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ASSESSMENT OF THE ADOPTION OF AGROCHEMICALS AMONG YAM FARMERS IN WUKARI LOCAL GOVERNMENT AREA, TARABA STATE, NIGERIA

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ABSTRACT

This study examined the assessment of the adoption of agrochemicals among Yam farmers in Wukari Local Government Area, Taraba State, Nigeria. A structured questionnaire was used to obtain information from a purposefully selected sample of 110 yam farmers from Wukari LGA of Taraba State, Nigeria. Data were analyzed using Descriptive Statistics (frequency, percentage) and inferential statistics (Anova) (F.test). The study found that, according to the socio-economic characteristics of yam farmers in the study area, a greater percentage (83% of them) fell between age ranges of less than 50 years. Male-dominated yam farming in the study area had 63%; 51% were married. 98% had one form of education or another. A greater percentage, 83%, was found to have more than 5 years of farming experience. The result indicates that the majority of the respondents depend on friends and co-farmers as their sources of information. Findings revealed that the majority were aware of the common agrochemicals used in the study area. In determining the Level of adoption of agrochemicals by yam farmers in the study area, the ANOVA model gave the best fit to the data. The result indicates that 5.433 of the F-value is positive and is significant at the 1% level of significance. It can be concluded that the maximum number of farmers in the study area were aware of agrochemicals, and there is also no significant difference in the level of adoption of agrochemicals between and within the various wards. In line with the findings of the study, the following recommendations are put forward: Since the cost of agrochemicals is high during the planting season, I recommend that farmers purchase agrochemicals before the planting season. It's also recommended that farmers in the study area should pay for extension services so they can be taught on the need to adopt agrochemicals. Furthermore, cooperative societies should help make agrochemicals available at a subsidy rate for their members.

Keywords: Wukari, Adoption, Agrochmicals, Yam Farmer, Food.

1. INTRODUCTION

Studies have shown that adopting new technologies can considerably increase the availability of food in developing countries like Nigeria, particularly when it comes to agricultural productivity (Olatade et al., 2016). The agricultural industry in Nigeria is the primary supplier of food, raw materials, and foreign exchange, and 70% of the population is heavily dependent on it to survive. Agrochemicals are technology that has become an increasingly significant component of Nigeria's agriculture sector in recent time. In an effort to increase agricultural output and in response to an increase in pests that destroy and degrade agricultural products in fields and storage, farmers have begun to utilize agrochemicals as a significant control approach.

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Agrochemicals are chemicals (fertilizers and insecticides) used to boost agricultural production, according to Sekhotha *et al.* (2016). They are used to manage diseases brought on by bacteria, fungi, pests, and viruses (Aper, 2018). They are also used as fertilizers, acidifiers, and soil conditioners. And until recently, agrochemicals and insecticides in particular were only used by the cocoa, cotton, vegetable, and fruit industries. But as of today, agrochemicals like insecticides and fertilizers are often used in crop cultivation especially in Nigeria. The adoption of agrochemicals has led to increase in food production (Popp *et al.*, 2018; Alexandratos and Bruinsma, 2012). Farmers appreciated the reduction in labor and yield that chemicals have brought to crop production. Although their over usage has had a negative impact on the health of plants and animals, it has also considerably raised the concentration of harmful compounds in food and the environment (Tago *et al.*, 2014). Oruonye and Okrikata discovered that Nigeria's efforts to improve food security and combat insect pests and crop infections that reduce yields have unintended consequences such as mass importation and the accumulation of toxic and outdated pesticides, which have detrimental effects on the ecosystem (Oruonye and Okrikata, 2018). More than three million farmers in underdeveloped nations are reportedly poisoned by agrochemicals each year, according to the World Health Organization (WHO) (WHO, 2000).

However, low adoption of agrochemicals has been attributed to a number of reasons. One reason why adoption has remained low is the cost of adopting the recommendations. Because the rural farmers are poor, they are not always able to purchase improved technological packages from research and extension workers. In this regard, Titilola cited in Agbarevo (2012) observed that low adoption should not always be attributed to unwillingness of farmers to adopt innovations but rather high cost of innovations. Moreover, the resource-poor farmers are unwilling to risk their small capital when the benefits expected from adoption have not been well demonstrated. Although, low adoption of agrochemicals can significantly affects tuber yield of crops like yam (Udealor and Asiegbu, 2006).

Yam (Dioscorea spp.) is primarily grown as a staple food in West African, Latin American, and Caribbean countries like Brazil, Cuba, and Jamaica (FAO, 2013). In Nigeria yam (*Dioscorea spp*) is a major crop produce in the savannah region of West Africa and grown in tropical regions where rainfall are divided into wet and dry season (FAO,1997). Yam is a monocot plant that is cultivated every year. There are numerous yam species, out of which six are economically important staple species. These species are Dioscorea alata (water yam), Dioscorea rotundata (white yam), Dioscorea bulbifera (aerial yam), Dioscorea esculentus (Chinese yam), Dioscorea dumetorum (trifoliate yam), and Dioscorea cayenenses (yellow quinea yam). Out of the species of yam, white yam is the most common species in Nigeria (Okeoghene *et al.*, 2013)

The crop significantly contributes to the diet as the third-largest source of carbohydrates after rice and maize. Additionally, because of its importance in social rites of passage, gratitude, etc., yam is prioritized over other food crops in the region. Yam is a plant that is farmed for its delightful underground roots and is propagated vegetatively for millions of farmers, processors, and consumers in West Africa. It is a significant source of food and income. Farmers are motivated to plant yams by three main factors: providing the family with food, income generation through marketing yam; and production of planting material (seed yam) to meet their own needs with some income from the sale of the surplus.

The tuber is the most important part of the yam plant, which is a good source of energy derived mainly from its carbohydrate content since it is low in fat and protein (Coursey, 1969). Yam

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could be eaten boiled or fried in oil. Yam tuber contains some pharmacologically active substances, such as dioscorine, saponin, and sapogenin. Yam is also a source of starch for industrial purposes. But with the ever-increasing demands for yam and the expanding population in Nigeria, the use of agrochemicals has dramatically increased. The misuse or overuse of agrochemicals by farmers is prevailing due to insufficient knowledge about the risks, which leads to high occupational exposure risks.

Even though, many scholars have conducted extensive research on the adoption of agrochemical crop farming in Nigeria. For instance, Adejumo *et al*. (2014) conducted a study on factors influencing choice of pesticides used by grain farmers in Southwest Nigeria. The results showed that education, farming experience and price of grains were positive and significant factors that influenced the choice of pesticides used by the farmers while age of household head exerted negative influence. Further-more, Obayelu *et al*. (2016) reported that age of farmer also had a negative influence on adoption of pesticide technology among smallholder farmers in Nigeria while the effects of farm income and farm size were positive as they significantly increase the probability of pesticide use. Khan *et al*. (2015) found that training, education level, and toxicity class of the pesticide were significantly associated with the probability of pesticide overuse by farmers. Little attention has been paid to how these adoptions affect yam production in the study region. In order to assess the impact of these adoptions on yam output in Wukari Local Government Area of Taraba State, Nigeria, The specific objectives of the study were to: describe the socio-economic characteristics of yam farmers in the study area; identify the source of information on agrochemicals in the study area; identify the common agrochemicals used in the study area; ascertain the levels of adoption of agrochemicals by yam farmers; identify major factors affecting adoption of agrochemicals in the study area;

2.MATERIALS AND METHODS

Study Area: The study was carried out in Wukari Local Government Area, Taraba State. With its headquarters in Wukari. It has ten (10) wards, which are Avyi, Tsokundi, Rafin-Kada, Chonku, Kente, Jibu, Akwana, Puje, Bantaje, and Hospital Ward, respectively. Wukari Local Government Area is divided into fifteen (15) traditional administrative districts, namely: Wukari, Avyi, Tsokundi, Rafin-Kada, Chonku, Kente, Jibu, Akwana, Gidan-Idi, Puje, Arufu, Chinkai, Wnokyo, and Gidin-Dorowa. The town is the base of the Wukari Federation, a traditional state. The Local Government has a total land area of 4,308 km^2. The topography of the area consists of valleys and low land slop, and because of the undulating nature of the land, the soil of the area varies from clay soil to sandy loam and heavy loam soil. The vegetation of the area is wooden guinea vegetation (Taraba State Diary, 2001). The local government area has a population of 314,546 inhabitants (National Population Census, 2006). Wukari local government is a tropical climate region with two seasons: the rainy season, which lasts from April to October, and the dry season, which starts in November and ends in March. The temperature in the area usually fluctuates between 230 °C and 310 °C.

Yam production is very popular in Taraba State, as it is mostly produced by the Jukun and Tiv ethnic groups in Wukari, Ibi, Takum, Donga, Gassol, Bali, and the Mumuye people of Zing and Yorro local government areas. The major yam markets in the state are found in "Wukari, Zing, Mutum-biyu, and Mai-hula," where buying and selling of yam tubers and planting materials take place. In Wukari local government area, more than three-quarters of the population are yam

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farmers, while the rest are civil servants and petty traders. The agricultural yam production of Wukari local government area is of commercial significance. Other important agricultural products include cassava, maize, groundnuts, guinea corn millet, etc. The white guinea yam (Dioscorea rotundata) is extensively cultivated in Wukari and is traditionally a staple food.

Sampling Technique: A purposeful sampling procedure was adopted for the study; five (5) wards notable for yam farming were selected out of the ten (10) wards in the study area. These include Avyi, Hospital, Puje, Tsokundi, and Chonku Ward. From each of the wards, 22 samples were collected, thus amounting to a total sampling population of one hundred and ten (110) respondents.

Data Collection: Data for this study were collected from primary sources. Primary data was collected using a well-structured questionnaire and interview techniques. The questionnaire used consists of five (5) sections: A, B, C, D, and E. Section A dealt with the socio-economic characteristics of the respondents. Section B focused on the sources of information on agrochemicals in the study area. Section C centered on common agrochemicals used in the study area. Section D covered the levels of adoption of agrochemicals by yam farmers. And Section E was based on major factors affecting the adoption of agrochemicals in the study area.

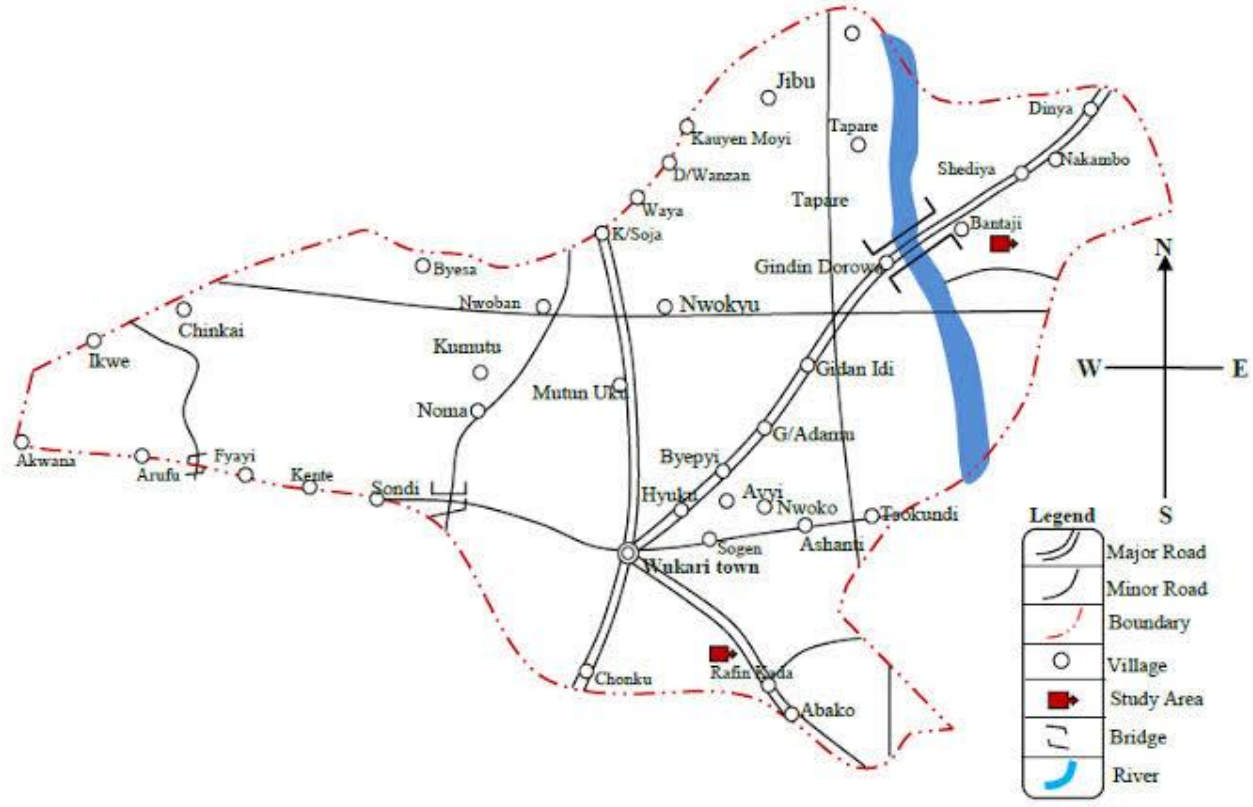

Figure 2. Map of Wukari Local Government showing the study area.

Source: Ministry of Land and Survey Wukari 2022

Data analysis Techniques: The Data analyses employed for the research are both descriptive and inferential statistics. Descriptive statistics (frequency, percentage, mean, and standard

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deviation) were used to analyze data that describe the socio-economic characteristics of yam farmers in the study area; identify the source of information on agrochemicals in the study area; identify the common agrochemicals used in the study area; and identify major factors affecting the adoption of agrochemicals in the study area. While an inferential statistic (Analysis of Variance (ANOVA) (F-test)) was used to ascertain the levels of adoption of agrochemicals by yam farmers,

Model Specification: Analysis of Variance (ANOVA) is used to analyze the difference in the means of different groups (for three or more groups). For F.test

$$F = \frac{MS_{between}}{MS_{within}} \quad 1$$

Where MS is mean square, SS, SS is Sum of square and DF is Degree of freedom

$$MS_{between} = \frac{SS_{between}}{DF_{between}} \quad 2$$

$$SS_{between} = \sum_{j=1}^{k} \left(\bar{X}_j - \bar{X}\right)^2 \quad 3$$

$$DF_{between} = n - k \quad 4$$

where k is the number of groups, and where n is to total of all the data sets combined

$$MS_{within} = \frac{SS_{within}}{DF_{within}} \quad 5$$

$$SS_{within} = \sum_{j=1}^{k} \sum_{j=1}^{l} \left(X - \bar{X}_j\right)^2 \quad 6$$

$$DF_{between} = k - 1 \quad 7$$

3.RESULTS AND DISCUSSION

3.1 Socio-Economic Characteristics of the Respondents

Based on the data gathered, some socio-economic characteristics of the respondents were ascertained. These include sex, age, gender, level of education, marital status, household size, and farming years' experience, other activity are, access to credit, how you acquire land, and whether you are a member of a cooperative society.

The frequency distribution of respondents according to sex, as shown in Table 1, shows that both men and women were actively involved in yam farming, but the percentage of men was higher. Males accounted for 63%, while females were 37%. This result corroborates the work of Yahaya

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(2001), where he reported that sourcing of agricultural extension services and adoption are along gender lines and that women are less likely to participate due to limited time to adopt available technology as a result of household responsibilities. Age describes the period of time a person or thing has been alive or has existed. Table 1 also reveals that 83% of the respondents are within the age range below 50 years, while 17% fall within the age range above 50 years. This implies that the majorities of the respondents are still within their active and productive ages and can adopt agrochemicals.

The married status is a status that exhibits a legal relationship between people, either as a husband or wife. As shown in Table 1 below, 51% of the respondents were married, and 49% were not married. This conforms to the findings of Adisa *et al.* (2018), who found that the majority (97.0%) of the respondents are married. Educational level has been seen as a factor influencing the personality of an individual. The findings revealed that the majority of yam farmers in the area of study are literate; 98% have one form of education or another, ranging from primary to tertiary institutions. Only 2% claimed not to have any form of education. This result corroborates with Ekong (2003) that affirmed that there is a positive association between literacy and adoption of technologies.

Table 1 showed that most (87%) of the respondents had less than 15 members in their households, while only 13% of the respondents had more than 15 members in their households. This indicated that most of the farmers have fewer members in their households, which could be the reason why hired labor has been patronized in the study area due to the fact that the respondents are engaged in manual labor. Results on the farming experience revealed that the majority of the yam farmers had farming experience of more than 5 years (83%), while 17% had farming experience of less than 5 years.

As seen in Table 1, farmers in the study area do engage in other activities such as craftwork (20.9%), Trading (48.2%), Civil service (14.5%), and others (16.4%). Table 1 also indicated farmland ownership in the study area, which was classified into purchased, rented, leasehold, gift, and inherited. The result shows that the majority of the respondents in the study area acquired their land through inheritance (51.8%), while only 25.5% of the respondents acquired it through rent, 7.3% through purchase, 3.6% through leasehold, and 11.8% through gift. About 57% of the respondents don't have access to credit, while 43% have access to credit. And 62% are members of cooperative societies, while 38% are not.

Table 1: Socio-Economic Characteristic of the Respondents

Variable	Frequency	Percentage	Rank
Sex			
Male	69	62.70	1
Female	41	37.30	2
Age (years)			
20-30	44	40.00	1
31-40	29	26.40	2
41-50	18	16.40	4
51 and above	19	17.20	3
Educational level			
Primary	71	64.50	1

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Secondary	28	25.50	2
Tertiary	4	3.60	4
Non-formal	5	4.50	3
Others	2	1.80	5
Marital status			
Single	48	43.60	2
Married	56	50.90	1
Widow/Widower	5	4.50	3
Others	1	0.90	4
House hold size			
0-5	41	37.30	1
6-10	39	35.50	2
11-15	16	14.50	3
16 and above	14	12.70	4
Farming years' experience			
0-5	19	17.30	4
6-10	35	31.80	2
11-15	20	18.20	3
16 and above	36	32.70	1
Other activity			
Craftwork	23	20.90	2
Trading	53	48.20	1
Civil servants	16	14.50	4
Others	18	16.40	3
How do you acquire land			
Purchase	8	7.30	4
Rent	28	25.50	2
Leasehold	4	3.6	5
Gift	13	11.80	3
Inheritance	57	51.80	1
Access to credit			
Yes	47	42.70	2
No	63	57.30	1
Member of cooperative society			
Yes	68	61.80	1
No	42	38.20	2

Source: Field Survey, 2022

3.2 Sources of Information on Agrochemicals

Most of the respondents use more than one source of information on agricultural production. Table 2 revealed that the majority of the respondents depend on 1-6 for information on yam production, while a minority depends on 7–12. This result is so because the sources of information used by the majority of the farmers are informal while the others are formal. This

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study confirms Rashid *et al.*, (2003), and Alam *et al., (2006)*, where informal sources were more useful as sources of information about farming.

Table 2: Frequency Distribution on Sources of information
Source: Field Survey, 2022

Variables	Frequency		Percentage		Rank
	Yes	No	Yes	No	
ADPs	31	79	28.20	71.8	12
Radio	91	19	80.9	19.1	3
Television	89	21	37.3	62.7	10
Research institutes	39	71	35.5	64.5	11
Friends/co-farmers	108	2	98.2	1.8	1
Opinion leaders	42	68	60.0	40.0	6
Village heads	73	37	82.7	17.3	2
Extension Agent	66	44	54.5	45.5	7
Internet	60	50	38.2	61.8	9
Newspaper	53	57	48.2	51.8	8
Town Announcer	41	69	66.4	33.6	5
Farmers' Association	81	29	73.6	26.4	4

3.3 Identification of Common Agrochemicals Used in Yam Production.

Most of the respondents can identify multiples of the common Agrochemicals used in yam production in the study area. Table 3 revealed that the majority (99.1%) of the respondents are aware of fertilizer, followed by 97.3% who are aware of Herbicides, pesticides (93.6%), insecticides (89.1%, rodenticides (79.1%, Fungicides 33.6% and nematodes (28.2%. As observed from the findings, the majority were aware of these agrochemicals (1, 2, 3, 4, and 5) because 1 has to do with the growth of yam, 2 is related to weed control, 3 and 4 have to take care of pests and insects, and 5 solves the issue of rodents. But most of the farmers were not very aware of 6 and 7 because they have to do with microorganisms, which the farmers in the study area lack knowledge of.

Table 3: Frequency Distribution of Common Agrochemicals

Variables	Frequency		Percentage		Rank
	Yes	No	Yes	No	
Fertilizer	109	1	99.1	0.9	1
Herbicides	107	3	97.3	2.7	2
Pesticides	103	7	93.6	6.4	3
Insecticides	98	12	89.1	10.9	4
Rodenticide	87	23	79.1	20.9	5
Fungicide	37	73	33.6	66.4	6

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Nematicide	31	79	28.2	71.8	7

Source: Field Survey, 2022

3.4 Level of Adoption of Agrochemicals by Yam Farmers.

Table 4 showed the level of adoption of agrochemicals by yam farmers in the study area, and findings revealed that the F-value is positive and is significant at the 1% level of significance, which shows that the model used is the best fit for the analysis. The result also shows that there is no significant difference in the level of adoption both within and between the groups, which implies that most yam farmers in the study area adopt agrochemicals.

Table 4: Level of adoption of agrochemicals by yam farmers

Test	Sum of square	df	mean square	F
Between groups	**320.813**	**4**	**80.203**	**5.433*** **
Within groups	**1550.059**	**105**	**14.762**	
Total	**1870.873**	**109**		

Source: Field Survey, 2022

3.5 Factors Affecting the Adoption of Agrochemicals in the Study Area

Results in Table 5 showed the various factors affecting the adoption of agrochemicals by yam farmers in the study area. Most yam farmers agree with these factors, while others disagree. They include: high cost of agrochemicals (98% agree while 2% disagree); Lack of awareness (91% agree while 9% disagree); Lack of agrochemicals (66% agree while 34% disagree); Inadequate extension agents or visits (94% agree while 6% disagree); Residual effects of agrochemicals: 80% agree while 20% disagree; disease: 73% agree while 27% disagree; Climate change: 78% agree, while 22% disagree; Inconsistency in Government policy: 81% agree while 19% disagree; Land tenure problem: 47% agree while 53% disagree; Socio-economic characteristics of farmers: 75% agree, while 25% disagree. This study corroborates Samiee *et al*., (2009) study in Iran, where extension contact was found to be correlated with adoption, while awareness of IPM technology had a positive and significant influence on farmers' eventual use of the technology. Further, Obayelu *et al*. (2016) reported that the age of the farmer also had a negative influence on the adoption of pesticide technology among smallholder farmers in Nigeria, while the effects of farm income and farm size were positive as they significantly increased the probability of pesticide use.

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Table 5: Factors Affecting the Adoption of Agrochemicals

Variable	Frequency	Percentage
High cost of agrochemical		
Strongly disagree	1	0.9
Disagree	1	0.9
Agree	28	25.5
Strongly Agree	80	72.7
Lack of awareness		
Strongly disagree	2	1.8
Disagree	8	7.3
Agree	49	44.5
Strongly Agree	51	46.4
Inadequate fund		
Strongly disagree	9	8.2
Disagree	28	25.5
Agree	45	40.9
Strongly Agree	28	25.5
Inadequate extension agent/visit		
Strongly disagree	5	4.5
Disagree	2	1.8
Agree	46	41.8
Strongly Agree	57	51.8
Residual effects of agrochemicals		
Strongly disagree	3	2.7
Disagree	19	17.3
Agree	56	50.9
Strongly Agree	32	29.1
Disease		
Strongly disagree	9	8.2
Disagree	21	19.1
Agree	50	45.5
Strongly Agree	30	27.3
Climate change		
Strongly disagree	8	7.3
Disagree	16	14.5
Agree	47	42.7
Strongly Agree	39	35.5
Inconsistency in Govt policy		
Strongly disagree	6	5.5
Disagree	15	13.6
Agree	52	47.3
Strongly Agree	37	33.6

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Land tenure problem		
Strongly disagree	17	15.5
Disagree	41	37.3
Agree	23	20.9
Strongly Agree	29	26.4
Socio-economic characteristics of farmers		
Strongly disagree	2	1.8
Disagree	25	22.7
Agree	46	41.8
Strongly Agree	37	33.6

Source: Field Survey, 2022

4.CONCLUSION AND RECCOMMENDATIONS

4.1 Conclusion

Based on the findings from the study, it can be concluded that the maximum number of farmers in the study area were aware of agrochemicals, and their major source of information depends on friends and co-farmers. The model used is the best fit for the analysis, as the outcome of the results is positive and significant at the 1% level of significance. So also, there is no significant difference in the level of adoption of agrochemicals between and within the various wards, while the major factors that have affected adoption of agrochemicals in the study area are the high cost of agrochemicals, inadequate funds, inadequate extension agents, and inadequate visits, among others.

4.2 Recommendations

In line with the findings of the study, the following recommendations are put forward:

1. Since the cost of agrochemicals is high during the planting season, I recommend that farmers purchase agrochemicals before the planting season.
2. It's also recommended that farmers in the study area pay for extension services so they can be taught about the need to adopt agrochemicals.
3. Furthermore, cooperative societies should help make agrochemicals available at a subsidy rate for their members.

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