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Original Article

Farmers' perceptions on arthropod pests of cabbage and their management practices in selected local government areas of Plateau state Nigeria

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ABSTRACT

Arthropod pests remain the major Agricultural productivity constraint around the World. This can be enhanced through pest management researches that consider farmers' knowledge gaps and indigenous control practices. This study is aimed to determine the Cabbage farmers' knowledge and perceptions on arthropod pests and the adapted control strategies within the three selected Local Government Areas (LGA) of Plateau state. A structured questionnaire was administered to 90 randomly selected farmers across 6 Villages from selected LGAs of Plateau state, Nigeria under the guide and help of communication officers in 2019. The responses elicited include farming practices, production profiles, perception and attitudes of farmers toward pests, pest damage, and pest control practices. The data collected were analyzed using descriptive and inferential (Fisher's exact test) statistics using SPSS 23.0. The results indicated that most farmers ($\ddot{x}$ = 84.44%) in all the study areas were men and more than 63% on the average were not educated beyond Primary school in all the study areas, with only view Secondary School (24.44%), and very view that went beyond Secondary School (12.56%). It was also observed that a larger proportion of the respondent had no contact with extension service providers or with extension publications on pest control. This influences farmers' perception on insect pests of cabbage and their control. An average of 96.69% in the study area believed that the fastest and only way to solve cabbage pest problem is the use of synthetic pesticides. Spray frequencies were as outrageous as 25 times or more within a growing season. Therefore, indiscriminate use, handling and disposal of pesticides containers characterized farmer's attitude in all the locations. There is therefore, serious need for field education of farmers on judicious use of pesticides to protect agro-ecosystem, the environment, and non-target animals' including human being.

Keywords: Arthropod pests, cabbage, farmers' perception, pesticides, questionnaires

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INTRODUCTION

Cabbage, *Brassica oleracea* (L), cole crop, is believed to be a native of Western Europe. Among the cole crops known, Cabbage is the most widely and intensively grown in many parts of the temperate and tropical regions of the world.[1] In Nigeria, cabbage ranks among the most important exotic vegetable group widely consumed in Nigeria and commonly grown on the Plateau because of the near temperate climate.[2] Other exotic vegetables cultivated on the Plateau include: Lettuce, Cucumber, Carrot, Beetroot, etc. Cabbage does well in some local government areas (LGAs) of Plateau state, these includes; Jos North, Jos South, and Riyom LGAs, respectively. The crop is predominantly cultivated in these areas because of their high altitudes which results in the areas having cool climates.[2] Cabbage is commercially cultivated for its large, leafy head that is low in saturated fat, cholesterol, high in dietary fiber, and rich in vitamins and minerals. It also contains lactic acid which helps in digestion and one cup of raw cabbage contains 93% water.[3,4] Vegetable plays an important role in human nutrition it can be eaten raw or cooked and it play an important role in human nutrition, being mostly low in fat and carbohydrate but high in vitamins, mineral, and dietary fiber. Many nutritionists encourage people to consume plenty of vegetables in their diet.[5] When vegetables are included in the diet, there is tendency of reduction in the incidence of cancer,

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stroke, cardiovascular disease, and other chronic ailments.[6-8] Research has shown that compared with individuals who eat <3 servings of vegetables each day, those that eat more than five servings of vegetables have an approximately (20%) lower risk of developing coronary heart disease or stroke by keeping a balance between the fluids of the body.[9]

With increasing knowledge of their food value, the level of vegetable consumption in Nigeria is rising annually.[10] However, Agricultural pests cause great losses by reducing either the quantitative or qualitative efficiency of a production system,[11] (i.e. they reduce productivity and economic value of the product through direct feeding, contamination or by introducing pathogens or toxic metabolites into their hosts). Among these pests, insects are regarded as the most successful arthropods because of their high rates of reproduction and characteristic adaptability to diverse ecological situations. Those species which infest plants have gone through a long period of co-evolution with their hosts by adopting a variety of associations with them. Since cabbage is not a common vegetable that can be cultivated in any part of the country, the demand then outweighs the supply causing scarcity of the commodity.[2]

Therefore, capacity to mitigate damage depends on famer's perception on pest damage impact, availability and accessibility to the recommended and adoptable pest management tactics wide gaps in Nigerian. Cabbage famers' knowledge on bio-ecology and status of pest as well as famers inclination toward indigenous pest management tactics limit production efficiency and profitability.[12] Productive capacity and efficiency can be enhanced through pest management research that takes cognizance of farmer's needs, values, knowledge gaps, indigenous control practices, and skill in resource utilization.[13-16]

The understanding of famer's indigenous knowledge and perceptions on pest challenges and their coping strategies is important in designing researches that will meet the need of the farmers on pest management,[17,18] such information is scarce with regard to cabbage production in Nigeria. This survey is therefore designed to determine the perceptions of cabbage farmers regarding arthropod pest and their control strategies at selected sites in 3 LGAs of Plateau state, Nigeria.

MATERIALS AND METHODS

The survey studies were carried out between August and November, 2019. Six villages with their coordinate [Table 1] were purposively selected from three LGAs of Plateau state [Figure 1] based on farmers growing capacity (both rainy and dry season). Simple random technique was used to select a total of 90 cabbage farmers from these six villages (30 farmers from each of the LGAs). Only farmers that are involved in cabbage production (solely or mixed) were selected for the study. The objective of the activity was briefly explained to the respondent high-lightening the need, importance and the possible outcome. The field survey included collection of information through farmers' interview.

On the basis of questionnaires, farmers were interviewed and details information concerning cabbage crop and its pests were obtained. Personal interaction with each respondent was also supplemented by field visitations to authenticate information given. This was also complimented with field observation to validate information on pest identity and the damage they caused. Options for the respondents to which best reflects their views on cabbage production were provided. Before conducting an interview, the peer-reviewed questionnaires were clearly explained to respondents for them to freely participate in the study without being coerced. Pilot-test was also conducted on nine farmers (not included in the samples), 2 weeks before the commencement of the study after which a few changes were made in the expression of some of the questions. The information gathered through the questionnaire covers famers' demographics, farm practice, production profiles, perception, and attitudes of farmers toward pest, pest damage, and pest management practices.

Statistical Analysis

Primary data collected from farmers, were analyzed using descriptive statistics and Likert scale measurement on a 5 point fixed at 1 (strongly disagreed) and 5 (strongly agree). Fishers' exact test (FET) was used to compare the variables constituting farmers' characteristic among surveyed LGAs to determine association between farmers' characteristics and insecticide spraying frequencies. The probability value (*P*-value) was estimated using two sided test at 5% level of significance.

Table 1: List of villages with their coordinates and their respective LGAs selected for the study

Local Government	Village	Latitude	Longitude
Jos North I	Naraguta1	9.97083	8.88250
Jos North I	Naraguta2	9.97000	8.88000
Jos North I	Naraguta3	9.97139	8.88056
Jos North II	Kunga1	9.95972	8.89694
Jos North II	Kunga2	9.96389	8.89639
Jos South I	Zawan1	9.76417	8.89639
Jos South I	Zawan2	9.77528	8.87028
Jos South I	Zawan3	9.76556	8.87528
Jos South II	Kuru1	9.75167	8.81278
Jos South II	Kuru2	9.75194	8.81389
Riyom I	Riyom	9.56389	8.69944
Riyom II	Makira	9.62250	8.73806

LGA: Local government areas

RESULTS AND DISCUSSION

Socio-economic Characteristics of Cabbage Farmers in the Study Area

Table 2 shows that cabbage farmers in the three LGA of Plateau state were not significantly different ($P < 0.05$) with respect to gender, age range, educational levels, farming experience, and farm size/scale of production. However, male form the majority of cabbage farmers in the three LGAs. This affirm the findings of Banjo *et al*.,[19] and Yusuf *et al*.,[20] who claimed that more men are in to vegetable production. Furthermore, the larger percentage of men as the major producer of vegetable as recorded in this study is in line with the work of Opobile *et al*.,[21] that reported that most Botswana farmers are men and therefore concluded that agriculture is not considered as an activity of women but men. This observation could be attributed to easier access men have to land and economic empowerment.[22,23] Going by Okonnya *et al*.[24] women should, therefore, be encouraged and empowered to go into vegetable production.

The age bracket between 31 and 50 years had the highest mean frequency of respondents with age bracket 31–40 years (24.44%) and age bracket 41–50 years (37.78%), followed by the elderly once (22.22%) [Table 2]. This is similar to the findings of Oladoja *et al*.[25] and Olaniran *et al*.,[18] that in the high labor intensive peasant farming people that are active are in the age bracket 30–50 years. This could probably be attributed to the fact that age is an essential factor that usually influences farm and farmers productivity in small scale farming.[26]

Most of the farmers (63%) were not educated beyond primary school with only view Junior Secondary School dropout. This confirm the findings of Banjo *et al*.,[19] that most vegetable farmers in Southwestern Nigeria had no formal education, which is the key to productivity enhancement. This had implication for farmers' efficiency in production, decision-making, openness to new innovations, and new technologies.[27,28] Farming experience varies between ≤1 year and ≤10 years across the three LGA with majority falls with-in 2–10 year. Furthermore, none of the respondent in the three LGA was into large scale cabbage production, most of them (56.67%) cultivate land areas within 2–4 has with an average of 2.22% respondent cultivating ≥5 has [Table 2]. Havorka[29] reported that urban agriculture is an important source of food

Table 2: Socio-economic characteristics of sample cabbage farmers

Variable	Jos North LG	Jos South LGA	Riyom LGA	Mean (%)	*P*-value[2]
Gender					
Male	29 (96.67)[1]	22 (73.33)[1]	25 (83.33) [1]	84.44	0.56[ns]
Female	1 (3.33)	8 (26.67)	5 (16.67)	15.56	
Age range (year)					
20–30	7 (23.33)	7 (23.33)	0 (0.00)	15.55	0.35[ns]
31–40	7 (23.33)	9 (30.00)	6 (20.00)	24.44	
41–50	12 (40.00)	7 (23.33)	15 (50.00)	37.78	
≥51	4 (13.33)	7 (23.33)	9 (30.00)	22.22	
Education Level					
non-formal	10 (33.33)	10 (33.33)	7 (23.33)	30.00	0.24[ns]
Primary school	9 (30.00)	9 (30.00)	12 (40.00)	33.33	
Secondary	7 (23.33)	6 (20.00)	9 (30.00)	24.44	
Post-secondary	4 (14.33)	5 (16.67)	2 (6.67)	12.56	
Farming exp (years)					
≤1	3[a] (10.00)	4[a] (14.33)	0[a] (0.00)	8.11	0.28[ns]
2–5	9[a] (30.00)	10[a] (33.33)	3[a] (10.00)	23.33	
6–10	2[a] (6.67)	9[a] (30.00)	4[a] (14.33)	17.00	
≥11	16[a b] (53.33)	7[a] (23.33)	23[b] (76.67)	51.11	
Farm size (ha)/scale of production					
≤1/small	12 (40.00)	12 (40.00)	13 (43.33)	41.11	0.32[ns]
2–4/medium	18 (60.00)	16 (53.33)	17 (56.67)	56.67	
≥5/large	0 (0.00)	2 (6.67)	0 (0.00)	02.22	

Percentage of respondent = ()[1], Fisher's exact test *P*-value: * = significant. ($P \leq 0.005$), ns = not significant ($P > 0.05$), LGA: Local government areas

and jobs in many countries. This was not the case in this study as most vegetable farmers were living in the peripheries of the city. Most vegetables are produced in rural areas and the peripheries of the cities where people are not buoyant and less educated farmers are found [Table 2]. This could probably be the reason for the small scale production and low level of farmers' knowledge of vegetable pests and diseases management methods.

Table 3 showed that across the three LGAs most respondents (78.89%) obtained their seeds from uncertified agro chemical stores while only 18.89% got theirs from Plateau Agricultural Development Programme (PADP). For varietal selection, higher premium was placed on crop yield (86.67%) and seeds availability (83.34%) than on pest infestation and damage. This founding is similar to the report of Okrikata and Ogunwolu[30] in a study on water-melon producer in three states in Nigeria. Not with-standing, in the selected areas, Gloria F1 was predominantly grown (74.45%) during the dry season while Oxylus is predominantly grown (72.22%) during rainy season. For Purple red, only very few respondents engaged in its production during both season.

Farmers' Perception on Pest of Cabbage Crop

Arthropod (62.22%) and pathogen (33.33%) were designated by the respondents, the most problematic pest of cabbage both raining and dry season. (Although, farmers' in the selected areas engaged more of dry season (62.22%) irrigation farming). They were frequently encountered on the crop and caused economic damage both qualitative (98.89%) and quantitative (40.00%) as well as increasing cost of production (11.44%) as a result of preventive/control measure used to mitigate damage [Table 4].

Cabbage-looper (68.89%) appears to have the highest population abundance in all the selected areas; followed by Diamond Black Moth (DBM) larvae (56.67%) and Beetle (44.44%) respectively. It was also discovered that cabbage-looper (68.89%) was the most damaging arthropod that caused significant damage to cabbage plants; followed by DBM larvae (44.44%) and cabbage aphids (20.00%) respectively [Table 4]. This is line with the work of Anene and Dike,[31] that cabbage-looper, DBM larvae, and cabbage aphids are major pest of cabbage in northern Nigeria.

Source of Information on Pest Control by Farmers in the Selected Area

Table 5 showed that majority of the respondents got their information about pests of cabbage from other farmers (85.44%) or from pesticide agents (75.56%) while only 32.22% of the respondents were informed certified agricultural extension agents. An insignificant proportion of the respondents (4.44%) took either no control or use cultural control practices to mitigate the effects of pest damage [Table 6].

Application of synthetic during Foliage (vegetative) and head stages was prevalent method of control ($\ddot{x}$ = 96.67%), with an average of 30% wood ash method, applied majorly during the nursery stage. The commonly used pesticide was DD-force, Perfect killer, Sharp-shouter, Para-force, Vippro-force, Sniper, Festox, and Emmy-force. It was also gathered that, when the resultant effect of a pesticide is not effective, farmers resulted in combining two or three of the listed pesticides.

Spray frequency traverse 1–25 per growing period in all the study areas. Information gathered on the pesticide spraying frequency [Figure 2] showed that majority of the respondent spray their farms within 21 and 25 times or more per growing period ($\ddot{x}$ = 61.11%). This is confirm the work of Denkyirah *et al*.,[32] on Ghanaian cocoa farmer's decision on the use of pesticides and frequency of application that significant association was detected as a result of education level. This can

Table 3: Farmers varietal selection in different LGA

Seed Source	Jos North		Jos South		Riyom		Mean (%)
Agro-chemical stores	22 (73.33)[1]		24 (80.0)[1]		15 (83.33)[1]		78.89
PADP	6 (20.00)		6 (20.0)		5 (16.67)		18.89
Variety planted	Dry	Rain	Dry	Rain	Dry	Rain	
Gloria Fl	*20 (66.67)	14 (46.67)	23 (76.67)	16 (53.33)	24 (80.0)	15 (50.00)	62.22
Oxylus	16 (53.33)	22 (73.33)	10 (33.33)	23 (76.67)	14 (46.62)	20 (66.67)	58.33
Purple	3 (10.00)	4 (13.33)	2 (6.67)	4 (13.33)	1 (3.33)	3 (10.00)	9.44
Reason for selection							
High yield	*25 (83.33)		29 (96.67)		24 (80)		86.67
Market value	6 (20.0)		5 (16.67)		5 (16.67)		17.78
Availability	20 (66.67)		29 (96.67)		26 (86.67)		83.34
Pest resistant.	14 (46.67)		14 (46.67)		3 (10.0)		34.45
Adaptation to environment	03 (10.0)		01 (3.33)		0 (0.00)		4.44

[1]Percentage of respondents,*Multiple responses allowed, LGA: Local government areas

Table 4: Farmers' perception on Pest of cabbage crop

Variable	Jos North	Jos South	Riyom	Mean (%)
Most problematic pest*				
Arthropods	29 (96.67)[1]	18 (60.00)[1]	30 (30.00)[1]	62.22
Birds	0 (0.00)	0 (0.00)	1 (3.33)	1.11
Rodents	7 (23.33)	5 (16.67)	0 (0.00)	13.33
Weed	0 (0.00)	4 (14.33)	0 (0.00)	4.78
Pathogens	14 (46.67)	9 (30.00)	7 (23.33)	33.33
Reasons for high rating*				
Reduce quantity of yield	12 (40.00)	16 (53.33)	8 (26.67)	40.00
Reduce of quality yield	29 (96.67)	30 (100.00)	30 (100.00)	98.89
Increase cost of production	0 (0.00)	4 (14.33)	6 (20.00)	11.44
Most abundant arthropod*				
Beetles	18 (60.00)	10 (33.33)	12 (40.00)	44.44
Cabbage looper	26 (86.67)	17 (56.67)	19 (63.33)	68.89
DBM larvae	22 (73.33)	16 (53.33)	13 (43.33)	56.66
Cabbage aphids	10 (33.33)	4 (14.33)	9 (30.00)	25.89
Cabbage thrips	3 (10.00)	7 (23.33)	3 (10.00)	14.44
White flies	6 (10.00)	0 (0.00)	14 (46.67)	18.89
Most damaging arthropod*				
Beetle	2 (6.67)	1 (3.33)	0 (0.00)	3.33
Cabbage looper	26 (86.67)	17 (56.67)	19 (63.33)	68.89
DBM larvae	22 (73.33)	10 (33.33)	8 (26.67)	44.44
Cabbage aphids	10 (33.33)	2 (6.67)	6 (20.00)	20.00
Cabbage thrips	3 (10.00)	5 (16.67)	1 (3.33)	10.00
White flies	3 (10.00)	0 (0.00)	12 (40.00)	16.67
Frequency of encounter				
Occasionally	0 (0.00)	18 (60.00)	5 (16.67)	25.56
Frequently	30 (100)	12 (40.00)	25 (83.33)	74.44
Rarely	0 (0.00)	0 (0.00)	0 (0.00)	0.00
Season				
Rainy	0 (0.00)	11 (36.67)	9 (30.00)	22.22
Dry+Irriga.	22 (73.33)	13 (43.33)	21 (70.00)	62.22
Both	14 (46.67)	6 (20.00)	0 (0.00)	22.22

[1]Percentage of respondents,*Multiple responses allowed, DBM = Diamond Black Moth

Table 5: Farmers' source of information on pest control

Source	Jos north	Jos south	Riyom	Mean (%)
Other farmers	16 (53.33)	4 (14.33)	16 (53.33)	85.44
Agric extension officers	5 (16.67)	19 (63.33)	5 (16.67)	32.22
Pesticide agent	20 (66.67)	23 (76.67)	25 (83.33)	75.56
Own experience	5 (16.67)	6 (20.00)	2 (6.67)	14.46

*Percentage of respondents, **Multiple responses allowed

comfortably be linked to the low levels of education [Table 2] probably, because they do not know the implication.

Table 7 further refilled the respondent ignorance on the implications of pesticides on the user, consumers of the produce and the environment. Their most concern was that it produces better yield of high quality. Most of these respondent do not even protect themselves while spraying the pesticides because they believed it has little or no negative effect on them; and if there is any, once they take little milk or oil-palm it is all over. This therefore made them to rate the use of chemical pesticide very high as the only effective means of combating the pests of

Table 6: Adopted method of arthropod pest protection

Method of control	Jos north	Jos south	Riyom	Mean (%)
No control measures	0 (0.00)	3 (10.00)	0 (0.00)	3.33
Cop rotation	0 (0.00)	1 (3.33)	0 (0.00)	1.11
Synthetic insecticide	30 (100.00)	27 (90.00)	30 (100.00)	96.67
Biological control measures	0 (0.00)	1 (3.33)	0 (0.00)	1.11
Use of wood ash	8 (26.67)	5 (16.67)	14 (46.67)	30.00
Stages of insecticide application				
Nursery stage	8 (26.67)	8 (26.67)	13 (43.33)	32.22
Foliage (vegetative)	30 (100.00)	26 (86.67)	29 (96.67)	94.45
Head stage	28 (93.33)	21 (70.00)	26 (86.67)	83.33

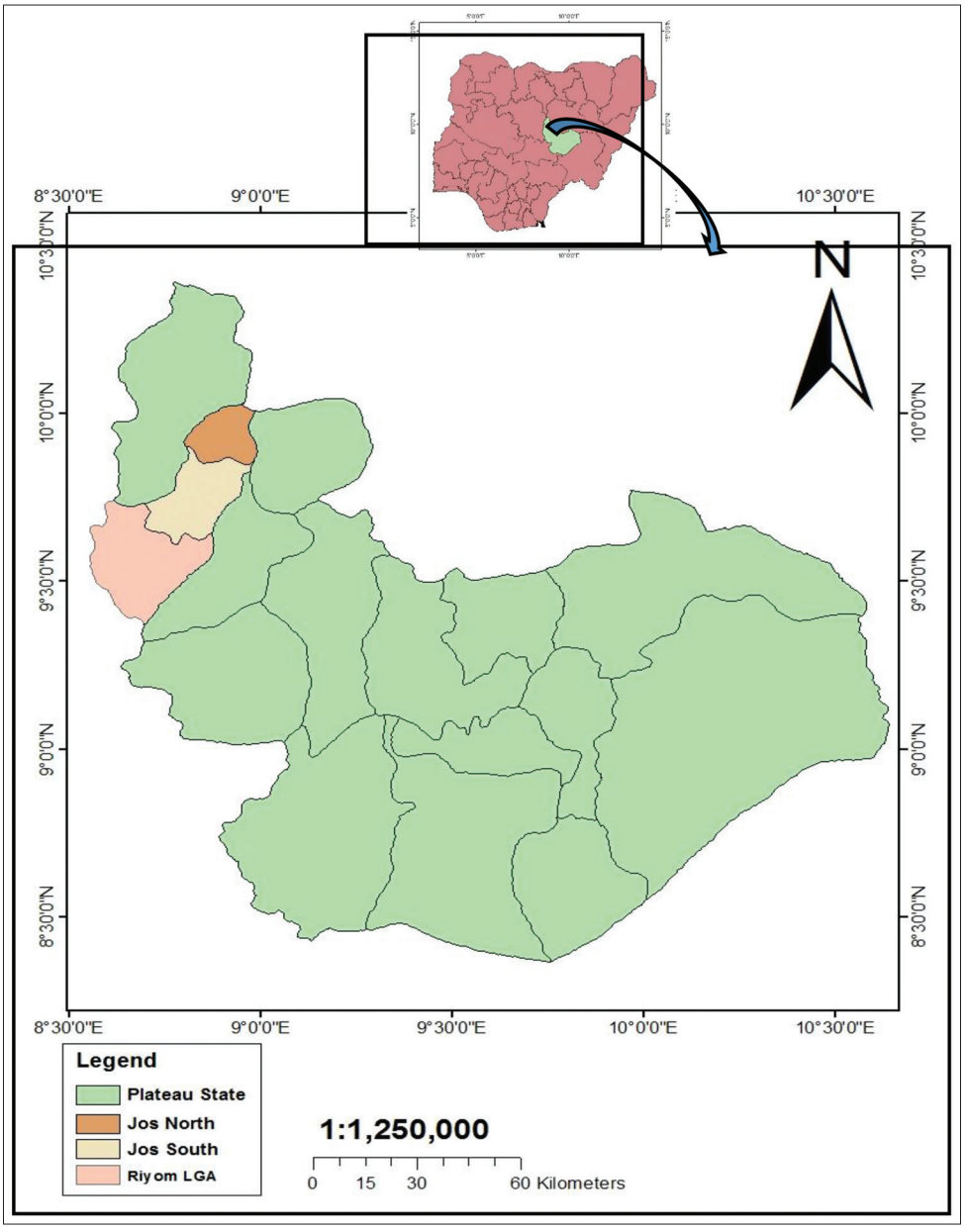

Figure 1: Map of Nigeria and Plateau state showing Jos North, Jos South and Riyom Local Government Areas

Table 7: Information on protective measure; gain and losses

Protective measures	Jos north	Jos south	Riyom	Mean (%)
Nose mask	6 (20.00)	15 (50.00)	11 (36.67)	35.56
Boots	2 (6.67)	5 (16.67)	2 (6.67)	10.00
Hand gloves	2 (6.67)	2 (6.67)	0 (0.00)	4.45
Overall	4 (4(14.33)	1 (3.33)	3 (10.00)	9.22
No protection	18 (60.00)	2 (6.67)	15 (50.00)	38.89
Side effects of synthetic products				
Sickness after application	16 (53.33)	16 (53.33)	16 (53.33)	53.33
Stomach problem to consumers	7 (23.33)	2 (6.67)	0 (0.00)	10.00
Is too costly	17 (56.67)	8 (26.67)	21 (70.00)	51.11
No bad effect	3 (10.00)	6 (20.00)	12 (40.00)	23.33
Benefit of synthetic products				
High yield	4 (14.33)	19 (63.33)	16 (53.33)	43.66
Better quality	21 (70.00)	8 (26.67)	10 (33.33)	43.33
Low rate of pest infestation	5 (16.67)	2 (10.00)	6 (20.00)	15.56
No benefit	0 (0.00)	0 (0.00)	0 (0.00)	0.00
Likert rating				
Strongly agreed	5 (16.67)	10 (33.33)	10 (33.33)	27.78
Agreed	18 (60.00)	17 (56.67)	20 (66.67)	61.11
I don't know	0 (0.00)	1 (3.33)	0 (0.00)	1.11
Disagreed	5 (16.67)	1 (3.33)	0 (0.00)	6.67
Strongly disagreed	2 (6.67)	1 (3.33)	0 (0.00)	3.33

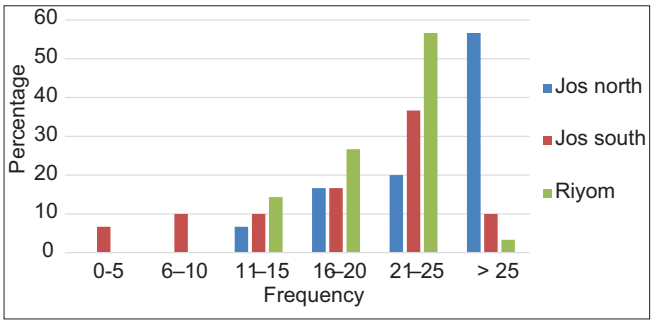

Figure 2: Spraying Frequency/Season

cabbage and larger percentage ($\bar{x}$ = 61.11%) of the respondents through Likert-rating agree that it should be continued.

CONCLUSION AND RECOMMENDATIONS

Based on this research, it is obvious that cabbage production is largely (>60%) in the hand of aged people (above 40 years of age), and most of this respondents (>63%) had no formal education. This reflected on their decision making on adopted farming system, method of pest management, choice of pesticides, frequency of pesticide application, and adopted protection method during pesticide applications. Furthermore, respondents who applied pesticides frequently have never weighted its impact on their production cost, side effects on consumers and revenue generated. In addition, injudicious usage of pesticides as a result of insect resistance problems will have far-reaching consequences on the consumers, agro-ecosystem and the environment at large.

There is, therefore, a serious need for extension officers to educate cabbage farmers on pest management methods and help bridge the knowledge gap through research to generate recommendation on adoptable pest population threshold level at which pesticide usage will be justified.

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