INFLUENCE OF SOCIOECONOMIC CHARACTERISTICS OF FARMERS ON KNOWLEDGE OF HERBICIDE USE IN EDO STATE, NIGERIA

UDDIN, I.O., ENWELU, I.A., IGBOKWE, E.M.

Abstract: The study described the socioeconomic characteristics of farmers using herbicides; identified their constraints in the use of herbicides; and the hypothesis that there was no significant influence of farmers' socioeconomic characteristics on their knowledge score on herbicide use was also tested. The study was conducted in Edo State in the south-south zone of Nigeria. Farmers in the state that were using herbicides constituted the population for the study. Multistage sampling technique was used. The total sample size for the study was one hundred and twenty (120) respondents. Data were collected with interview schedule. Data collected were analyzed using mean statistic and standard deviation and presented in percentage. Hypothesis for the study was analyzed using multinomial logistic regression with a $p \leq 0.05$ level of significance. The results of the study revealed that greater proportion (35.8%) of farmers completed secondary school education and only 6.7% obtained Higher National Diploma/First Degree Certificate. The mean household monthly income was N 47,500.83. Major constraints to herbicide use were high cost of herbicide ($\bar{X}$ = 3.30) and lack of knowledge calibrating sprayers ($\bar{X}$ = 2.83). Result of the hypothesis indicated that some socioeconomic characteristics of farmers (sex, monthly income and household size) affected their knowledge of herbicide use. The study among other things however, concluded that although farmers had low educational level, it did not significantly influence their knowledge of herbicide use.

Keywords: Constraints, farmers' knowledge, herbicide use, Nigeria, socioeconomic.

Introduction: The bulk of food consumed in most parts of Nigeria is produced by farmers in rural areas who employ indigenous techniques and family labour for most of their farm operations. Hot climatic conditions with high solar radiation of tropical and subtropical countries favour the predominance of C-4 photosynthesis plants, some of which are very aggressive and undesirable species, generally well adapted to the adverse conditions of high temperatures and drought, and which easily interfere with the growth and development process of crops [1]). The noxious incidence of the undesirable plants, also known as weeds, is one of the major constraints to world agricultural production [1]). Weeds are plants that under certain conditions cause economic and social harm to the farmers.

In most of the poor or developing countries, however, the small farmer and his/her family usually spend more than 40% of their time in hand weeding, which limits agricultural productivity and the improvement of their standard of living and culture [2]). It has also been proved that hand-weeding does not always benefit the farmers, because in some circumstances they control weeds out of the "critical period" of weed competition, i. e. when most of the damage caused by the weeds has already been done.

The FAO has estimated pre-harvest crop losses due to weed infestation, plant diseases; arthropods (largely insects and termites) to be around 30 to 35%, and post-harvest losses (grain storage, etc.) amounted to an additional 10 – 20% [3]. The damage caused by weeds is seen in various ways and seriously affects various agricultural processes. Losses caused by weeds may be from 5 to 10% in the agriculture of developed countries, while losses can be up to 20 to 30% in developing or emerging countries, i. e. those that depend to a great extent economically on their agricultural production [2]).

Reference [4]) state that weeds cause problems due to:

- competition with crops for nutrients, water and light;
- the release of root exudates and foliar leachates toxic to crops;
- the creation of a favorable habitat for the proliferation of other pest (arthropods, mites, pathogens and others), serving as boost for them; and
- Interference with the normal harvesting process and contamination of produce.

These situations limit the productivity of the farmers and the well being of their family. Thus, the farmer is left with no choice than to employ more sophisticated methods to control weeds. In order to arrest these problems, chemical weed control has become an increasingly necessary operation in the consistent and economic production of crops. In addition to agricultural diversification and yield optimization, chemical weed control has formed an integral part of the policies of many governments world over [5].

The use of herbicides have significantly increased crop yield in the short term by limiting damage by weed pest, competition for water and nutrients from

weeds and by providing large amounts of nutrients in a form that is readily available to plants. Synthetic pesticides are purposely introduced into agricultural systems to protect crops against weeds, insects, fungi and other pests [6]. Methods of weed control are many and varied including prevention, mechanical, cultural, physical, biological and chemical [7]; [8], each may be used alone or combined but all are usually integrated for a successful weed control programme [9]; [10]. Weed control is jointly used with other farm operations for efficient crop production.

However, in the long run, these processes can lead to serious depletion of soils because the natural processes of converting organic matter and the balance of microorganisms in the soils have been disrupted [11]-[15]. Also, herbicides used for control of weeds can kill beneficial insects like butter flies, moths, spiders, bees, lady bugs, aphids, among others which play other roles in the environment such as pollinating plants [16]. Those applying herbicides to their crops are also susceptible to health problems. When the beneficial insects are gone, there is no natural control over the pests, so their populations can increase much more quickly after the initial application, requiring further applications of pesticides to control the original pest.

Attractions of farmers in the use of herbicide may be its fast and timely weeding, reduction in the use of human labour which is becoming very costly and scarce as a result of rural-urban drift and rural farmers' children engaged in school activities. But the use of herbicides demands thorough knowledge of at least their effects on the users and the environment and funds for purchase and application of herbicides.

However, with the increasing awareness concerning the importance and health hazards associated with herbicides use on the part of consumers, environment and farming groups, it is important to investigate the prevailing factors that influence farmers' decision to use herbicides. On the basis of the foregoing, the following questions become pertinent:

What are the socioeconomic characteristics of farmers using herbicides in Edo State? What is the influence of their socioeconomic characteristics on their knowledge of herbicide use? What are the constraints faced by farmers using herbicides? Answers to these questions were the main thrusts of the study. Therefore, the study assessed the socioeconomic characteristics of farmers using herbicides and determined their constraints in the use of herbicides. The hypothesis for the study was that there was no significant influence of farmers' socioeconomic characteristics on their knowledge score of herbicide use.

Methodology:

Area of study: This study was carried out in Edo State in the south-south zone of Nigeria. Edo State lies between longitude 06004'E and 06043'E and latitude 05044' N and 07034' N. The state is divided into three agricultural zones as follows: Edo Central, Edo North and Edo South. Edo central zone is divided into five blocks as follows: Esan Central, Esan West, Esan North-East, Esan South-East and Igueben Local Government Areas (LGAs). Edo North Zone comprises 6 blocks, namely: Owan West, Akoko-Edo, Etsako West, Etsako East, Owan East and Etsako Central LGAs. Edo South Zone consists of seven (7) blocks namely, Oredo, Ovia South West, Ovia North East, Ikpoba-Okha, Egor, Uhunmwode and Orhionwon LGAs. In all, there are total of 18 blocks or LGAs in the study area [17]

Population and sampling procedure: The population for the study comprised all farmers that use herbicides in the state. Multistage sampling technique was used in selecting respondents for the study. Three (3) agricultural zones which make up the state were selected in the first stage. In the second stage, two (2) blocks were purposively selected from each zone based on the presence of farmers using herbicides. In the third stage, two (2) circles were similarly purposively selected from each block giving a total of four (4) circles per zone and a total of twelve (12) circles. In the fourth stage, a list of farmers who use herbicides was compiled. From the list, ten (10) farmers were selected from each circle through simple random selection technique. Thus the total sample size for the study was one hundred and twenty (120) respondents (Table 1).

Agricultural zones in Edo State	Number of blocks	Number of blocks selected	Circles selected	Respondents
Edo Central	5	2	4	40
Edo North	6	2	4	40
Edo South	7	2	4	40
Total	**18**	**6**	**12**	**120**

Measurement of variables/data analysis: Socioeconomic characteristics were measured as follows: age (years), sex (male or female), marital status (married, single, widowed etc.,) educational level (primary, secondary, tertiary etc.), estimated monthly income (N), farm size (hectare) and household size (number of person eating from the same pot). Knowledge score was determined by listing 30 relevant knowledge questions and asking respondents to tick True or False. The questions contained both open and closed (structured) questions. Each correct answer scored 1 (one) point and wrong answered scored 0 (zero). The highest score was 30 points and the lowest was 0 (zero). The respondents were thereafter categorized into three (3) groups based on their knowledge level namely:

a. Low knowledge (for those respondents with 1 – 10 score)

b. Moderate knowledge (for those respondents with 11 – 20 score)

c. High knowledge (for those respondents with 21 – 30 score)

Constraints of respondents to herbicide use were determined by listing perceived constraints and asking them to rate the extent of the constraints on a four point Likert-type scale of: to a great extent (4), to an extent (3), to a little extent (2) and to no extent (1). The values were added up to get 10 which were later divided by 4 to get a mean score of 2.5. Variables with mean values of 2.5 and above were regarded as constraints to respondents' effective use of herbicide while those with mean values less than 2.5 were not regarded as constraints to respondents' effective use of herbicide. Mean statistic and standard deviation were used in the analysis of data which were presented in percentage. Hypothesis for the study was analyzed using multinomial logistic regression. Chi-square test was used to test the overall model for goodness of fit-test. The level of significance that was used for the hypothesis was $p \leq 0.05$. Maximum likelihood estimation was used to predict the odd ratio for the dependent variable using log likelihood function = $L = \text{Log}(L^*) = \text{Log}\{(\pi_1(1-\pi i)\} = \text{Log}\pi i + \text{Log}(1-\pi i)$. The Statistical Product and Service Solutions (SPSS) Version 16 software package was used for analysis.

Results/Discussion:

Socioeconomic characteristics of respondents: Table 2 shows that majority (60.8%) of the respondents were male while 39.2% were female. This shows a male dominated work force. The reason for this may be attributed to the fact that males are more likely to handle herbicides (chemicals) than males. Also, males usually do more do tedious work associated with farming than females [18].

Sizeable proportion (46.7%) of the respondents fell between the age bracket of 41 and 50 years, while 22.5%, 22.5%, 5.8% and 2.5% were between 51 – 60 years, 31 – 40 years, 61 and above and less than 30 years respectively. The mean age of the respondents was 47.05 years. The implication of this finding is that the respondents are still in their active and productive age and have the ability to synthesize and utilize information received on herbicide use. This is similar to the finding of [19] that the mean age of farming household in Southern Nigeria is 49 years.

Majority (85.8%) of the respondents were married while 6.7%, 4.2% and 3.3% were widowed, separated and single respectively. References [20] and [21] also revealed in their separate studies that majority of farmers in Nigeria are married. This shows that married people dominate agricultural production in the area. The implication of this is that the farmers could have more persons in the household to cater for and helping hands in the application of herbicide on their farms.

Small proportion (35.8%) of the respondents had completed secondary school education, while 19.2% completed their primary education. Also, 15.8% of the respondents had OND/NCE, while 15.0% attempted secondary school education. Those who had HND/First degree constituted 6.7%, while 5.8% attempted primary school education. On the other hand, 0.8% had higher degrees (Masters and Ph. D) while 0.8% had no formal education. Similar results of low educational qualifications were reported in other developing countries [22]- [25]. Low educational level of respondents may impact negatively on their use of herbicides. This is because education would enable farmers to develop the right knowledge, attitude and practices on herbicide use.

Entries in Table 2 further show that more than half (57.5%) of the respondents had estimated monthly income of N 10,000 - N 40,000 while 33.3% had N 40,001 - N 80,000, 5% had N 80,001 - N120,000, 2.5% had N120,001 - N160,000, 0.8% had N160,001 - N200,000; N200,001 and above respectively. The mean monthly household income was N 47,500.83. This implies that farmers in the area do not earn enough income to cater for their respective households. Also, farmers in the study area may keep farming at subsistence level. High income is very crucial for farmers to purchase herbicides and protective personal equipments in their use of herbicides. Inability to buy protective covering apparel may result to serious health consequences in the use of herbicides.

Also in Table 2 majority (64.2%) of the respondents had farm sizes of less than 3 hectares, while 35% had farm sizes of 3 – 6 hectares. The remaining 0.8% had farm sizes of more than 6 hectares. The average farm size was 2.46 hectares. This shows that the farmers

are small scale farmers and as such generally have small farm size. Small-scale farmers operate at subsistent level, making them vulnerable and less able to own and manage large farms where the use of herbicides is inevitable.

Half (50.00%) of the respondents had a household size of 1-5 persons, while 48.30% of them had 6-10 persons in their households. The remaining 1.70% had household size of 11-15 persons. The average household size was 6 persons. The household size of the respondents may be considered as above average as it is above the national average of about 5 persons in rural Nigeria [26]. This large number of household may be an advantage in the use of family labour for herbicide application but bring about intense competition for limited household resources of low household income and food resources.

Table 2: Distribution of respondents according to socioeconomic characteristics

Socio-economic characteristics	Percentage (n=120)	Mean (б)
Sex		
Male	60.8	
Female	39.2	
Age (years)		
≤30	2.5	47.05
31 – 40	22.5	
41 – 50	46.7	
51 – 60	22.5	
61 and above	5.8	
Marital status		
Married	85.8	
Widowed	6.7	
Separated	4.2	
Single	3.3	
Educational level		
No formal education	0.8	
Primary school attempted	5.8	
Primary school completed	19.2	
Secondary school attempted	15.0	
Secondary school completed	35.8	
OND/NCE	15.8	
HND/First degree	6.7	
Higher degrees (Masters and Ph.D)	0.8	
Estimated monthly income		
₦ 10,000 - ₦ 40,000	57.5	47,500.83
₦ 40,001 - ₦ 80,000	33.3	
₦ 81,001 - ₦ 120,000	5	
₦ 121,001 - ₦ 160,000	2.5	
₦ 160,001 - ₦ 200,000	0.8	
₦ 200,001 and above	0.8	
Farm Size		
Less than 3	64.2	2.46
3 – 6	35	
More than 6	0.8	
Household Size		
1 – 5 Persons	50.0	6 persons
6 – 10 Persons	48.3	
11 – 15 Persons	1.7	

Socioeconomic characteristics influencing farmers' knowledge on herbicide use: In Table 3 results of the multinomial logistic regression analysis on the influence of socio-economic characteristics on knowledge score of farmers on herbicide use reveal variables that had significant influence on knowledge

score namely; sex (X_2 = 64.59; p = 0.00), age (X_2 = 44.61; p = 0.00), household size (X_2 = 41.96; p = 0.00) and monthly income (X_2 = 23.88; p = 0.03). This result connotes that increase in the magnitude of any of these variables will lead to increase in the knowledge of farmers on herbicide use in the study area. Therefore,

The null hypothesis was rejected for these variables. On the contrary, marital status (X_2 = 11.67; p = 0.56), educational level (X_2 = 20.10; p = 0.09) and farm size (X_2 = 20.23; p = 0.09) had no significant influence on knowledge of herbicide use. This implies that these variables do not add to the knowledge of respondents on herbicide use in the study area. In view of these findings, the null hypothesis was accepted for these non-significant variables.

The result of this finding is an indication that sex consideration (male or female) is still an important factor for education of children in rural areas. According to [27] report, the highest percentage of illiterate women farmers was identified in Syria (62.50%) and in Nigeria (60%). Consequently it argued that women's access to agricultural extension (farm knowledge) and their ability to comprehend and use technical information (herbicide use) are lower when women lack the minimum formal education. This is a serious problem when the scenario is compared to the increasing role of women in agriculture. The influence of household size on knowledge of herbicide use may be possible because members of the family knowledgeable in herbicide use may teach other members of the family. Whereas increased income may provide opportunities for more members of the family to be educated on herbicide use.

Findings on age having positive influence on the knowledge score, agrees with findings of [28] who reported that older farmers have higher accumulated capital, more contacts with extension workers, better preferred by credit institutions and larger family size, all of which may make them more prepared to adopt and use technologies such as herbicides than the younger ones. Therefore, age of farmers can influence their decision to use herbicides.

In terms of education level having no significant influence on knowledge score, this is in contrast with [29]; [30] who reported that education affects agricultural productivity by increasing the ability of farmers to produce more output from given resources and by enhancing the capacity of farmers to obtain and analyze information. However, it may be because some aspects of herbicide use like application of herbicides may not require technical information like in the case of calibration of knapsack sprayers. Nevertheless, education is inevitable for knowledge of implication of use of herbicides on health and environment.

Table 3: Socioeconomic characteristics influence on knowledge score of farmers on herbicide use

	Model Fitting Criteria	Likelihood Ratio Tests	
Effect	-2 Log Likelihood of Reduced Model	Chi-Square (X^2)	Sig. (p-value)
Intercept	253.018	49.78	0.00
Sex	2.678E2[a]	64.59	0.00
Age	2.478E2[a]	44.61	0.00
Marital status	2.149E2[a]	11.67	0.56
Educational level	2.233E2[a]	20.10	0.09
Household size	2.452E2[a]	41.96	0.00
Monthly income	2.271E2[a]	23.88	0.03
Farm size	2.235E2[a]	20.23	0.09

Intercept only = 524.492; Final -2 Log Likelihood = 203.234; X^2 = 321.258; $p \leq 0.05$

Constraints faced by farmers in the use of herbicides: Entries in Table 4 indicate the perceived constraints to farmers' use of herbicide. The major constraints include: cost of herbicide (δ = 3.30), inability to calibrate knapsack sprayer (δ = 2.83) and limited access to information on herbicide use (δ = 2.76). Other perceived constraints were: weed identification and control decisions (δ = 2.75); weather (δ = 2.58) and understanding label instructions (δ = 2.53).

Reference [16] in a study on the effect of herbicide on crop production and environment in Makurdi Local Government Area of Benue State found out that 80% of farmers in the study area had problem of high cost

of herbicides. High cost of farm inputs can lead farmers to use illegal means to acquire farm inputs such as smuggling and the eventual use of banned herbicides which may be cheaper to buy but can constitute harm to the farmer and impact negatively on the environment, namely the soil, water, air, and food chain. A sound knowledge on how to calibrate sprayers will help farmers apply actual amount of herbicides required to take care of specific land areas but the reverse will amount to wastage and over concentration of herbicides in lands. The implication of this is that farmers will spend more and in the long run the soil will be damaged as vital soil nutrients and microorganisms will gradually wear out. Limited access to information on herbicide use pose threat to farmers in the use of herbicides.

Weed identification and control decisions are very essential to know if farmers must purchase the right herbicides for use in their farms. Weather as a constraint may not be unconnected with recent trends in climate change. Understanding label instructions could be a constraint in the study area because only 35.8% of respondents completed their secondary education. This may be responsible for difficulties in understanding some technical terms contained in label instructions of certain herbicides.
The result of standard deviation for cost of herbicide (std=0.71) gave the real situation on the ground more than other constraints variables because it is very close to unity. This is a matter of concern for farmers in the use of herbicides since poverty is wide spread in rural areas in Nigeria.

Table 4: Distribution of constraints faced by farmers in the use of herbicides

Constraint	Mean (б)	Std. deviation
Understanding label instructions	2.53*	1.05
Weed identification and control decisions	2.75*	1.18
Inability to Calibrate knapsack sprayer	2.83*	1.02
Mixing herbicide	2.47	1.08
Cost of herbicide	3.30*	0.71
Weather	2.58*	1.11
Soil type/topography	2.27	1.01
Limited access to information on herbicide use	2.76*	0.97

Acknowledgment: The authors wish to acknowledge the technical contribution to this paper by members of academic staff of Department of Agricultural Extension, University of Nigeria, Nsukka, Nigeria.

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Uddin1, I.O., Enwelu, I.A., Igbokwe, E.M.
1,2,3 Department of Agricultural Extension/ Faculty of Agriculture/
University of Nigeria/ Nsukka/ Nigeria
/Corresponding author's / innocent.enwelu@unn.edu.ng