

Article

Adoption of the “Conservation Farming” practice in maize production by small holder farmers in the Makoni District of Zimbabwe

Mafuse Never, Gono Nyeeverwai, Manyumwa Dadirayi*, Munyati Vincent Tinashe Gwati
Maponga and Muhau Edgar

Bindura University of Science Education, Faculty of Agriculture and Environmental Science, Department of Agricultural Economics, Education and Extension, P. O. Box 1020, Bindura, Zimbabwe.

Accepted 19 November 2013

The study is on adoption of “conservation farming” (CF) in maize production by small holder farmers of Makoni District in Zimbabwe as recommended by both government and non-governmental organization. The objective of this study was to find out the reasons why farmers did or did not adopt the recommended CF in maize production. Four categories of farmers were distinguished as: Adopting with support, adopting without support and non-adopting without support. One focus group consisted of first two categories whilst the other focus group consisted of last category. A Lead farmer, Ministry of Agriculture extension worker and a non-governmental organization field worker were the three key informants interviewed and the most frequently mentioned reasons for non-adoption of CF were: It is hard work throughout the year taking up time for other non-agricultural activities and overburdens women who do much of the winter weeding; Surplus maize produced is not profitable on the market compared to tobacco; Benefits take long to be realised especially on unfenced fields where the benefits of mulch are interrupted by crop residue removal during the dry season. Both participating and non-participating farmers in the project promoted by non-governmental organizations who have fully adopted CF mentioned reasons for adoption as: Increased maize productivity due to early planting and other high crop management practices in addition to the improved soil fertility which reduced witch weed infestation and improved water use efficiency; Saving of agricultural inputs which are expensive like inorganic basal fertilizer; Social belonging to a CF group has created avenues to venture into other income generating activities. The study concludes that some participating farmers are motivated to use CF in maize production. The non-adopting farmers viewed CF as unprofitable. Non-governmental organizations and government should promote CF without input incentives so as to remove the external motivation. Farmers with livestock need to be included in the project by promoting mechanized CF.

Key words: Conservation farming, Adoption, willingness.

INTRODUCTION

This study focuses on adoption of conservation farming (CF) in maize production in Makoni district of Zimbabwe.

In this study CF refers to the practice of using planting basins, soil cover (mulching) and the use of manure and

*Corresponding author. E-mail: dadiraimanyumwa@yahoo.com.



Figure 1. Maize production by smallholder farmers in Makoni District in Zimbabwe.

composts as basal dressing in the planting basins. CF is thus a part of conservation agriculture as the other principles of conservation agriculture are not being precisely carried out. These other principles are; mixing and rotating crops, timely implementation of farming operations, precise operations done completely and efficient use of inputs as they are beyond the capacities of some of the small holder farmers. In Zimbabwe CF has been promoted by relief and development agents in an attempt to ensure that food is available at household level (Hove et al., 2011). CF has been tested and promoted as one of the interventions for addressing the prevalent problems of food insecurity, environmental degradation and poverty among the region's rural communities. The promotions began in 2003 aimed at bringing Zimbabwe out of the food deficit zone which was made worse by the 2002 drought and the changing rainfall patterns. CF is regarded as a medium term strategy to achieve increased yields and ensure food availability at household level. Benefits such as increase in yield, reduced soil erosion and improved soil fertility have been noted by the farmers using the farming method (Twomlow et al., 2006).

The innovation involves digging planting basins which are holes dug in a weed-free field by use of a hand-hoe or a pick into which a crop is planted. Planting basins are prepared in the dry season from July to October. Planting basins for maize production are 15cm long by 15cm wide by 15cm deep in a permanent planting grid of 0.9metres by 0.6metres on an area equivalent to 0.25hectares. After the preparation of basins compost is mixed with the soil in the basin before planting as shown in Figure 1. The

mulch consists of crop residues in the case of fenced fields and where fencing is absent the farmers cut grass and put it on the inter row space during the growing season.

Planting basins with manure

In the post-independence period from 1980 small holder farmers have been using conventional farming where an ox-drawn plough is used to turn over the soil before planting. The use of inorganic fertilizers in the form of basal and topdressing increased in this area leading to an increase in maize productivity. After a decade of success the country faced reduced crop productivity due to the land policy reforms and economic crisis. Farmers without draught power are the most affected because they have to wait to have their land ploughed and thus losing on the benefits of the first effective rains. Other factors leading to reduced maize yields are soil erosion and decline in soil fertility.

In Makoni District farming is the main livelihood of smallholder farmers which is defined by Ellis (2000) as "the activities, the assets and the access that jointly determine the living gained by an individual or household." Livelihoods are shaped by different factors which are constantly changing resulting in livelihood outcomes that households seek to be equally affected by the changing environment. A livelihood in this study refers to the ways in which a household makes ends meet from one harvest to the next. Makoni district is one of the major

maize producing districts in Zimbabwe due to the favourable weather of agro-ecological zone IIB which it experiences and the loamy sand soils that it has. Most households in Makoni district rely on their own production to access maize for 80 per cent of the consumption yearly. A general decline in maize productivity has been experienced and the major constraint has been the unavailability of agricultural inputs, low soil fertility and erratic rains.

Governments, United Nations agencies, corporations and Non-Governmental Organisations in sub-Saharan Africa are trying to convince farmers to adopt CF to improve their crop productivity and conserve soil and water (FAO, 2001; Giller et al., 2009; Haggblade and Tembo, 2004; Mazvimavi and Twomlow, 2009). Despite these efforts, adoption levels are low in Southern Africa with less than 1% of arable land under conservation agriculture (Hove et al., 2011). These development agents have promoted CF as a form of relief aid as most of the small holder farmers could not afford farming inputs which were expensive and not available in the local market.

Adoption

According to extension literature adoption hangs together with four conditions namely; the farmer must want to, know how to, be able to and be allowed to follow the requirements of the farming practice being promoted (Leeuwis and Ban, 2004). The decision to take up a farming practice is determined by willingness which is the balance between claims and benefits of the new innovation in relation to the old system of farming. The knowledge required to carry out the new practice need to be available to the farmers. Ability to practice an innovation is influenced by the skills involved and the availability of resources or inputs to carry out specific activities. The societal norms and values have a bearing on farming systems that are allowed in an area. This study however looks at one aspect of willingness to adopt the innovation.

Problem definition

Conservation agriculture is claimed to be a panacea for the problems of poor agricultural productivity and soil degradation in Sub-Saharan Africa. It is actively promoted by international research and development organisations, with such strong advocacy that critical debate is stifled (Giller et al., 2009). Farmers practising CF have achieved yields that are 15 to 75 percent greater than their conventional methods according to Mazvimavi and Twomlow (2007). This has been as a result of farmers

preparing land early, spreading the limited farm labour and planting on time with respect to the effective planting rain. Mupangwa et al. (2011) highlighted that, "the planting basins are dug by hand in a grid of 0.9 m x 0.6 m spacing harvest rainwater and reduce surface runoff from cropping fields and increase crop yields substantially."

Adoption is defined for the purposes of this study as the decision a household makes whether to use conservation planting basins in maize production or to use conventional farming. The adoption rate of CF in the study area is less than 33% despite the efforts put by both NGOs and the government to support the innovation.

RESEARCH STRATEGY AND METHODS

The study is based on both primary and secondary data. Secondary data through desk research was done before going for fieldwork to collect primary data. Desk study was carried out on background information to the research topic and on adoption theories.

The Case study strategy

A case study was used to gain a rich understanding of the context of this study and the processes taking place at the household. The objective of the study was to identify the factors affecting adoption of CF in Makoni district and the use of a case study in this exploratory study was aimed at gaining new insights and to ask adoption questions with a broad perspective. This strategy helped to give answers to the questions why, what and how in relation to adoption of CF. A rich understanding of the context of the study and the processes taking place at farmer level was gained by use of this strategy.

Twelve cases in 3 farmer categories namely; project participating, adopting and non-adopting were studied. The reason for using multiple cases was to establish whether the findings of the participating farmers are applicable to the adopting farmers and what factors hinder the non-adopting farmers from using CF.

Data collection

Varied methods of data collection which included interviews, focus group discussions and observations were used in order to check for consistency of findings as triangulation of data increases validity and enriches the data. The use of multiple methods provided a better opportunity to evaluate the extent to which findings may be trusted and conclusions to be drawn from evidence or reasoning.

Interviews

One to one interviews with the 12 households in the three farmer categories were done with the aid of a semi structured interview questionnaire. The questions on the questionnaire were varied according to the category of the farmers being interviewed. The data collected from these interviews was used to reveal and understand 'what' and 'how' as well as placing more emphasis on exploring 'why' of practising CF.

A qualitative interview in this regard helped to understand the reasons for decisions made by adopting and non adopting farmers

Adopting farmers practise conservation farming B	Participating farmers practise conservation farming A
Non adopting farmers use conventional farming C	Defaulting farmers use conventional farming D

Figure 2. Four categories of farmers in Makoni District. Adoption support (agricultural inputs, training and extension).

and also the reasons for their attitudes and opinions. Semi structured in depth interviews provided an opportunity to probe for answers from respondents to explain or build on their responses. Using of words or ideas lead discussions into areas that the researchers had not previously considered but were significant to address research objective. Semi structured interviews allowed the respondent to 'think aloud' about issues that are taken for granted thus allowing a rich collection of data. The researcher had more control over who answered the questions according to the specified categories and according to the research objective. Open ended questions were answered and the order and logic of questioning was varied according to the responses which were given during the interview.

Interviews with key informants

Three key informants who are actors in the delivery of the farming technique namely a Lead farmer coordinating the activities of project participating farmers as well as adopting farmers, NGO field worker and a village AGRITEX worker were interviewed to get their views on the factors affecting adoption of CF. Secondary data on cropping records and training records were accessed through key informants and were used to check on the productivity of maize under CF compared to conventional farming as well as checking on the knowledge that the farmers get through training.

Focus group discussions

Focus group discussions were done to enhance various viewpoints to be shared by the group so that more information was brought up on the adoption of CF beyond that shared from the household interviews. The topics for discussion were clearly and precisely defined and the discussion was guided with a focus to enabling and recording interactive discussion between participants. The village extension worker assisted in the identification of focus group

participants who provided information to the research questions from the participating, adopting and non adopting categories. Two focus group discussions were conducted one for participating and adopting farmers with 5 men and 5 women and one for non adopting farmers with 4 men and 4 women.

Sampling

Random sampling of one village from the 18 villages in ward 12 was done to remove bias. A purposive sample of 12 households from three farmer categories namely participating A, adopting B and non-adopting farmers C were interviewed as shown in Figure 2. The study focused on three categories as the fourth category consisting of defaulting farmers D is made up of less than an estimated 2 percent of the targeted farmers and the time available for research was limiting to find respondents in this category.

Purposive sampling

The information gathered from the non probability (non-random) sampling enabled generalisation of theory on adoption of CF by smallholder farmers in Makoni District. Purposive sampling enables selection of cases that answer research questions and meet research objectives (Saunders et al., 2007). Purposive sampling was used to obtain a homogenous sample across the 3 categories therefore households without draught power were selected and an in depth study of this sub-group was done. The cases selected in each of the three categories had a minimum number of differences for example households without livestock were selected that is selecting maximally similar cases. This was done in order to link up explanations on willingness, knowledge, ability and allowance in the data analysis.

Participants for the focus group discussions were randomly selected from the list of the extension worker.

RESULTS

The results of this work are presented in Tables 1-3.

DISCUSSION

Willingness

The motivation or aspirations of farmers to practise CF were assessed by weighing the benefits and claims of CF.

Benefits of CF

Increased maize yield

The adopting farmers pointed out that the increased yield of maize was the major driver of CF. Increase in maize yield was as a result of early planting with the first effective rains as planting basins are prepared in the autumn

Table 1. Summary of findings for 9 household interviews.

household characteristics	Participating 1	Participating 2	Participating 3	Adopting 1	Adopting 2	Adopting 3	Non adopting 1	Non adopting 2	Non adopting 3
Sex	Male	Female	Female	Female	Female	Male	Male	female	Male
Labour units(ability)	2	2	3	2	1	1	3	1	1
Maize area under CF past season(ha)	0.6	0.25	0.8	0.4	0.5	0.25	0	0	0
1.Yield (t/ha) CF	4.2	4.8	3.8	1.9	1.8	2.4	Nil	Nil	Nil
2.Maize area under conventional past season(ha)	0	0.5	0.5	0	0.5	0	1	0.5	0.5
2.Yield (t/ha)Conventional	Nil	0.3	0.2	Nil	0.5	Nil	0.75	0.5	0.4
3.Maize sold(tonnes)	1	0	1:Exchanged	0	0	0	0	0	0
Crops grown	Maize, groundnuts, rapoko, soya beans	Maize, groundnuts	Maize, groundnuts, soya beans	Maize groundnuts, sunflower	Maize, sugar beans, rapoko	Maize, groundnuts, sugar beans	Maize, beans, tobacco*	Maize, groundnuts	Maize, groundnuts
Agricultural activities * most important	Field crop production* Vegetable production	Field crop production* Vegetable production	Field crop production* Broiler production	Field crop production* Vegetable production	Field crop* production Vegetable production	Field crop* production Vegetable production	Field crop production* Vegetable and fruit production	Field crop production Casual labour	Field crop production Vegetable* production
Non agricultural activities	- Pensioner ,builder	Pensioner	-	Petty trade	-	Petty trade	-	Firewood selling Barter trade*	Building Brick moulding

and winter months of May to August. The maize established early and had a better growth as disease and pest incidences are lower earlier on

in the season. Witch weed was suppressed by the continuous use of organic matter and the early planting. The other factor that contributed to

increased productivity is the high level of crop management carried out on the CF field which included the use of organic matter as basal

Table 2. Focus group discussions results.

Household characteristics	Adopting	Non adopting (conventional farmers)
1.Livelihood activities	Field crop production, vegetable and fruit production, livestock production, formal employment, petty trade, barter exchange	Field crop production, vegetable and fruit production, livestock production, formal employment, petty trade, casual labour
2.Characteristics of households with adequate maize harvests and farming method	Farmers using CF, access to inputs, formal employment	Farmers using CF, access to inputs, formal employment, with livestock, with livestock manure
3. Characteristics of households with inadequate maize harvests and farming method	Farmers using conventional farming, poor access to inputs, poor soils, late planting	Farmers using conventional farming, poor access to inputs, chronically ill members, elderly, many household members
Topics related to adoption	Increased yields - high crop management levels . Increased soil fertility, reduced soil erosion, reduced witch weed infestation, increased soil moisture retention, low inputs, belonging to social group(diversifying activities)	Faster and easier to use, helps to mix soil with fertilizers and manure, controls pest and diseases by burying them under the soil
4.Benefits of CF/conventional farming	Mulching unfenced fields is problematic, high labour requirements in the first seasons for marking out ,digging basins, weeding, farming activities time consuming as they are done throughout the year	Draught power required ;expensive to hire, delayed planting, land degradation, buries weed seeds, moves and spreads grasses such as runner grass in the whole field
5.Claims of CF/ conventional farming		

dressing and thinning out of maize crop to leave 2 plants per station. Weeding on CF maize was done early in order to reduce competition for nutrients, water and sunlight from occurring between crop and weeds.

Increased yields mean increased food availability for a household and a source of income when surplus is sold. From the study only one farmer sold (1tonne) surplus maize and the other exchanged (0.5 tonnes) for labour at harvesting. Surplus maize was being used as feed for poultry rearing as an income generating activity by one of the CF groups which has diversified its group activities. This implies that there is need to integrate programmes such as livestock, crop production and farmer market linkages. Adoption of CF can take place when maize can be used as fodder for other income generating projects.

All respondents in three farmer categories devoted the largest area under cultivation to maize production which shows that they prioritise maize as the food crop of their preference and they go on to classify themselves into food secure and food insecure social statuses using the amount of maize grain reserves that a household has. Participating and adopting farmers realised more reliable maize yields from CF which is proving to be more sustainable while non-adopting farmers had low yield despite having more area under cultivation (Figure 3).

Increased soil and water conservation

Participating and adopting farmers acknowledged that

soil fertility is improved by CF as the organic amendments are concentrated in the same area over a period of time. This has also been noted to improve the availability of soil moisture and helps to suppress witch weed infestation. However the reduction in soil erosion was not highlighted by most respondents. A comparison of maize grown under conventional and CF was done and those practising were quick to point out that maize under CF is less susceptible to moisture stress due to mulching. Mulching reduces evaporation, increases infiltration and increases soil fertility as it is broken down by termites, worms and microorganisms. The use of mulch to smother weeds was not highlighted as all the respondents fields are not fenced and have a problem of getting more than 30 percent mulch to cover their plots throughout the cropping period. FAO (2008) points out that CF contributes to reduction of land degradation and improves a sustainable farming system which is important for sustainable land management. Respondents did not realise the importance of CF on environmental issues such as a decrease in agro chemical contamination due to a reduced reliance on mineral fertilizer.

Savings on Inputs

Farmers practising CF are saving on inputs as resources used for hiring draught power such as money or exchange for labour are being used within the household. No expenses are incurred for the wear and tear of

Table 3. Key informant interviews results.

Checklist topics	Lead farmer	AGRITEX worker	NGO field officer
1. Livelihood activities of households	*Field crop production, vegetable production, formal employment, petty trade, casual labour	*Field crop production, vegetable and fruit production, livestock production, formal employment, petty trade, casual labour	*Field crop production, vegetable and fruit production, livestock production, formal employment, petty trade, casual labour, remittance
2. Income generating activities.	*Cash crop, livestock rearing, petty trade, horticulture	*Cash crop, horticulture, casual labour, livestock rearing, apiculture, petty trade	*Cash crop, petty trade, livestock rearing, horticulture
3. Maize productivity past 3 seasons	Increase from 0.5t/ha to 5t/ha	Average yields for conventional farming have been 2007/8 0.4t/ha, 2008/9 0.6t/ha, 2009/10 0.5t/ha, 2010/11 0.7t/ha, 2011/12 0.5t/ha. CF 2007/8 1.1t/ha, 2008/9 1.3t/ha, 2009/10 1.5t/ha, 2010/11 1.8t/ha, 2011/12 2t/ha.	Average yields for CF 2007/8 1.2, 2008/9 1.4, 2009/10 1.5t/ha, 2010/11 2t/ha, 2011/12 2.2t/ha.
4. Maize yield gap for the 3 categories	food self-sufficient, adopting have less than 3 months of food shortage and non adopting have up to 9 months of food shortage	Participating farmers able to bridge food requirements from one season to the other, adopting farmers 3 months of food shortage, non adopting farmers more than 6 months of food shortage	Participating farmers able to bridge food requirements from one season to the other, adopting farmers 3 months of food shortage, non adopting farmers dependent on food handouts 6-9 months of food shortage.
5. Benefits of CF	Increased yields, increased soil fertility, reduced soil erosion, increased soil moisture retention, early planting, low input expenditure as no hiring of draught power and purchase of inorganic fertilizers	Increased yields due to high crop management levels and early planting. Increased soil fertility, reduced soil erosion, reduced witch weed infestation, increased soil moisture retention, early planting, low input expenditure as no hiring of draught power and purchase of inorganic fertilizers	Increased yields, increased soil fertility, reduced soil erosion, reduced witch weed infestation, increased soil moisture retention, early planting, low input expenditure as no hiring of draught power and purchase of inorganic fertilizers, improved land management, efficient input use
6. Claims of CF	Mulching unfenced fields is problematic, high labour requirements in the first seasons for marking out ,digging basins, weeding, farming activities time consuming as they are done throughout the year	Mulching unfenced fields is problematic, high labour requirements in the first seasons for marking out ,digging basins, weeding, farming activities time consuming as they are done throughout the year	Mulching unfenced fields is problematic, high labour requirements in the first seasons for marking out and digging basins
7. Effect of CF on culture	Social cohesion is enhanced	Social cohesion is enhanced, enhanced entrepreneurial skills	Social cohesion is enhanced, improved women participation in decision making, enhanced entrepreneurial skills
8. Social status of the 3 categories of farmers.	Adopting farmers have self esteem as they are better off than non adopting farmers in food availability	Confident and convinced adopting farmers better off than indifferent non adopting farmers	Adopting farmers using own resources more confident, Non adopting farmers indifferent

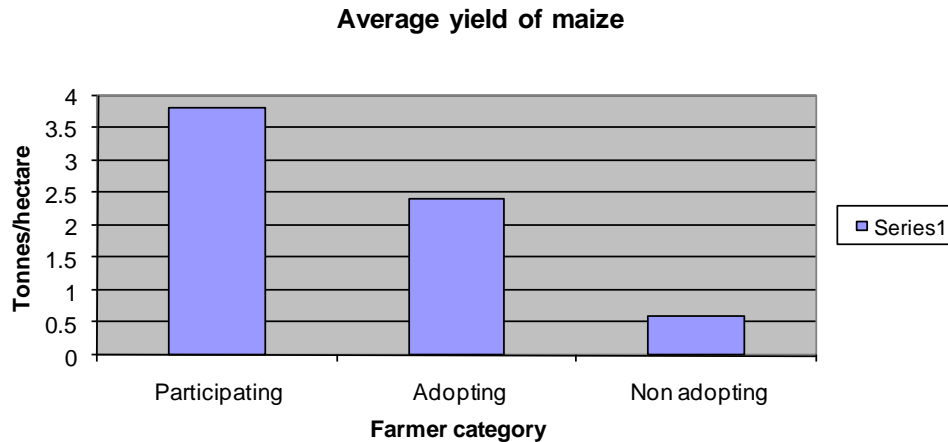


Figure 3. Average maize yields for the 3 farmer categories.

farming implements as a hoe is the major tool required under this CF as they are not yet mechanised. Crop residues and animal manure are used to make organic matter used as basal dressing in the planting stations replacing the expensive inorganic compound fertilisers. Low levels of topdressing fertilizers are used and are placed within the basin to ensure that no losses are incurred. These are used to supplement the high maize nitrogen requirement at flowering as their soils are sandy and for maize productivity to be increased there is need to apply Ammonium nitrate as topdressing fertilizer. However, from the findings there was no indication of savings on labour as a farming input.

Social grouping

CF has strengthened the social fabric in the study area between adopting and participating farmers because 2 out of the 4 adopting farmers practising CF are friends of the Lead farmer. The CF group has diversified activities into other income generating activities such as commercial poultry keeping project using part of surplus grain produced under CF as feed for poultry. The group indicated that they meet to discuss and help each other on cross cutting issues such as HIV/AIDS and child protection. The self esteem attained in the social groupings and the sense of belongingness is an indicator of the success and potential sustainability of the project.

Claims of CF

Labour

Labour is the main resource required at the farming

system in order to process all the inputs into outputs. Thus CF requires manual labour in the initial accurate marking out of planting stations and the digging of the pit, often with compacted soils or rocky fields has resulted in labour being singled out as the major claim of CF. After the first season the planting basins are remade at the same position as the preceding year and the subsequent placement of basal dressing follows.

Farmers sample did not note any reduction on the demand for labour as the CF activities take the whole year. These activities are winter weeding, storing crop residue and grass on raised platforms or fenced areas to prevent in situ grazing by livestock during the dry season and compost making. Weeding during the cropping season has been highlighted as requiring a lot of labour especially for women because mulch is inadequate throughout the season to smother weeds. CF has shifted much of the work to women as they do much of the weeding especially the winter weeding and the cutting of grass for mulching during the growing season.

The non-adopting female farmer pointed out that she could not practise CF due to shortage of labour as the other labour unit in the household (sister) is not well due to HIV/AIDS confirming the point of (Toupozis and Guerny, 1999) that labour shortages compounded by HIV/AIDS occurring together with declining household income lead to food insecurity and livelihood insecurity. This was shown by the household indicating that she depends on barter trading of clothing for maize besides engaging in other income sources such as firewood selling and casual labour.

Time consuming

Farming activities for both cropping season and off

season require high management levels such as turning the composts which is done on a regular basis and the farmer has to be on the farm at all the time. The results contrast with (FAO 2010) on the issue of CF saving time as labour management was reported to be high and labour being spread throughout the year. The respondents expressed that CF is time consuming as it restricts women from doing other household and community roles especially at weeding when labour is at peak. The CF time management aspect may be realised under mechanized operations.

Maize is unprofitable

For small holder farmers, CF is being promoted entirely on maize as a food crop which does not fetch high price on the local market. This contributes to low adoption of CF as other farmers prefer to work on tobacco which also requires a lot of labour and its farming operations also takes a long time because they earn high income from tobacco and manage to buy the maize grain from those with surplus. These farmers have a commercial farming orientation as they prefer a cash crop under contract farming in comparison to a food crop as priority for their labour whilst the adopting farmers prefer a reliable source of a food crop through CF practice.

CF results are long term

CF results take more than 3 seasons to be fully realised. Below is a quotation from one non adopting farmer to illustrate this point,

One can grow thin from digging and can die before enjoying the benefits from CF. Those practising it do not know the real value of their labour as it is cheaper to buy maize than to produce it

The results show that non adopting farmers have weighed the benefits and claims of CF in comparison to conventional farming. The increased maize productivity as the major benefit of CF has been outweighed by the high labour requirements and the unprofitability of the maize so produced. These farmers have opted to go for tobacco production as a cash crop as it is profitable and they can afford to buy maize for home consumption.

Conclusion

The study showed that participating and adopting farmers are willing to use CF in maize production because of the

increase in yield that they have benefited from. These two categories of farmers have managed to bridge the seasons with adequate amounts of maize as the major cereal for household consumption.

Benefits such as soil and water conservation and increased soil fertility have been noted as secondary benefits. Farmers who had problems of witch weed infestations have had their problem addressed as the CF practices have suppressed the infestations.

Social cohesion brought about by the CF groups working together has created a sense of belongingness and such groups are diversifying their activities into other profitable enterprises such as small livestock production. CF has strengthened the social capital in the community as they organise themselves into functional groups with high participation in their projects.

Savings on inputs like draught power and using organic manure for basal dressing means that resource constrained farmer can afford to produce their own food and not depending on food aid.

The use of surplus maize as feed in small livestock production has opened up avenues for livelihoods diversity such as broiler production which is a profit maximising behaviour. It is also beneficial in that the diversified farm produce

leads to a reduction in the purchase of supplementary food stuffs, providing a healthier diet and offering the possibility of integrating CF with other projects in the health sector.

High labour claims attached to CF and low market prices for maize contribute immensely for low uptake of CF.

RECOMMENDATIONS

There is need to scale up CF in smallholder farmers as this contributes to food security. However, the free inputs provided by the CF stakeholders to farmers should be removed as this portrays false and unsustainable benefits of CF.

All CF stakeholders should find ways of enhancing maize market linkages and value addition for products as the current depressing market prices do not favour maize production. There is need for participatory marketing strategies for maize.

CF should be practiced on all crop and not maize alone as this affects the willingness to adopt the innovation.

The integration of CF with other projects on nutrition, HIV/AIDS, trees and livestock is recommended for a holistic approach to farming as a system. CF in an integrated farming system with livestock and trees has the potential of promoting sustainable livelihoods and achieve food security.

The mechanised CF should be spread to all farmers as this reduces the problem of labour among smallholder farmers.

There should be reorientation of institutions that support CF as this establishes the once broken social capital in the communities. This would bridge the gap between the resource constrained farmers and those farmers with resources.

REFERENCES

- Ellis F (2000). Rural livelihoods and diversity in developing countries, Oxford, UK.
- Food and Agriculture Organization of the United Nations (2001). The economics of conservation agriculture Rome: United Nations Food and Agriculture Organization.
- Food and Agriculture Organisation of the United Nations (2011). Evaluation Report for Zimbabwe. Available at [http://typo3.fao.org/fileadmin/user_upload/oed/docs/Evaluation of FAO Cooperation in Zimbabwe 2011 ER.pdf](http://typo3.fao.org/fileadmin/user_upload/oed/docs/Evaluation_of_FAO_Cooperation_in_Zimbabwe_2011_ER.pdf) [accessed on 02/07/2012].
- FAO/WFP Crop and Food Security Assessment Mission (CFSAM) to Zimbabwe 2010 Report. Available at <http://www.fao.org/reports> [accessed on 12/09/2012].
- Giller K, Witter E, Corbeels M, Tittonell (2009). Conservation agriculture and smallholder farming in Africa: The heretics' view. *Field Crops Research* Vol. 114, Issue 1 pg. 23-24 Available at <http://www.sciencedirect.com/science/article> [accessed on 16/05/2012].
- Haggblade S, Tembo G, Donovan C (2004). Household level financial incentives to adoption of conservation agricultural technologies in Africa: Working Paper No.9. Food Security Research Project: Zambia. Available at <http://www.aec.msu.edu> > [accessed on 27/06/2012].
- Hove L, Kadzere I, Sims B, Ager M, Mulila-Miti J (2011). Conservation agriculture research and development in southern Africa: A review of achievements and challenges in the past 20 Years. Presented at: Conservation agriculture regional symposium for southern Africa, 8-10 February 2011, Johannesburg South Africa 2011. Available at < <http://ecoport.org/ep> [accessed on 01/07/2012].
- Leeuwis C, Ban A (2004). *Communication for Rural Innovation*. 3rd ed. Blackwell Publishing CTA, 2004.
- Mazvimavi K, Twomlow S (2007). Conservation Farming impacts in Zimbabwe Presentation to the FAO Coordinating Committee on Agricultural Relief Program in Zimbabwe, 31 May 2007.FAOHarare. Available at <http://www.zimrelief.info>[accessed 10/04/2012].
- Mazvimavi K, Twomlow S (2009). Socioeconomic and institutional factors influencing adoption of conservation farming by vulnerable households in Zimbabwe. *Agric. Syst.* 101:20-29. Available at www.elsevier.com/locate/agsy [accessed on 14/05/2012].
- Mupangwa W, Dimes Walker S, Twomlow S (2011). Measuring and simulating maize (*Zea mays* L) yield responses to reduced tillage and mulching under semi-arid conditions. *Agric. Sci.* 2(3):167-174; Available at <http://www.scrip.org/journal/AS> [accessed on 09 April 2012].
- Saunders M, Lewis P, Thornhill A (2007). *Research Methods for Business Students*, 4th Ed, Prentice Hall.
- Toupozis D, Guerny D (1999). The implications of HIV/AIDS for household food security in Africa UNECA. Food security and sustainable Development division .Available at<http://www.uneca.org>.
- Twomlow S, Steyn J, Preez C (2006). Dry land Farming in Southern Africa In *Dry land Agriculture in Southern Africa* 2nd edition .Agronomy Monograph No. 23. American society of Agronomy. Madison Wisconsin, USA.