



*Research Article*

# Assessing the Effects of Conservation Agriculture on Maize Yield in Nyakatsapa, Mutasa District, Manicaland Province: Implications on Extension Advice to Farmers in Promoting the Agriculture

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ARTICLE INFO	ABSTRACT
<b>Article No.:</b> 011213367	<p>The study assessed the effects of conservation agriculture on maize yield in Nyakatsapa, Mutasa district. 20 ca farmers, 20 farmers doing conventional farming system and area AEW were used as research subjects in 2011/2012 farming season. Questionnaires and interviews were used as research instruments. Mean yields under ca and conventional tillage were compared and analysed using 'Z' statistical test at 0.025 level of significance. Results showed that maize mean yield from ca was significantly higher than the mean yield from conventional system. Hectare of all ca farmers increased from 40.5ha in 2009/2010 to 100ha in 2011/2012 season. Yield in 2009/2010 was 1 t/ha but rose to 2.3t/ha by 2011/2012 season. Agritex, ZFU and NGO provided extension service to Nyakatsapa ca farmers. Agritex provided every type of extension. ZFU and NGO did not conduct any field days on ca. Extension records revealed that (15/20) was attendance on field days and (19/20) on field demonstrations. Results revealed that fertilizer and seed were the main inputs given. The study therefore, recommends that farmers in Nyakatsapa use conservation agriculture which produces higher yields than conventional system in maize production. Soil, nutrients and moisture are conserved.</p>
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## INTRODUCTION

Nyakatsapa Mission Farm – Ward 18 in Mutasa South district of Manicaland province has experienced very low maize yields. Low yields may be due to inherent soil infertility and marginal rainfall. These problems have not been addressed well for many years in Nyakatsapa. It was also observed that farmers also lacked extension advice from Government and private organisations/NGOs.

Maize is one of the world's three most important cereals along with wheat and rice. Maize is currently produced on nearly 100 million hectares in 125 developing countries and is among the three most widely grown crops in 75 of those countries (FAOSTAT). For example, maize is the most important cereal crop for food in sub-Saharan Africa and Latin America and its yield per ha is the highest of all grain crops. The growing demand for food consumption in developing countries alone is predicted to increase by around 1.3% per annum until 2020 (Ortiz, Taba, Chávez Tovar, Mezzalama, Xu, Yan, Crouch, 2010) but according to reports by Stocks (2004), half of the countries of Africa South of Sahara were designated by FAO as having food shortages. In Sub-Saharan Africa, some of the constraints to sustained production of this crop are soil degradation and drought.

For best yields, maize requires well drained fertile soils, adequate moisture levels and warm temperatures from germination to maturity. The amount of rainfall per year ( $\pm 1000$ mm) expected in Nyakatsapa has not been received for many years. Therefore the area has not had adequate moisture levels to suffice the level and amount needed by maize during its growing period.

Nyakatsapa Mission Farm is in Ward 18 of Mutasa district in Manicaland province. It is in agro-ecological Region 2B which has some areas which are prone to dry spells. Recent research has shown that profitable corn production requires an adequate soil fertility amendment. Insufficient nutrients lower yields.

The area is sloppy and is susceptible to soil erosion. A very thin layer of topsoil has been left on top and cannot adequately sustain the growth of maize in terms of nutrients and soil moisture. The area has continuously experienced low maize yields in the past years because of these and other reasons.

Conservation agriculture can be used to restore soil structure, conserve moisture and nutrients because it reduces soil degradation. Extension service is important to farmers because it provides technical advice which enables farmers to realise higher crop yields. The introduction of CA should be followed up by an extension service for a long period of time (FAO, 2005). Extension service, for example through NGO, can also provide technical inputs to farmers. Reports in Nyakatsapa indicated that extension services had been lacking for years which date back from 2009. In 2009, Agritex, with the help of a NGO called Sustainable Agriculture Trust, came into the area and introduced conservation agriculture technique.

Reports have shown that yields are higher in conservation agriculture than in conventional farming

due to early planting, more efficient use of rainfall, a better crop stand and precise application of soil fertility amendments. This is the case in years of drought and of good rainfall. The economic potential of conservation agriculture, in terms of costs of production, profit, yield, soil conservation, etc. is very important (FAO, 2004).

The main objective of the researcher is to assess the effects of conservation agriculture on maize yield in Nyakatsapa Mission area. This was done in order to establish whether conservation agriculture was the solution to low maize yield level in the area.

## Hypothesis

H<sub>0</sub>: There is no difference in mean yield levels obtained from conservation agriculture and conventional farming.

H<sub>1</sub>: The mean yield obtained from conservation agriculture is greater than the mean yield obtained from conventional agriculture.

## RESEARCH METHODOLOGY

### Research Site

The study was carried out in Mutasa district, Manicaland province. The actual study was carried out in Mutasa South, Ward 18 which includes Nyakatsapa Mission Farm. The district lies in agro-ecological zones 2B and 3. The mean annual rainfall is about 800mm/annum. The soil ranges from sandy to clay loam. The pH range is 6.5 – 7.2 as tested by Africa University Soil Science Laboratory.

### Data Collection

### Data sources

The research used both quantitative and qualitative data. To have an evaluative research, quantitative data is more appropriate. Chambers (1993) says there is a broad consensus that the quantitative paradigm is the most desirable approach to evaluation researches. The quantitative approach allows for the deduction of meaningful relationships between data and its findings.

Qualitative data gathered through in-depth interviews of participants gives an understanding of the lifestyle of respondents and helps in the interpretation of data. The complimentary nature of qualitative and quantitative data makes its use in this research a necessity.

Quantitative information was collected for mean yields in subsequent seasons (2009 – 2011/12) in Mutasa South Ward 18.

### Primary Data

The data was collected through written questionnaires and interviews. Questionnaire collected data on production, which included area of land under cultivation, crop distribution, agronomic practices, labour, inputs used. Written questionnaires were

administered to 20 farmers to complete. The questions were both open- or closed-ended.

**Secondary Data**

Secondary data was gathered through document review obtained from Agritex district offices in Mutasa. Data collected included statistics on farmers involved in conservation agriculture in Mutasa communal area. Yields of maize per season, extension and support services details were also provided through secondary data.

**Selection of Respondents**

Systematic sampling technique was used to select the respondents. A total of 20 households out of 100 who

do conservation agriculture were sampled and interviewed out of a total of 150 households in Nyakatsapa Mission Farm, Ward 18, Mutasa district. Another sample of 20 households who practice conventional farming methods was taken.

**Stakeholder Consultative Meetings**

These included conservation agriculture farmers, Agritex, NGO (Sustainable Agriculture Trust – SAT) to discuss the production efficiency of the farmers.

**Data Analysis**

The Z-distribution comparison of means was used to statistically find if there was difference in mean yields from conservation agriculture and conventional tillage.

**RESULTS**

Table 4.1 Yield of maize (of 2011/2012 season) of each farmer in Nyakatsapa Mission Farm (ton/ha)

Conservation agriculture					Conventional tillage				
2.6	2.6	3.0	2.8	1.4	1.0	1.0	0.8	0.8	0.24
2.6	4.0	2.2	2.2	3.0	0.2	1.6	0.4	0.4	0.8
2.6	2.0	2.4	2.6	1.0	0.6	0.2	0.6	0.5	0
3.0	2.0	2.6	4.0	2.2	1.0	0.4	0.6	1.6	0.4

Mean yield levels from conservation agriculture and conventional tillage were recorded.

0.657 ton/ha were obtained respectively. The variances were 8.97 and 3.52 for conservation agriculture and conventional tillage respectively. Table 4.2 below shows the details.

The mean yield of maize under conservation and conventional systems were calculated, 2.54 ton/ha and

Table 4.2 Means and variances of yield levels of maize (t/ha) sampled in Nyakatsapa Mission Farm in 2011/2012 season

Conservation Agriculture		Conventional Agriculture	
n <sub>1</sub>	20	n <sub>2</sub>	20
x <sub>1</sub>	2.54	x <sub>2</sub>	0.657
s <sup>2</sup> <sub>1</sub>	8.97	s <sup>2</sup> <sub>2</sub>	3.520

Source: Survey Data (2012)

Where:

- n= sample
- x= mean (t/ha)
- s<sup>2</sup> = variance

However, a statistical analysis to find and prove if there was real difference between the mean yields x<sub>1</sub> and x<sub>2</sub> was done using 'Z' statistic, two tail test. Below is the

'Z' statistic test procedure for comparison of mean yields x<sub>1</sub> and x<sub>2</sub>.

'Z' statistic procedure

- (i) H<sub>0</sub>: no difference exists, x<sub>1</sub> = x<sub>2</sub>
- (ii) H<sub>1</sub>: There is a difference x<sub>1</sub> > x<sub>2</sub> ... (one tail test).

Test statistic (T.S): Z<sub>stat</sub> ... (n<sub>1</sub> + n<sub>2</sub> > 30)

$$Z = \frac{x_1 - x_2}{\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}}$$

Rejection Region (R.R): Alpha ( $\alpha$ ) =  $0.05/2 = 0.025$

$$\begin{aligned}
 Z &= \frac{2.54 - 0.657}{\sqrt{\frac{8.97}{20} + \frac{3.520}{20}}} \\
 &= \frac{1.883}{\sqrt{0.445 + 0.176}} \\
 &= \frac{1.883}{\sqrt{0.621}} \\
 &= \frac{1.883}{0.77} \\
 &= 2.34
 \end{aligned}$$

Decision: The above result ( $Z = 2.34$ ) led the researcher to reject  $H_0$  and accepted  $H_1$ .

Conclusion: It is concluded that the two means are significantly different.

Inference: Conservation agriculture (ca) produce higher levels of maize yields than conventional tillage.  $x_1$  is bigger than  $x_2$ .

The above results lead the researcher to reject  $H_0$ . It is concluded that the two means are significantly different and infer that ca produce higher levels of maize yields.  $x_1$  is bigger than  $x_2$ .

### Production trends

Table 4.3 Production trends from 2009/2010 – 2011/2012 seasons in Nyakatsapa Mission Farm – Ward 18, Mutasa district.

Season	Number of all farmers practising conservation agriculture	Hactrage	Total Yield For the hectrage (tons)
2009/2010	81	40.5	40.5
2010/2011	91	65.5	152.88
2011/2012	100	100	234

Source: Agritex (2012)

81% was the smallest number of farmers doing ca and the largest was 100% in 2009/2010 and 2011/2012 seasons respectively. Hectrage of all farmers also increased from 40.5ha in 2009/2010 to 100ha in

2011/2012 season. The yield in 2009/2010 was 1 t/ha but rose to 2.3t/ha by 2011/2012 season.

### Extension and Support Services

Table 4.4 Extension service providers and numbers of conservation farmers who received the extension services in Nyakatsapa, Ward 18, Mutasa, in 2011/2012 season

Extension	Organisation/Dept providing the service	Actual number of farmers who received/attended extension out of 20
Training of C.A farmers	Agritex, ZFU, NGO	18
Field days on C.A fields	Agritex	15
Advice meetings	Agritex, ZFU, NGO	17
Field demonstrations on C. A	Agritex	19

Agritex, ZFU and NGO provided extension service to Nyakatsapa ca farmers. Agritex provided every type of extension recorded. ZFU and NGO did not conduct any field days on ca. The lowest attendance of ca farmers was (15/20) was on field days and the highest attendance (19/20) was on field demonstrations (Table 4.4).

Table 4.5 Inputs given to ca farmers in Nyakatsapa Mission Farm – Ward 18, Mutasa South

Season	Inputs from Zimbabwe Farmers Union (ZFU) or Government or Non Governmental Organisations
2009/2010	Fertilisers (Compound D, AN) seed (maize, cow peas, beans, round nuts, ground nuts, vegetable pack)
2010/2011	Seed (maize, sunflower, beans), vegetable pack, hoe, sickle
2011/2012	Seed (maize only), fertilisers (Compound D, AN), hoe, sickle, vegetable pack

Source: Agritex (2012)

Results revealed that fertilizer and seed were the main inputs given. Seed included maize, legume and vegetable. In 2011/2012 season, no legume seed and fertilizers were given to farmers.

## DISCUSSION

Results showed that the two means were significantly different. Conservation agriculture (ca) produced higher levels of maize yields than conventional agriculture. This was because  $x_1$  was bigger than  $x_2$ . The outcome ( $Z = 2.34$ ) showed that the difference was big and, hence, justified the difference.

The number of farmers doing ca increased from 81% to 91% and then to 100% (Table 4.3). The results showed that there was a gradual increase in the number of farmers who were adopting ca from 2009/2010 season to 2011/2012 season. This was probably due to response to extension and ca campaigns done by various organisations. The yield in 2009/2010 was 1 t/ha but rose to 2.3t/ha by 2011/2012 season. In 2009/2010 the yield was low because there was drought. It was also noticed that most farmers did not use kraal manure in addition to inorganic fertilizers. In 2011/2012 season, yields were high because most appreciative and keen farmers implemented the relevant conservation techniques advocated by extension agents. This is in agreement with FAO (2004) who mentioned that the full technical and economic advantages of conservation agriculture can be appreciated by the farmer. Farmers applied inorganic fertilizers and kraal manure in planting basins. The manure would provide additional nutrients and reduce any incidental leaching of nutrients. It was observed that manure conserved nutrients, moisture and soil in the planting basins. This enhanced increase in maize yields from 1t/ha to 2.3t/ha by 2011/2012. Hectrage of all farmers also increased from 40.5ha in 2009/2010 to 100ha in 2011/2012 season. This was because more and more farmers were joining ca because there was a notable increase in yields after 2009/2010 season. There was land expansion which increased total hectrage per season after 2009/2010 season.

Results showed that about 75% - 95% attendance of farmers was registered on various gatherings of ca (Table 4.4). The turnout of farmers showed that most of the ca farmers were willing to receive technical knowledge at chosen venues. The

willingness enhanced adoption of the ideas, inputs or skills and, hence rendered farmers very innovative in their fields.

Results in Table 4.4 revealed that Agritex provided every type of extension recorded during the survey. This was possible because the Area Extension Workers (AEW) actually work and stay with the farmers in allocated areas for many years, unlike the other organisations who come for a specific program and go. So, Agritex had ample time with farmers and would cover more ca programs. Farmers received all the extension services they needed for the success of ca programs which were running in their area.

Results revealed that seed given included maize, legume and vegetable. In 2011/2012 season, no legume seed was given to farmers (Table 4.5). The crops/products from maize, legume and vegetable seeds would provide starch, protein and vitamins which are essential requirements for human beings. Thus, the seed inputs covered the dietary needs of farmers. This incentives invited more farmers from conventional agriculture to ca. In 2011/2012 season, no legume seed was given to farmers because Government, through Agritex, wanted to put more emphasis of ca on maize than any other crop.

## CONCLUSION AND RECOMMENDATIONS

Conservation agriculture produces higher maize yields in sandy soils, low rainfall areas of Zimbabwe than conventional agriculture. Extension service providers who include Agritex are needed by farmers for their assistance in extension. They provide relevant technical information and inputs for ca and this enhances high yields. An example of this was the technical knowledge gained from extension workers on the conservation of nutrients, moisture and soil in ca through basins, more especially, when organic and inorganic fertilizers were used in combination, in Nyakatsapa.

It is recommended that farmers in Nyakatsapa Mission Farm use conservation agriculture and not conventional systems in maize production. Soil, nutrients and moisture are conserved. It is also recommended that extension service providers do equal number of turns in providing necessary information by farmers as this may further increase ca maize yields in Nyakatsapa.

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