AN ANALYSIS OF THE ADOPTION OF GLYPHOSATE HERBICIDE FOR THE
CONTROL OF SPEAR GRASS (Imperata cylindrica) BY YAM FARMERS IN GUINEA
SAVANNA AGRICULTURAL ZONE OF NIGERIA.

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Abstract

This study analysed the adoption of glyphosate herbicide for the control of spear grass in three local
government areas (Ankpa, Olamaboro and Omala) of Kogi State between June 2011 and December
2012. Some of the objectives were to describe the socioeconomic characteristics of the respondents,
determine the adoption level and ascertain the socioeconomic factors influencing the adoption. A
total of two hundred and sixteen (216) sets of questionnaire were distributed. The data collected
were analyzed using descriptive statistics, logit regression analysis, mean scoring from 3-point
Likert scale, z-test and percentage scoring methods. The study revealed that the yam farmers were in
various stages of adoption. Out of 216 farmers only (186) farmers (84.7%) adopted glyphosate
herbicide technology, of (186) adopters, 33.3 percent were low level adopters, while 41.9 percent and
24.7 percent were medium and high level adopters respectively. The results of logit regression
revealed that farm size, educational level and income do not significantly influence the adoption.
However extension visits and knowledge of the use of glyphosate herbicide significantly influenced
the adoption of glyphosate herbicide at 10%. The 3-point Likert type rating scale used in knowing
the level of seriousness of perceived constraints showed that high cost of herbicides, lack of capital,
lack of access to credit and lack of technical know how with mean scores of 2.58, 2.57, 2.56 and
2.33 respectively were perceived to be very serious constraints while unavailability of herbicide and
poor market information with mean scores of 1.82 and 1.88 respectively were seen to be less
serious. This study recommends that efforts should be made by extension agents to increase the
knowledge of farmers on the use of the technology.

Introduction

Few decades ago, Nigeria was ranked as the top producer of yam, providing 36.72 million metric tons
annually, Food and Agricultural Organization of the United Nations, (FAO, 1997). Yams are excellent
sources of carbohydrate and some minerals. About 85% of a tuber is edible which partly composed of 65–75%
water, 15–33% starch, 1–2.5% protein, 0.5–1.5% fibre, 0.7–2% ash and 0.05–0.2% fat. According to
Consultative Group on International Agricultural Research (CGIAR) (1996) carbohydrates rich food like yam
and cassava products make up to 60 – 90% of daily food intake in West Africa when compared to about 50%
in developed countries. Yam has ritual, socio-cultural and economic influences on the lives of the people
(Orkwor et al., 1998).

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However, yams are particularly sensitive to competition from weeds during part of their growth. Weeds such as *Imperata cylindrica* interferes with crop growth through direct competition for resources that determines growth and through allelopathic interactions thus reducing the quality and quantity of harvest (Akobundu and Ekeleme, 2000).  

*Imperata cylindrica* is a serious weed pest among African farmers. It reduces crop yield and quality, limits farm size to the level that family labour can handle and, increases labour requirement for weeding. The weed also causes physical injury to the skin, and increases the presence of pathogens and insects of economic importance.

Garry et al. (1997), the area affected by Imperata expands as fallow length becomes shorter. In many farming systems recurrent fires are used to clear vegetation and continuous cropping is replacing the traditional cropping/bush fallow due to increase in population and pressure on land. Small scale farmers suffer more from imperata infestation because they do not have sufficient resources to purchase inputs to control the weed in a sustainable manner.

Technologies developed to control Imperata have been used successfully in large estates or commercial farms where there is an ample supply of labour, capital, and herbicides. However, very few have been widely adopted by small – scale farmers (Terry et al., 1997). There are serious concerns about the impact of weeds, particularly imperata and Striga, on agricultural production and productivity and the low adoption rate of the existing imperata management technologies by small – scale farmers in Nigeria, especially in the savanna zone. This development prompted the International Institute for the Tropical Agriculture (IITA), Ibadan to request financial assistance from the Department for International Development (DFID) to implement a 3 – year participatory project (2002–2004) on Imperata and Striga control in Nigeria.  

The objectives of the project were to: identify, evaluate, and develop methods for controlling *Imperata cylindrica*. Disseminate improved imperata management options using participatory research and extension approach (PREA) and increase the capacity of NGOs (CBOs), research institutions/private sector to facilitate uptake of improved weed management practices in small – scale, disadvantaged farming communities.

The weed has been identified as the major natural problem affecting the production of yam by many farmers in some rural communities in Kogi, Benue, Cross River State and other parts of Nigeria (Chikoye et al., 2005). Past research in West Africa has shown that selected herbicides, mechanical, cultural, biological, chemical, alley cropping and cover crops were used individually or as integrated programmes for effective combat of spear grass. For example, Chikoye, et al. (2002) showed that the use of herbicides such as glyphosate or cover crops gave higher crop yield and net benefits in corn, cassava and yam than hand weeding. Cover crops have the ability to shade spear grass and reduce it to non-competitive levels within 2-5 years (Udensi et al., 1999). The use of glyphosate, also, gave higher grain yields and crop value in soybeans, higher tuber yields and crops benefit in yam, higher tuber and stem yields in cassava than the farmer’s control. The use of the herbicide gave significantly higher control of spear grass in soybeans when compared with traditional weeding with hoe (Avav and Okereke, 1997).

Glyphosate technology has been introduced to farmers by IITA in the study area for over 7 years. The percentage of the farmers who adopted the integrated technologies that were introduced by IITA has not been determined. After the intervention, it is expected that the herbicide should have been adopted by now while
yam production should be on the increase in the study area. However yam output has not seemed to be significantly improved upon. It is therefore, important to ascertain the extent of adoption of the technology. Has the glyphosate technology witnessed high or low adoption? Could the problem of poor yam yield be that of inability to adopt the glyphosate technology correctly? This study therefore attempted to ask: what are the socio-economic factors influencing the adoption of glyphosate herbicide technology? What are the adoption levels of the glyphosate technology among yam farmers? What is the output valued in Naira of yam between the contact and non-contact yam farmers? What are the constraints to the adoption of the glyphosate herbicide technology in Kogi State?

Objectives of the Study

The specific objectives of this study are to:

i. ascertain the socio-economic factors influencing the adoption of glyphosate herbicide technology.

ii. determine the level of adoption of glyphosate herbicide among the yam farmers in Kogi State.

iii. compare the output valued in Naira from yam between the contact and the non – contact yam farmers.

iv. identify the constraints to the adoption of the glyphosate herbicide technology.

Methodology

The Study Area

The study was conducted in Kogi State (see Figure 1) which is in Guinea Savanna Agricultural Zone of Nigeria. The state is located in the middle belt region of Nigeria. It is known as confluence state because the confluence of rivers Niger and Benue met at its capital Lokoja. The State was created on the 27th August, 1991 from parts of Kwara and Benue States. The State lies between latitude 7°30′N and 7°50′N and Longitude 6°42′E and 6°70′E. Kogi State is made up of 21 local government areas and divided into four agricultural zones namely:- Zone A, with Ayetro-Gbede as headquarter, zone B with Anyigba as headquarter, zone C has Koto-Karfe as headquarter, while Zone D with Alloma as the headquarter. The State comprises of three major ethnic tribes namely Igala, Ebira and Yoruba (Okun), other minor groups include Kankanda, Kupa, Ogori-Mangongo, Nupe, Bassa-Komo, Bassa-Nge, and Gwari (Koseeds, 2004). Kogi State has total land mass of about 30,354.4 km² and is the fifteenth largest state in the country in terms of land mass. The state is bordered by nine other states and is the most centrally located state in the country (Koseeds, 2004). Based on the 2006 census Kogi State population stood at 3,278,487, Kogi State has an average maximum temperature of 32.2°C and average minimum of 28.8°C. Lokoja, the State capital is generally warm throughout the year.

Kogi State has two distinct climate; dry season which starts from November and ends in February while raining season begins from March and stops in October. Annual rainfall ranges from 1016mm - 1524mm. About 80% of the populations are involved in subsistence farming. Among the arable crops grown in the state are: yam cassava, sweet-potatoes, cocoyam, groundnut, beniseed, rice, maize, millet, sorghum, bambara nuts, and pigeon pea, while tree crops include oil palm, citrus, mango, cashew, plantain, banana, guava, and kolanut and live stocks such goats and sheep are reared (Koseeds, 2004).
Population and Sampling Technique

Data collection was carried out in three stages. The first stage was through the use of purposive sampling to select three local government areas (Ankpa, Olamaboro and Omala) (Table 1) where the adoption of the glyphosate technology was experimented by IITA. The second stage was by random sampling to pick three cells of Agricultural Development Project (ADP), Agricultural Extension Structure from each of the three local government areas. Each of the cells has 20 contact farmers. The last stage was the use of random sampling to pick 12 contact and 12 non-contact farmers of the technology from each cell. This translated to 36 respondents who adopted and 36 who did not in each of the three local government areas. In summary, 108 contact and 108 non-contact farmers were randomly selected in the three identified LGAs to make a total of 216 respondents. The summary of the sampling procedure is given in Table 1.

Fig.1: The Study Area
Source: GIS Lab, Kogi State University,
Table 1: Distribution of Respondents by Local Government/Communities

<table>
<thead>
<tr>
<th>Zone</th>
<th>Local Government Area</th>
<th>ADPAgric Extension cells</th>
<th>Herbicide Contact farmers</th>
<th>Herbicide Non-Contact farmers</th>
<th>Total No of Respondents</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Ankpa</td>
<td>Inye</td>
<td>12</td>
<td>12</td>
<td>24</td>
</tr>
<tr>
<td></td>
<td>Ankpa town</td>
<td></td>
<td>12</td>
<td>12</td>
<td>24</td>
</tr>
<tr>
<td></td>
<td>Ogodo</td>
<td></td>
<td>12</td>
<td>12</td>
<td>24</td>
</tr>
<tr>
<td></td>
<td><strong>Subtotal</strong></td>
<td></td>
<td><strong>36</strong></td>
<td><strong>36</strong></td>
<td><strong>72</strong></td>
</tr>
<tr>
<td>B</td>
<td>Olamaboro</td>
<td>Okpo town</td>
<td>12</td>
<td>12</td>
<td>24</td>
</tr>
<tr>
<td></td>
<td>Imane</td>
<td></td>
<td>12</td>
<td>12</td>
<td>24</td>
</tr>
<tr>
<td></td>
<td>Ogugu</td>
<td></td>
<td>12</td>
<td>12</td>
<td>24</td>
</tr>
<tr>
<td></td>
<td><strong>Subtotal</strong></td>
<td></td>
<td><strong>36</strong></td>
<td><strong>36</strong></td>
<td><strong>72</strong></td>
</tr>
<tr>
<td>C</td>
<td>Omalla</td>
<td>Abejukolo</td>
<td>12</td>
<td>12</td>
<td>24</td>
</tr>
<tr>
<td></td>
<td>Ibado</td>
<td></td>
<td>12</td>
<td>12</td>
<td>24</td>
</tr>
<tr>
<td></td>
<td>Ogodu</td>
<td></td>
<td>12</td>
<td>12</td>
<td>24</td>
</tr>
<tr>
<td></td>
<td><strong>Subtotal</strong></td>
<td></td>
<td><strong>36</strong></td>
<td><strong>36</strong></td>
<td><strong>72</strong></td>
</tr>
<tr>
<td></td>
<td><strong>Total</strong></td>
<td></td>
<td><strong>108</strong></td>
<td><strong>108</strong></td>
<td><strong>216</strong></td>
</tr>
</tbody>
</table>

**Source:** Field survey, 2012

**Data Collection Methods**

Data for this study were gathered essentially from primary source. The primary data were collected by a structured questionnaire containing thirty six (36) relevant questions for the study. These were validated by experts in the Department of Agricultural Economics and Extension, Kogi State University, Anyigba to reflect all the objectives of the study. The questionnaire was divided into four sections and each section contained relevant questions on the objectives.

In section A, respondents provided information on their socio-economic characteristics. Section B focused information on the levels of adoption of glyphosate herbicide technology among the yam farmers. Section C obtained information on the output valued in naira from yam by contact glyphosate herbicide contact and non contact. Section D contained information about the constraints to the adoption of glyphosate while Section E provided information about the factors influencing the adoption of glyphosate herbicide among farmers. The researcher collected the data with the assistance of ADP extension workers who were trained and used as enumerators.

**Method of Data Analysis**

**Objective 1**

To find out the socio-economic factors influencing the adoption of glyphosate herbicide. Logit regression was used to achieve this as adopted by Feleke and Zegeye (2006)\textsuperscript{12} to analyze the influence of socio-economic characteristics on the adoption of improve maize varieties in southern Ethiopia. The model is specified as follows:

\[
\text{Lny} = \text{Ln} \left( \frac{p}{1 - p} \right) = \text{Ln} (p/i_p) = b_0 + b_1 x_1 + b_2 x_2 + \ldots + b_8 + e
\]

Where:

\[
Y = \text{Glyphosate usage (1 = usage, 0 = otherwise)}
\]

\[
P = \text{probability of the use of glyphosate.}
\]

\[
\text{Ln} = \text{Natural logarithm function.}
\]
Bo = Constant.

$B_1 - B_8$ = Logistic regression coefficients.

$X_1$ = Age of the farmer (in years).

$X_2$ = Level of education (in years).

$X_3$ = Household size (number of persons).

$X_4$ = Farm size (in hectares).

$X_5$ = Farming experience (in years).

$X_6$ = Yam output valued (in Naira).

$X_7$ = Extension contact (No of visits in the year).

$X_8$ = Ability to apply agro-chemicals (Yes = 1, No = 0).

**Objective 2**

To determine level of adoption of glyphosate herbicide among the yam farmers in Kogi State, adoption level was measured by using likert scale in which scores were given to each adoption stage as used by Iwueke (1990). Values were assigned for each stage of the adoption process, the values assigned were 0 for unawareness, 1 for awareness, 2 for interest, 3 for evaluation, 4 for trial, 5 for adoption, and 0 for rejection and 4 for discontinuance. Using Iwueke methodology of measuring adoption level, the integrated package of yam production technology was used, the integrated package has the following steps; step 1 direct application of glyphosate at 4 and 8 weeks after planting + 1 hoe weeding at 12 weeks after planting, step 2 involved the use of fusillade post emergence at 3 weeks after planting + 2 hoe weeding at 8 and 12 weeks after planting, step 3 involved pre-tillage application of glyphosate followed by mucuna at 6 weeks after planting + 2 hoe weeding at 8 and 12 weeks after planting. A farmer who adopted these 3 steps will score a maximum point of 15. Based on the above criteria, a farmer was considered as a low adopter if he recorded a score between 1-7 while a score between 8-11 implied that such farmer was medium adopter while score between 12-15 was considered high adopter and a score of 0 was for non-adopters.

**Objective 3**

Z-test statistics was used to determine the significant differences in yam output valued in Naira between glyphosate herbicide contact farmers and non-contact farmers. The z-test model can be explained as used by Okporie (2006) where z-test was computed as:

$$Z = \frac{\bar{X}_A - \bar{X}_B}{\hat{Sd}}$$

Where $\bar{X}_A$ = Mean of sample A (Contact farmers)

$\bar{X}_B$ = Mean of sample B (Non contact farmers)

$\hat{Sd}$ = Standard error of the difference between means obtained

$$\hat{Sd} = \sqrt{\frac{S^2_A}{N_A} + \frac{S^2_B}{N_B}}$$
Objective 4:
This objective was achieved by calculating the mean score from 3-point likert rating scale to indicate level of seriousness of the constraints, in this case very serious attracts 3 points, serious was 2 points while not serious attracts 1. These points were summed up to get a total point of \((3+2+1 = 6)\). The total point was divided by 3 to have an average of 2 points. In essence, a mean score above 2 was categorized as very serious constraints and any one below 2 was grouped as non-serious constraint. This description was in accordance to (Anyanwu et al. 2002).

Results and Discussion

Table 2: Result of the Logit Regression Analysis of Socio-economic factors influencing adoption of Glyphosate Herbicide

| Variables                        | Coefficients | Std Error | Z  | P>|z|  |
|----------------------------------|--------------|-----------|----|------|
| Age                              | -.094        | .0353428  | 2.66| 0.008*|
| Education                        | .019         | .046789   | 0.41| 0.684 |
| Household size                   | .092         | .0756999  | 1.21| 0.206 |
| Farm size                        | .092         | .0756651  | 1.22| 0.223 |
| Farm experience                  | .045         | .030775   | 1.46| 0.143 |
| Income                           | 8.80         | 3.60e-06  | 0.24| 0.80  |
| Extension Visit                  | .138         | .082071   | 1.68| 0.092*|
| Knowledge of application of glyphosate | 3.27     | .5606729  | 5.84| 0.000**|

Source: Computed from field survey data 2012

\[
\text{LR Chiz (8) =} \quad 68.65^{***}
\]

\[
\text{Pr =} \quad 0.0000
\]

NB: Figures in parentheses are t-values* and ** denotes 10 and 1 percent level of significance respectively.

Socioeconomic Factors Influencing the Adoption of Glyphosate Herbicide Technology

The result of the logistic regression analysis for the determinants of socio-economic factors influencing the adoption of glyphosate herbicide among yam farmers in the study area is shown in table 2 it contains the explanatory variables which have been found to be significant at 10% and 1% level of probability using logistic regression statistics.

From the result of the logistic regression in Table 2 the coefficient of determination (LR) of 68.65 and the adjusted (pr) 0.0000 which implies that 100% of the changes experienced in the total farm income of the farmers were explained by the variables in the model and the prior ratio of 68.65 was significant at 1% and 10%. The result indicates that age of the respondents had coefficient of -.0939357 on the adoption which is statistically negative significant at 10%. This implies that age of the farmers was not a significant determinant of adoption of glyphosate herbicides in the study area. Education of the respondents had a coefficient of .0190617 which was not significant but positive. Household size with coefficient of .0916096 was not statistically significant to the adoption. This implies that the size of the household does not affect family labour on the adoption of glyphosate herbicides. From the results, it shows that farming experience with coefficient of .0450444 was not statistically significant. However experience had some effect on adoption of the herbicide as experience is the best teacher- great lessons are learnt from experience. Past odds or negative experiences will be avoided or minimized to avoid a repeat of such occurrences which results on better
performances. Also the more experiences the better the practices and the farmers tendency to accept innovations or extension messages. The result showed that income had positive influence with coefficient of 8.8007 which was statistically not significant. The result revealed that extension visits with coefficient of .1381565 was statistically significant at 1% and had positive effect on adoption. This means that more extension visits will lead to more awareness of adoption of new technology which may translate to increased in yield and income of yam farmers. The result also shows that knowledge of application of glyphosate was positive with a coefficient of 3.274187 and was statistically significant at 1%. This means that acquisition of knowledge has a positive and significant influence on the adoption of glyphosate herbicide.

**Level of Adoption of Glyphosate Herbicide**

Table 3: The result of the level of adoption of glyphosate herbicide

<table>
<thead>
<tr>
<th>Adoption</th>
<th>Frequency</th>
<th>% of farmers</th>
<th>% of adopters</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Low Adoption</td>
<td>62</td>
<td>28.7</td>
<td>33.3</td>
</tr>
<tr>
<td>2 Medium Adoption</td>
<td>78</td>
<td>36.1</td>
<td>41.9</td>
</tr>
<tr>
<td>3 High Adoption</td>
<td>46</td>
<td>21.4</td>
<td>24.7</td>
</tr>
<tr>
<td>4 Non-adopted</td>
<td>30</td>
<td>13.4</td>
<td>–</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>216</strong></td>
<td><strong>100</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>

**Source:** Computed from field survey data 2012

**Distribution of farmers by level of adoption of glyphosate herbicide**

Table 3 shows the distribution of respondents according to levels of adoption. The result of this study indicated that the glyphosate technology adopted by yam farmers were in various categories of adoption. Out of 216 farmers only 186 farmers (84.7%) adopted glyphosate herbicide technology. Of 186 adopters, 33.3 percent were low level adopters while 41.9 percent and 24.7 were medium and high level adopters respectively.

This was similar to the findings of Chinaka et al. (2007)\(^1\) on adoption of improved agricultural technologies by farmers in Aba Agricultural zone, Abia State who stated that there was a gap between awareness and adoption of innovation.

**Table 4: Comparison of the yam output valued in Naira of contact and non-contact farmers of glyphosate herbicide**

<table>
<thead>
<tr>
<th>Variables</th>
<th>Mean</th>
<th>Standard error of mean difference</th>
<th>Z-cal</th>
<th>Z-tal</th>
<th>DF</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contact (Sample A)</td>
<td>136628</td>
<td>20808.51</td>
<td>1.9348</td>
<td>1.960</td>
<td></td>
</tr>
<tr>
<td>Non-contact (Sample B)</td>
<td>96366.67</td>
<td>20808.51</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Source:** Field survey 2011

**Comparison of the yam output valued in Naira of contact and non-contact farmers on glyphosate adoption**

The z-test results showed that z-calculated was 1.935 while the z-tabulated was 1.960. Since the z-tab was higher than the z-cal it means there was no significant difference between the output valued in Naira of glyphosate contact and non-contact farmers. This could be due to the fact that most of the glyphosate
herbicides farmers were low and medium adopters as indicated in Table 4. This implies that even when some adopted, it was not properly adopted to significantly influence the output (valued in naira) of the adopted.

Table 5: A 3-Point Likert Rating Type of Scale on the Constraints to the Adoption of Glyphosate Herbicide Technology

<table>
<thead>
<tr>
<th>Constraints</th>
<th>Very Serious 3</th>
<th>Serious 2</th>
<th>Not Serious 1</th>
<th>Total no of resp (N)</th>
<th>Total no of score (ΣFiAi)</th>
<th>Mean score</th>
<th>Proportion of resp in %</th>
</tr>
</thead>
<tbody>
<tr>
<td>High cost of herbicides</td>
<td>138</td>
<td>65</td>
<td>13</td>
<td>216</td>
<td>557</td>
<td>2.58</td>
<td>86</td>
</tr>
<tr>
<td>Unavailability of herbicide</td>
<td>54</td>
<td>78</td>
<td>84</td>
<td>216</td>
<td>402</td>
<td>1.86</td>
<td>62</td>
</tr>
<tr>
<td>Lack of capital</td>
<td>148</td>
<td>108</td>
<td>14</td>
<td>216</td>
<td>553</td>
<td>2.57</td>
<td>85.8</td>
</tr>
<tr>
<td>Illiteracy</td>
<td>189</td>
<td>85</td>
<td>85</td>
<td>216</td>
<td>427</td>
<td>1.97</td>
<td>65.6</td>
</tr>
<tr>
<td>Lack of access to credit</td>
<td>152</td>
<td>45</td>
<td>19</td>
<td>216</td>
<td>565</td>
<td>2.62</td>
<td>87.3</td>
</tr>
<tr>
<td>Ecological pollution</td>
<td>15</td>
<td>70</td>
<td>131</td>
<td>216</td>
<td>316</td>
<td>1.46</td>
<td>48.66</td>
</tr>
<tr>
<td>Cultural belief</td>
<td>26</td>
<td>55</td>
<td>135</td>
<td>216</td>
<td>323</td>
<td>1.49</td>
<td>49.66</td>
</tr>
<tr>
<td>Lack of technical know-how</td>
<td>102</td>
<td>84</td>
<td>30</td>
<td>216</td>
<td>504</td>
<td>2.33</td>
<td>77.66</td>
</tr>
<tr>
<td>Poor market information</td>
<td>40</td>
<td>94</td>
<td>82</td>
<td>216</td>
<td>390</td>
<td>1.80</td>
<td>60</td>
</tr>
<tr>
<td>Lack of extension services</td>
<td>70</td>
<td>49</td>
<td>97</td>
<td>216</td>
<td>405</td>
<td>1.88</td>
<td>62.66</td>
</tr>
</tbody>
</table>

Source: Field survey 2012

Conclusion

From the findings one can draw a conclusion that glyphosate adoption has not been properly adopted as recommended. Inadequate knowledge of use of the technology, high cost and inaccessibility to fund were the major draw backs to the adoption. Aggressive and sustainable training and visit on glyphosate adoption should be put in place by both public and private extension outfits who advocate glyphosate usage for the control of this stubborn, energy shaping weed. Cooperative society can also be embraced by yam farmers to
jointly share the cost of purchasing a large bulk of glyphosate herbicide which will partly reduce cost and enhance a greater access to the use of the technology. However, farmers and extension workers must exercise restrain to the over use of the herbicide because of its detrimental effect on soil and the crop planted.

Competing Interest
Herbicides use often requires additional land to increase the size of farm and justify the huge financial outlay. However, land tenure which is held unto tenaciously by the traditional farmers always hinders the possibility of increasing the land size for yam production.

Authors Contributions to Knowledge
This study has provided information on the social economic characteristics of yam farmers that influence the adoption of glyphosate herbicides. The study also ascertained that the use of the herbicides positively influenced the yam output. It also provided information on the constraints to the adoption of the herbicides and the various levels of adoption. These contributions to knowledge should help the agricultural extension agents, researchers and glyphosate manufacturers to adjust their approaches to the methods of information dissemination and use which should enhance the adoption of the herbicides.

Recommendations
This study therefore recommends that;
1. Extension agents should step up their visits on glyphosate adoption education in rural areas on how to use the technology as recommended.
2. Workshops should be organized by Ministry of Agriculture and private organizations to educate farmers and update extension workers on knowledge of glyphosate usage.
3. More collaborative research with relevant bodies to bring about a less, costly but effective herbicides for control of spear grass.
4. Groups have been found to be important information sharing and in creating a spread, diffusion or multiply effect with relevant improved technologies adoption. Therefore farmers should be encouraged by extension agents to join cooperative societies so as to benefit from the groups which may reduce cost of purchase of glyphosate and enhance availability and successful adoption of the technology.
5. Adequate supply of herbicides in agro-service centers in rural communities should be put in place and within reach of farmers.
6. Provision of credit facilities to farmers without given much collateral at low interest rate and also cut down bureaucratic bottlenecks so as to enable the farmers access agricultural loans.
7. Provisions of herbicides to farmers at subsidized rate, so that the less privileged can have access to them.
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