.3 Challenges faced by small holder farmers/subsistence farmers in the adoption and implementation of conservation farming.

The following were responses from the respondents:

- lack of inputs;
- lack of fencing material;
- requires a lot of time;
- no instant benefits;
- lack of cooperation from other community members on restriction of free movement of animals; and
- laggards keep on anticipating free food hand-outs from relief programmes implemented by donor agencies such as Care International and hence do not cooperate in developmental activities such as formation of farmer groups or control of livestock from roaming.

7. Conclusions.

From the above findings and discussion we establish the following conclusions:

- conservation farming mitigates the effects of drought and promotes sustainable rural development and household food security:
- farmers experienced good yields through CF and managed to sell surplus to the grain marketing board. (GMB);
- farmers got income to buy food, pay school fees and escape the effects of hunger from CF:

- conservation farming contributes towards household food security;
- through CF, the majority of the rural people will have enough food and have ample time to work on other developmental projects; and
- conservation of natural resources like soil and water promotes sustainable development and future generations will also be able to utilize such resources conserved through CF.

It is therefore apparent that conservation farming contributes greatly towards sustainable rural development.

8. Recommendations

In light of what the study has revealed about the contribution of conservation farming towards sustainable rural development and household food security, we make the following recommendations:

- famers should be encouraged to observe the CF calendar by timing land preparation to give adequate time for all the other activities;
- farmers should be introduced to mechanised CF;
- local leaders such as village heads and chiefs should be encouraged to come up with by-laws collectively with their communities in order to promote fencing and stover retention;
- formation of farmer groups or tillage groups for either labour constrained households, labour capacitated households or draught power sufficient households;
- farmers should increase area under conservation farming as it has high yields;
- since there is competition for stover between livestock and crops, farmers should fence their land with live fencing such as sisal to preserve stover for mulching their arable land;
- the use of herbicides is also recommended in the first few years of taking on board a new piece of land to reduce on labour requirement for weed control;
- farmers should be provided with technical assistance and other farming technologies to improve agricultural yields; and
- farmers should be encouraged to cultivate small grains such as rapoko and millet and market for these should be established as a trigger for production.

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