# FACTORS AFFECTING THE ADOPTION OF REDUCED TILLAGE PRACTICES BY MAIZE FARMERS IN KAGARKO LOCAL GOVERNMENT AREA OF KADUNA STATE

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**Abstract**

*The study examines factors affecting the adoption of reduced tillage practices among maize farmers in Kagarko Local Government Area of Kaduna State. Data were gathered through the administration of questionnaire to ninety (90) maize farmers who were randomly selected from three villages. Multiple regression and costs and returns analyses, percentages, frequency counts were used to analyse the data collected for the study. The results of the costs and returns analysis showed that N18,737 was incurred with a gross revenue of N 128,750 per hectare. The result further reveals that a profit of N 110,013 and benefit cost ratio of 6.87 per hectare with N 5.87k net return on investment were realized in a month. The result of the regression analysis reveals that education, marital status, farm inputs cost and farming experience exert significance effect on maize output in the area. The findings from the study showed that reduced tillage practices is profitable (N110,013) and significantly influenced by farmers education, marital status, farm inputs cost years of farming experience. The study therefore recommended adult literacy through the use extension approaches such as farmers' field school and village adoption practice to enhance farmers' skill and knowledge.*

***Keywords:*** *Adoption, reduced tillage practices, farmers*

## Introduction

Tillage is any operation or practice taken to prepare the soil surface for the purpose of crop production. Ahn and Hintze (1990) states that tillage is any physical loosening of the soil as carried out in a range of cultivation operations, either by hand or mechanized. The overall goal of tillage is to increase crop production while conserving resources (soil and water) and protecting the environment (Opara-Nadi 2009). In reduced tillage dead plant material that remains on the ground after the crop is harvested is left on or near the surface of the soil, rather than being plowed deeply into the ground as in traditional tillage. The dead plant material at the surface of the soil helps to keep moisture within the ground, and protects the soil from erosion (www.soils.org).

Reduced tillage of the soil reduces labour, fuel, irrigation and machinery costs. As sustainable agriculture becomes more popular, monetary grants and awards are becoming readily available to farmers who practice conservation tillage. Some large energy corporations which are among the greatest generators of fossil-fuel-related pollution may purchase carbon credits, which can encourage farmers to engage in conservation tillage (Derpsch, 2011). Under such schemes, the farmers' land is legally redefined as a carbon sink for the power generators' emissions. This helps the farmer in several ways, and it helps the energy companies meet regulatory demands for reduction of pollution, specifically carbon emissions.

Conservation agriculture (CA) aims to make better use of agricultural resources through the integrated management of available soil, water and biological resources, combined with limited external inputs (Wallheimer, 2011). It contributes to environmental conservation and to sustainable agricultural production by maintaining a permanent or semi-permanent organic soil cover. Zero or minimum tillage, direct seeding and a varied crop rotation are important elements of conservation agriculture.

Adoption of conservation agriculture at the farm level is associated with lower labour and farm-power inputs, more stable yields and improved soil nutrient exchange capacity. Crop production profitability under conservation agriculture tends to increase over time relative to conventional agriculture. Other benefits attributed to conservation agriculture at the watershed level relate to more regular surface hydrology and reduced sediment loads in surface water. At the global level, conservation agriculture sequesters carbon, thereby decreasing $CO_2$ in the atmosphere and helping to dampen climate change. It also conserves soil and terrestrial biodiversity.

Tilling is used to remove weeds, shape the soil into rows for crop plants and furrows for irrigation. This leads to unfavorable effects, like soil compaction; loss of organic matter; degradation of soil aggregates; death or disruption of soil microbes and other organisms including Mycorrhiza, arthropods, and earthworms; and soil erosion where topsoil is washed or blown away. Reduced tillage farming avoids these effects by excluding the use of excessive tillage. With this way of farming, crop residues or other organic amenities are retained on the soil surface and sowing/fertilizing is done with minimal soil disturbance.

Conservation agriculture is practiced on about 57 million ha, or on about 3 percent of the 1 500 million hectares of arable land worldwide. Despite the apparent advantages, and despite the few notable exceptions in the developing world, conservation agriculture has spread relatively slowly, especially in farming systems in temperate climates. The transformation from conventional agriculture to conservation agriculture, in which reduced tillage is a component seems to require considerable farmer management skills and involves investment in new equipment. However, it may also require minimum levels of social capital to foster its expansion.

In the light of this situation, the main objective of this study is to assess the factors influencing adoption of reduced tillage practices among maize farmers in Kagarko local government area of Kaduna State, and this can be achieved specifically through: describing the socio-economic variables of farmers, determining the cost benefits of reduced tillage practices, and identifying the factors militating against the adoption of RTP.

Residue-based minimum tillage with direct seeding is perhaps the best example of conservation agriculture, since it avoids the disturbance caused by mechanical tillage (Hussain *et al*, 2010). The last two decades have seen the perfecting of the technologies associated with minimum tillage agriculture and their adaptation for nearly all farm sizes, soil and crop types and climate zones. This research will provide useful information to farmers, researchers, students as well as policy makers.

**Hypothesis**: There is no significant relationship between farmers' socio economic variables and their level of adoption of reduced tillage maize production technology in the study area

**Materials and Methods**

The study was conducted in Kagarko Local Government Area of Kaduna State. It is situated in Kaduna South between latitude $9^0\ 27^1$ and $7^0 41^1$E and longitude $6^0 - 9^0 100^1$. The local government is bordered in the north by Kachia local government, east by Jaba local government of Kaduna State and south by Niger State (KADP, 2009). It has a projected population of 310,335 people in 2015, based on annual growth rate of 3.2% (NPC, 2006).

Kagarko local government area has ten (10) political wards viz: Iddah, Kurmin Jibrin, Arbi, Jere south, Jere north, Kagarko south, Kagarko north, Katuga, Kushe and Kukui ward. The inhabitants are predominantly peasant farmers who engaged in maize, ginger, cassava, sorghum, groundnut and vegetable production. They are Koro, Gbagy and Kadaras by tribe with hausa-fulani settlers.

**Sampling Techniques**

Simple random sampling procedure was used to select six (6) wards from the ten (10) wards in the local government. Purposive sampling was used to select three (3) villages from each of these six (6) wards in the local government due to their engagement in reduced tillage maize production, while five (5) farmers were randomly selected from each of the three (3) purposively sampled villages. i.e. 5 x 3 x 6 = 90. A total of 90 maize farmers constituted the sample size for the study.

**Analytical Tools:** To analyze the data collected, descriptive statistics such as frequency counts and percentage were used while Net farm income and multiple regression were used also to determine the profitability of RTP and determine socio-economic factors and adoption of RTP by farmers.

In computing the costs and returns, Net farm income (NFI) and profitability indices like, benefit-cost ratio and return to Naira invested was used to explain the extent to which a naira invested in reduced tillage maize production contributes to the net farm income. The model for estimating NFI can be represented by the equation:

NFI = $PyYi - (\in (PxXi) - \in FK)$.

NFI = Net farm income

Yi= Quantity of output

Py= unit price of output

Xi = quantity of variable inputs ( I = 1,2,3,………..n).

Px = unit price of variable inputs

Fk = cost of fixed inputs (k = 1,2,3,………..n)

$\in$ = summation

**Multiple regression:** Multiple regression involving the use of ordinary least squares (OLS) estimation techniques was used to determine the factors affecting the adoption of reduced tillage practices in the study area. Three functional forms (i.e linear, semi-log and double-log) were tried, and the best fitted functional form in terms of its conformation with the a-priori, econometric and statistical criteria was chosen as the lead equation.

The linear model specification in its implicit form is given by:

$Y= f(X_1, X_2, X_3, X_4, X_5, X_6, X_7, X_8, X_9, \mu)$

The model is explicitly specified in the form below:

$Y = a + b_1X_1 + b_2X_2 + b_3 X_3 + b_4X_4 + b_5X_5 + b_6X_6 + b_7X_7 + b_8X_8 + b_9X_9 + e$.-------------i)

Where:

Y = Level of adoption of reduced tillage (measured as adoption % of total tillage practices ).

$X_1$ = Farmers' age (years)

$X_2$ = Education (Number of years in formal schooling)

$X_3$ = Marital status (single = 1, married = 0)

$X_4$ =Family size (number in household)

$X_5$ = Farm size (hectares)

$X_6$ = Income (Naira)

$X_7$ = Extension contact (number of visits)

$X_8$ = Farm inputs cost (Naira)

$X_9$ = Farming experience (years)

$b_1 - b_9$ = Regression coefficients

a = constant

e = error term

## Results and Discussion

### Socio- Economic Characteristics of the Respondents

#### Age

The age distribution of the respondents as revealed by Table 1 shows that most (47.78%) of the respondents were between 40 and 49 years. This is followed by those between 50 and 59 (27.78%). However, there is low percentage of 30 and 39 years, 69 and 69 years, 20 and 30 years and 70 and 79years in the age of maize producing farmers using reduced tillage. This implies that the farmers in the area are youths who will be interested in investing both time and energy in a profitable venture. This corroborated the finding by Babasanya *et al.* (2013) that youthful population is an advantage for the adoption and spread of innovative practices.

#### Level of Education

About (32.22%) of the sampled respondents had primary education. This was closely followed by those with no formal education (31.11%). Those who were educated at secondary and tertiary level represent 25.56% and 11.11% respectively. This implies that the respondents were able to read and write and could easily communicate and adopt beneficial technologies. This agrees with Ganiyu *et al* (2014) who stated that educated farmers are more likely to be more responsive to innovation.

#### Marital Status

Table 1. further shows that 72.22% of married couples were involved in maize production under reduced tillage. The single and widow were only 17.78% and 10% respectively. The implication of this is that maize cultivation is a source of food and income to the respective farm families in the study area.

#### Gender

The respondents distribution by gender shows that majority (65.56%) were male while 34.44% were females. This shows that males were more involved in maize production using reduced tillage compared to the females in the study area. This agrees with the finding of Ganiyu (2015) that in most communities, it is believed that men are stronger and energetic than women and therefore women's role in the community are in form of cooking, rather than farming.

#### Household size of the Respondents

Majority (68.89%) of the sampled maize farmers had 1-5 households. This was followed by 6 – 10 and 11 – 15 family members representing 16.67% and 14.44% of the farming families respectively. This means that household size play no significant role in maize production due to the prevalence of hired labour.

#### Farming Experience of the Respondents

The respondents farming experience as depicted in Table 1 revealed that majority (64.44%) of the respondents had 1-8 years of farming experience. This is followed by 28.89% and 6.67% of the respondents with 9-16 years and 17-24 years of experience respectively. This means that experience in farming is not a pre-requisite for maize cultivation.

**Farm Size of the Respondents**

Table 1 further shows that 1-4 hectares was the major farm size of the (74.44%) respondents. However, 20% of the farming families had 5-8 hectares while only 5.55% had 9-12 hectares of land.

**Table 1.** Socio- Economic Characteristics of Respondents

| Variables | Frequency | Percentage (%) |
|---|---|---|
| **Age** | | |
| 20 - 29 | 2 | 2.22 |
| 30 - 39 | 11 | 12.22 |
| 40 - 49 | 43 | 47.78 |
| 50 - 59 | 25 | 27.78 |
| 60 - 69 | 8 | 8.89 |
| 70 - 79 | 1 | 1.11 |
| **Level of Education** | | |
| No formal education | 28 | 31.11 |
| Primary education | 29 | 32.22 |
| Secondary education | 23 | 25.56 |
| Tertiary education | 10 | 11.11 |
| **Marital Status** | | |
| Married | 65 | 72.22 |
| Single | 16 | 17.78 |
| Widowed | 9 | 10.00 |
| **Gender** | | |
| Male | 59 | 65.56 |
| Female | 31 | 34.44 |
| **Household Size** | | |
| 1-5 | 62 | 68.89 |
| 6-10 | 15 | 16.67 |
| 11-15 | 13 | 14.44 |
| **Farming Experience** | | |
| 1-8 | 58 | 64.44 |
| 9-16 | 26 | 28.89 |
| 17-24 | 6 | 6.67 |
| **Farm Size in Hectares** | | |
| 1-4 | 67 | 74.44 |
| 5-8 | 18 | 20.00 |
| 9-12 | 5 | 5.56 |
| **Total** | 90 | 100 |

Source: Field survey, 2015

**Cost and return analysis:** The result of the cost and return analysis per hectare for an average farmer shows that ₦18,737 was incurred while gross revenue of ₦128,750 was realized thereby returning a profit of ₦110,013 and benefit cost ratio of 6.87 per hectare. Table 2 further shows that the net return on investment in a month was ₦5.87k per naira invested; implying that for every ₦1 invested in maize production per hectare there was a return of ₦5.87k, making a profit of ₦5.87k on every one naira invested. This indicates a considerable level of profitability of maize production using reduced tillage practices in the study area. This concurs with Hussain *et al* (2010), where it was observed that no-till crop production system yield higher returns than conventional tillage.

**Table 2:** Cost and return analysis for maize production enterprise per hectare in Kagarko LGA of Kaduna

| Item | Unit | Qty | Amount |
|---|---|---|---|
| Variable costs | | | |
| Maize seeds | Kg | 20 | 1,933 |
| Organic fertilizers | Kg | 300 | 3,267 |
| Empty jute bags | No | 35 | 1,750 |
| Agrochemical | litres | 9.2 | 3,880 |
| Labour | MD | 11 | 4,450 |
| TVC | | | 15,280 |
| Fixed costs | | | |
| Depreciation of fixed assets excluding land | | | 457 |
| Land rent | | | 3,000 |
| TFC | | | 3,457 |
| Total production costs (TVC + TFC) | | | 18,737 |
| Maize output | Kg | 2500kg | 125,000 |
| Quantity consumed | | 50kg | 2,500 |
| Quantity as gift | | 25kg | 1,250 |
| Gross farm income | | | 128,750 |
| Net farm income (NFI) = GFI - TPC) | | | 110,013 |
| Benefit – cost Ratio | GFI | 6.87 | |
| TPC | | | |
| Net return to investment | NFI | 5.87 | |
| TPC | | | |

*Source: Field survey, 2015*

**Factors Affecting Adoption of Reduced Tillage Practices**

Multiple regression analysis was used to determine the factors that affect adoption of reduced tillage practices for maize production in the study area. The results of the analysis were presented in Table 3. As the table shows, education was positively related with the adoption of reduced tillage practices in the study area. This relationship is statistically significant at 1% level of significant. This implies that the more educated the farmer is, the higher will be his level of adoption of RTP. This corroborates the findings of Ganiyu (2015) who posited that education facilitates adoption of technology. Similarly, marital status of farmers was positive and significantly influenced adoption of reduced tillage practices at 1% level of significance, implying that married farmers adopt the technology than the single and widow in the area. This is not unconnected to the use of family labour which also has the advantage of reduced cost of labour as RTP. Farm inputs cost was positive and significantly affect adoption at 5% level of significance, implying that the higher the cost of farm inputs, the higher will be the adoption of reduced tillage practices by the farmers. This is in line with Ganiyu (2014) who submitted that farm inputs has positive correlation with cassava output. Also, farming experience had a positive (0.221) and significant relationship with adoption at 10% level of significance. This means that the more the years of farming experience of farmers, the higher their levels of adoption. This concurs with the submission of Babasanya *et al.* (2013) where it was found that farmers experience influenced the adoption of new cassava cultivars.

However, age is negative (-0.0031) and insignificantly related to adoption of reduced tillage maize production system. This implies that the older the farmer, the less the adoption of reduced tillage for maize production in the area since the old people are usually indifferent to change. Also, family size, farm size, income and extension contact are positive but insignificantly related to adoption. The adjusted $R^2$ value of 46% obtained in Table 3 implied that the specified variables in the model explain the variation in adoption of reduced tillage maize production system in the study area. The remaining 54% was due to other factors that were not included in the model. Based on the findings of this study, the hypothesis that there is no significant relationship between farmers' socio economic variables and their level of adoption in the study area was rejected because farmers' socio economic factors influence adoption.

**Conclusion**

Farmers' adoption of reduced tillage practice in maize production is sacrosanct to sustainable family farming as identified by the study. And since most of the farmers in the area are youth, it may serve as a veritable means of employment. The study also identified labour as the most expensive resource (N4,450) in maize production from the total production costs of N18,737, with a N5.87K net return to investment. Also, education, marital status, farm inputs cost and farming experience were positively related to adoption of reduced tillage practices and significantly affect its adoption for maize production in the study area.

**Recommendation**

Since farm inputs cost is a significant factor of adoption, provision of high yielding maize varieties that are resistant to pests and diseases to farmers by the government is therefore recommended. Also, the study identified education as a factor influencing adoption of reduced tillage in maize production thus; efforts should be intensified by government to encourage adult literacy through the use of different extension approaches such as farmers 'farm school and village adoption strategies as practiced in South Indonesia, and Kenya and Uganda respectively to enhance farmers' skill and knowledge.

**Table 3:** Factors Affecting Reduced Tillage Practices.

| Variables | Coefficients | Standard Error | t-value |
|---|---|---|---|
| Constant | 3.532 | 0.364 | 9.69*** |
| Age | -0.0031 | 0.013 | -0.24 |
| Education | 0.288 | 0.701 | 4.10*** |
| Marital status | 0.742 | 0.140 | 5.30*** |
| Family size | 0.008 | 0.027 | 0.30 |
| Farm size | 0.122 | 0.035 | 0.35 |
| Income | 0.160 | 0.216 | 0.941 |
| Extension contact | 0.039 | 0.027 | 1.45 |
| Farm inputs cost | 0.294 | 0.121 | 2.42** |
| Farming experience | 0.221 | 0.113 | 1.96* |

F-value = 264.10*** Adj R-square = 0.46 *** = Significant at 1% ** = Significant at 5% *= Significant at 10%

**References**


Ahn, P.M. and Hintze, B. (1990). No tillage, minimum tillage and their influence on soil properties. In: Organic-matter Management and Tillage in Humid and Sub-humid Africa. Pp. 341 – 349. IBSRAM proceedings No. 10. Bangkok.

Babasanya , B., Oladele, O.G., Odidi, O.O., Ganiyu, L and Apene, E., Etim, J., Olafemi,S.O. and Sirajo, A. (2013). Farmers Perception and Knowledge Need for Adoption of New Cultivars of Cassava in Igabi LGA, Kaduna State. *Journal of Biology, Agriculture and Healthcare*, the International Institute for Science, Technology and Education (IISTE) New York, USA. Vol 3, No. 2, Pp 45 – 52.

Derpsch, R. (2011)."A short History of No-till". *NO-TILLAGE*. Retrieved 26 March 2011.

Ganiyu, L., Babasanya, B., Yahaya, U.F., Sirajo, A. and Babarinde, E.J. (2014). Economic Analysis of Cassava Production in Jaba Local Government Area of Kaduna State. 48th Annual Conference of the Agricultural Society of Nigeria (ASN), ETF Lecture Theater, University of Abuja, Abuja. 24th – 28th Nov., 2014, Pp 328 - 331.

Ganiyu, L. (2015). Factors Affecting Adoption of Forest Conservation Practices by Farmers in Kaiama LGA., Kwara State, Nigeria( the case of Kainji Lake National Park). Unpublished M.Sc thesis, Department of Agricultural Economics and

Rural Sociology, Ahmadu Bello University, Zaria.

Hussain, M., A. Saboor, A. Ghafoor, R. Javed, and S. Zia (2010). Factors affecting the adoption of no-tillage crop production system. Sarhad J. Agric. 2 (3): 409 -412

KADP (2009). Kaduna State Agricultural Development Programme.

NPC (2006). Census figure, National Population Commission, Abuja.

Opara-Nadi, O.A. (2009). Soil tillage in Africa: Needs and Challenges. In: Organic-matter Management and Tillage in Humid and Sub-humid Africa. International Board for Soil Research and Management (IBSRAM) Proceedings No. 10. Bangkok.

Wallheimer, B. (2011). "No-till, rotation can limit greenhouse gas emissions from farm fields". physorg.com. Retrieved 26 March 2011

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