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Rodent damage and management approach by cereal crops farmers in Ido local government area, Oyo state

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Abstract
Rodent pest species inflict damage not only on the field crops but also on the store produce. A lot of efforts have been made by the farmers in an attempt to reduce their damage which varies from one agro-ecosystem to another. In this present study, one hundred (100) questionnaires were administered to the farmers to know the rodent damage and Management approach by Cereal Crops farmers in Ido Local Government Area, Oyo State. Statistical Package for Social Sciences (SPSS) version 20.0 was used to analyze the questionnaires. The results showed that the major constraints of cereal crop production identified were pests (90.0%) and insufficient rain (84.0%). Maize was identified as the crop with highest endurance of rodent damage on the field (99.0%) and in the store (99.0%). The most susceptible stage to rodent damage in cereal crop production was Seedling stage (85.0%). Information was mostly sourced by the farmers through personal experience (61.0%) and informal pest traders (43.0%). Inputs for rodent management were mostly sourced from Agrovets (66.0%). Majority of the farmers (71.0%) opined that rodent management should start after noticing nuisance. Rodenticides (52.0%) and traps (43.0%) were the two most frequently used rodent management methods. None of the farmers has benefitted from government support while majority of them (84.0%) were willing to be beneficiaries of government support in rodent management. Conclusively, efforts should be made in the community management of rodents especially among the farmers in order to make the management more effective.

Keywords: rodent, damage, management, cereal crops, farmers

Introduction
Rodents have been implicated as the most persistent and cosmopolitan vertebrate pest species. They have been recognized as most notorious pest species because of the economic, environmental, social, and public health problems they cause (Buckle and Smith, 2015; Makundi and Massawe, 2011) [8, 5]. Over one-third of mammalian species across the world are rodents (Witmer, 2007; Wilson and Reeder, 2005) [15, 14]. The success of the rodent pest species has been attributed to their high reproductive potential as they have short oestrus cycle, their females produce large number of litters and more litter size per year (Odeyemi and Daramola, 2000) [12]. Rodent pest species inflict damage not only on the field crops but also on the store produce. A lot of efforts have been made by the farmers in an attempt to reduce their damage which varies from one agro-ecosystem to another. In the time past, most farmers believed that rodent pest species were very difficult to control. Therefore, they usually planted two rows for rodent pest depredation in addition to every eight rows of crops cultivated (Chamber *et al.*, 1999) [6]. At present, making provision for rodent pest species in the agro-ecosystem in Nigeria may be difficult because of the continuous increase in human population and short fall in the food supplies. Cereal crops are one of the groups of crops usually attacked by rodent pests and majority of the peasant farmers cultivate one cereal crop or the other. Being small-holder farmers, they usually feel a great deal of the rodent damage impacts compared to the farmers who cultivate the crops in large scale. For example, Abate *et al.* (2015) [1] reported that Maize (*Zea mays* L.) is an important crop for food security in Ethiopia. The maize cultivation has, however, been seriously damaged by rodent pests in Ethiopia (Mulungu, 2017) [11]. Losses incurred annually in some countries due to rodent damage are unbearable. Unfortunately, quantitative assessment of rodent damage is not taken as of paramount importance in some of the countries. A study carried out by Bekele *et al.* (2003) [2] reported that out of 84 rodent species in Ethiopia, there are about 12 species of significant importance.

This present study is aimed at investigating the farmers' experiences about rodent damage and management in the cultivation of cereal crops in Ido Local Government Area, Oyo State.

Materials and Methods

Description of Study Area

The present study was carried out in Ido Local Government Area, Oyo State. The Local Government is located within the latitude 7 30 24 N and longitude 3 42 43 E., with its headquarters at Ido town.

Source: www.facebook.com

Fig 1: Map of Oyo State showing Ido Local Government Area (the study area)

Ido Local Government was carved out of the former Akinyele Local Government. Ido Local Government has an area of 986km2 and a total population of 103,261 based on 2006 National Population Census. It covers the areas spanning Apata, Ijokodo, Omi Adio, Akufo, and Apete. It shares boundaries with Oluyole, Ibararap East, Akinyele, Ibadan South-West, and Ibadan North-West Local Governments in Oyo State and Odeda Local Government in Ogun State. Despite the fact that Ido Local Government is fast becoming urban area, there are still agrarian areas where crops are grown by the farmers. On account of extensive fertile soil, which is suitable for Agriculture, the basic occupation of the people is farming. People in the area grow varieties of cash crops such as cocoa, kola nut, palm oil, timber. They also grow food crops such as maize and rice. The area has also gained tremendously from industrialization process with the presence of industries. Very recently, Ibadan terminus of the resuscitated Nigerian Railway Corporation was situated in Ido Local Government.

Sample size

The sample size for the present study was calculated using the formula below:

$$n = \frac{z^2pq}{e^2}$$

where n = the required sample size,
z = the critical value (1.96) at 95% confidence level,
p = an estimated proportion,
q = 1-p,
e = the margin of error which is fixed at 0.05 (Cochran, 1963) [7]

An estimated proportion of 93% was used for sample size computation for this study because it was believed that the farmers were well experienced about the rodent damage and management. The present study is to investigate the farmers' experiences about rodent damage and management in the cultivation of cereal crops in Ido Local Government Area, Oyo State. The calculated sample size for this study was 100.

Sampling techniques

Questionnaire as structured by Tomass *et al.* (2020) [13] was adopted with some modifications. The modified questionnaire was reviewed and validated by an Agricultural extension

expert. The questionnaire was then administered to a hundred (100) farmers within the study area (Ido Local Government Area) for them to fill. All the questionnaires were retrieved from the farmers upon completion. The farmers were asked to provide their socio-demographic details such as age, years spent in farming, marital status, family size, sex, education. The questionnaire also includes the respondents' farm data which comprise number of plots owned, total farm size (ha), farm size (ha) for cereals, cereal crops mostly grown, annual crop yield (kg/ha); farmers' perception about rodent damage (constraints to cereal crops production, whether they had experienced rodent outbreak or not, place/crop with biggest rodent problem, crop with highest endurance of rodent damage on the field and in the store, factors in favour of rodent occurrence on the crop field, most susceptible stage to rodent damage in cereal crop production); farmers' perception about rodent management (Source of information about rodent management, Source of input for rodent management, when to start rodent management, most frequently used rodent management methods); farmers' indigenous practices, willingness to cooperate with neighbors and benefit from support on rodent management.

Data Analysis

The questionnaires were analyzed using Statistical Package for Social Sciences (SPSS version 20.0). Frequencies and percentages of the responses as given by the respondents were computed for each of the questions in the questionnaire and data were presented using tables and figures. Test of significance was computed using Chi-square.

Ethical issues

There were no ethical issues in this present study. All the respondents consented to filling out the questionnaires administered to them.

Results

Socio-economic profile of the respondents

Farmers who participated most in the study were within the age of 35-40 years (36.0%) and 41years and above (35.0%) while those who were within the age of 18-22 participated least (2.0%) (Table 1). The difference in the age (years) of respondents was statistically significant (χ^2 = 46.5, df = 4, $p<0.05$). Respondents who had spent 16-20 years in farming were the most (29.0%) while those who had spent 21 years and above in farming were the least (7.0%) (Table 1). Based on the number of years spent in farming, there was statistically significant difference among the respondents (χ^2 = 17.7, df = 4, $p<0.05$). Majority of the farmers who participated in the study were married (85.0%). None of the respondents were either separated or divorced (Table 1). There was significant difference in the marital status of the respondents (χ^2 = 267.1, df = 4, $p<0.05$). Majority of the farmers had family size between 1-5 (66.0%) (Table 1). The difference in the family size among the respondents showed statistical significance (χ^2 = 172.3, df = 4, $p<0.05$). More males participated in the study (60.0%) than females (40.0%) and there was significant difference between the number of males and females (χ^2 = 4.0, df = 1, $p<0.05$). More than half of the total number of farmers who participated in the study was of tertiary level of education (56.0%) (Table 1). Those who had informal (3.0%) or primary (3.0%) education were the least. The difference in the level of education among the farmers was statistically significant (χ^2 = 83.92, df = 3, $p<0.05$).

More than one-third of the farmers owned 1-5 plots (36.0%) while only just 1.0% of the farmers had less than 1 plot (Table 2). The difference in the number of plots owned by the farmers was statistically significant (χ^2 = 41.0, df = 5, $p<0.05$). More than half of the farmers had 1-5 ha as their total farm size (59.0%) followed by those with total farm size less than 1 ha (37.0%) (Table 2). Total farm size (ha) as owned by the farmers showed significant difference (χ^2 = 191.96, df = 5, $p<0.05$). More than half the farmers had less than 1 hectare (ha) of land for cereal crop cultivation (59.0%) while the remaining farmers had between 1-5 ha for cereal crops (41.0%) (Table 2). In other words, none of the farmers had more than 5 ha allocated for cereal crops cultivation. There was statistically significant difference in the farm size for cereal among the farmers (χ^2 = 209.72, df = 5, $p<0.05$). The study revealed that Maize was the mostly grown cereal crop by the farmers (99.0%) and there was significant difference between the cereal crop mostly grown among the farmers (χ^2 = 488.12, df = 5, $p<0.05$). Farmers with annual crop yield between 21-30kg/ha were more than others (31.0%). Only 3.0% of the farmers usually had more than 51 kg/ha annual crop yield (Table 2). There was significant difference in the annual crop yield (kg/ha) as recorded by the farmers (χ^2 = 28.4, df = 5, $p<0.05$).

Table 1: Socio-demographic profile of respondents

Category	Frequency (Percent)
Age (years)	
18-22	2 (2.0)
23-28	9 (9.0)
29-34	18 (18.0)
35-40	36 (36.0)
41 and above	35 (35.0)
Years spent in farming	
1-5	22 (22.0)
6-10	28 (28.0)
11-15	14 (14.0)
16-20	29 (29.0)
21yrs and above	7 (7.0)
Marital status	
Single	9 (9.0)
Married	85 (85.0)
Separated	0 (0.0)
Divorce	0 (0.0)
Widow(er)	6 (6.0)
Family size	
1-5	66 (66.0)
6-9	33 (33.0)
10-13	1 (1.0)
Sex	
Male	60 (60.0)
Female	40 (40.0)
Education	
Informal	3 (3.0)
Primary	3 (3.0)
Secondary	38 (38.0)
Tertiary	56 (56.0)

Table 2: Respondents' farms data

Category	Frequency (Percent)
Number of plots owned	
Less than 1	1 (1.0)
1-5	36 (36.0)
6-10	13 (13.0)
11-15	16 (16.0)
16-20	22 (22.0)
21yrs and above	12 (12.0)
Total farm size (ha)	
Less than 1	37 (37.0)
1-5	59 (59.0)
6-10	4 (4.0)
11-15	0 (0.0)
16-20	0 (0.0)
21yrs and above	0 (0.0)
Farm size (ha) for cereal	
Less than 1	59 (59.0)
1-5	41 (41.0)
6-10	0 (0.0)
11-15	0 (0.0)
16-20	0 (0.0)
21yrs and above	0 (0.0)
Cereal crops mostly grown	
Maize	99 (99.0)
Wheat	0 (0.0)
Rice	1 (1.0)
Sorghum	0 (0.0)
Millet	0 (0.0)
Others	0 (0.0)
Annual crop yield (kg/ha)	
1-10	21 (21.0)
11-20	16 (16.0)
21-30	31 (31.0)
31-40	17 (17.0)
41-50	11 (11.0)
51 and above	3 (3.0)

Farmers' perception about rodent damage

Constraints to cereal crop production

The major constraints identified with the cereal crop production include pests, waterlogged farmlands, shifting to cash crops, insufficient rains, and infertile soils. Of all these constraints, pests received the highest attention from the respondents (90.0%) followed by insufficient rains (84.0%). Waterlogged farmlands (16.0%) and infertile soils (16.0%) were recognized by the farmers as the least factors constraining the cereal crops production (Figure 2). The difference in the constraints of cereal crop production as identified by the farmers showed statistical significance (χ^2 = 111.57, df = 4, $p<0.05$).

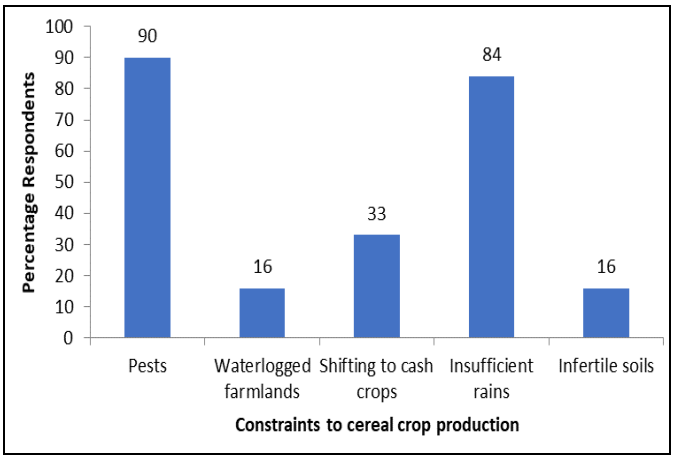

Fig 2: Proportion of respondents' responses on Constraints to cereal crop production

Experience about rodent outbreak?

Majority of the farmers (87.0%) responded in affirmative that they had experienced rodent outbreak (Figure 3). The difference in the farmers' responses was significant (χ^2 = 54.76, df = 2, $p<0.05$)

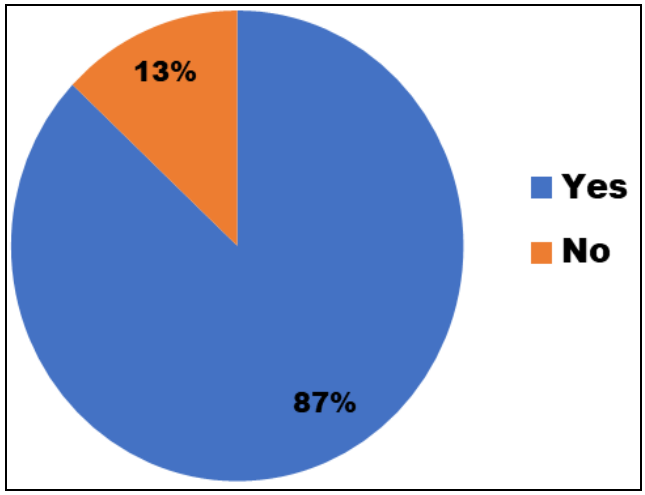

Fig 3: Responses on whether respondents had experienced rodent outbreak

Place with biggest rodent problem

The probable places/crops with biggest problem in the present study include household compound, maize, wheat, rice, sorghum, millet, and others. More than half of the farmers (58.0%) identified maize crop as that which receives biggest rodent problem (Figure 4). There was significant difference in the places/crops with biggest rodent problem (χ^2 = 258.96, df = 6, $p<0.05$).

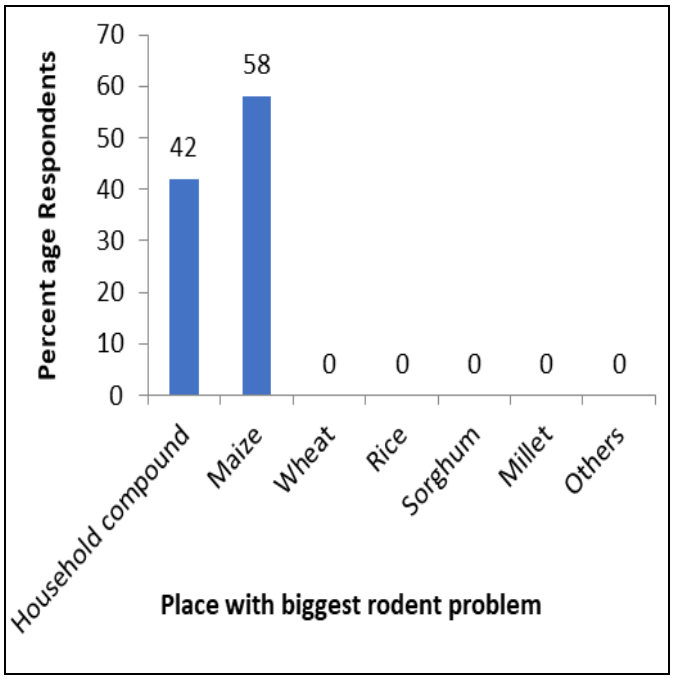

Fig 4: Percentage Respondents with respect to the place with biggest rodent problem

Crop with highest endurance of rodent damage on the field

Figure 5 shows the percentage respondents with respect to crop with highest endurance of rodent damage on the field. Maize was the crop with highest endurance of rodent damage

on the field (99.0%). There was statistically significant difference in the crop with highest endurance to rodent damage on the field ($\chi^2 = 488.12$, df = 5, $p<0.05$).

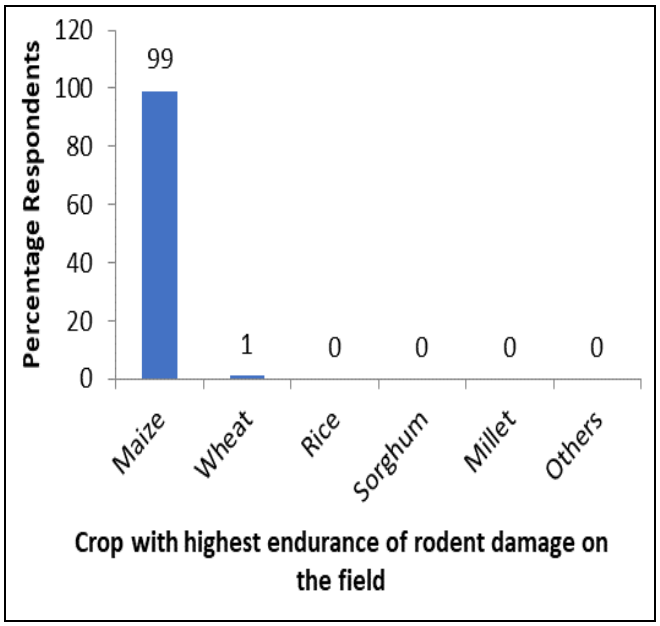

Fig 5: Percentage respondents with respect to Crop with highest endurance of rodent damage on the field

Crop with highest endurance of rodent damage in the store

Figure 6 shows the percentage respondents with respect to crop with highest endurance of rodent damage in the store. Maize was the crop with highest endurance of rodent damage in the srore (99.0%). There was statistically significant difference in the crop with highest endurance to rodent damage in the store ($\chi^2 = 488.12$, df = 5, $p<0.05$).

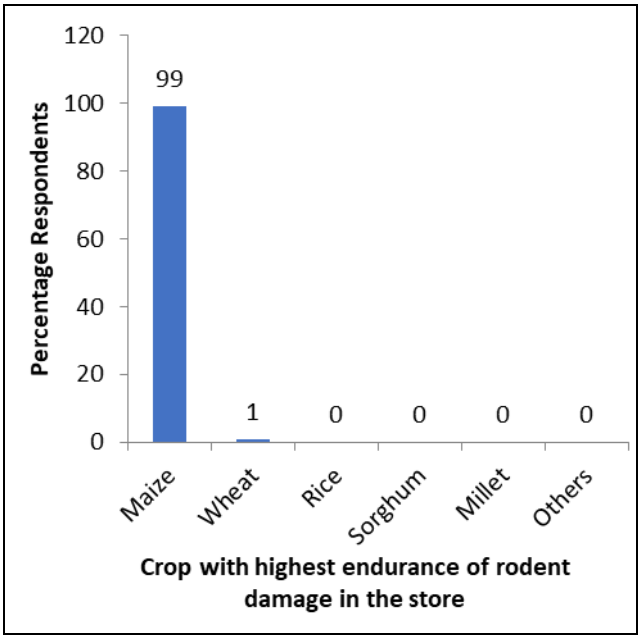

Fig 6: Percentage respondents with respect to Crop with highest endurance of rodent damage in the store

Factors in favour of rodent occurrence on the crop fields

Among the factors in favour of rodent occurrence on the crop field are infrequent weeding, soil mounds nearby, non-crop near farmlands. Non-crop near farmlands was viewed by most f the farmers (94.0%) as the factor in favour of rodent occurrence on the crop field followed by infrequent weeding (87.0%) (Figure 7). There was statistically significant difference in the factor in favour of rodent occurrence on the crop fields ($\chi^2 = 88.52$, df = 3, $p<0.05$).

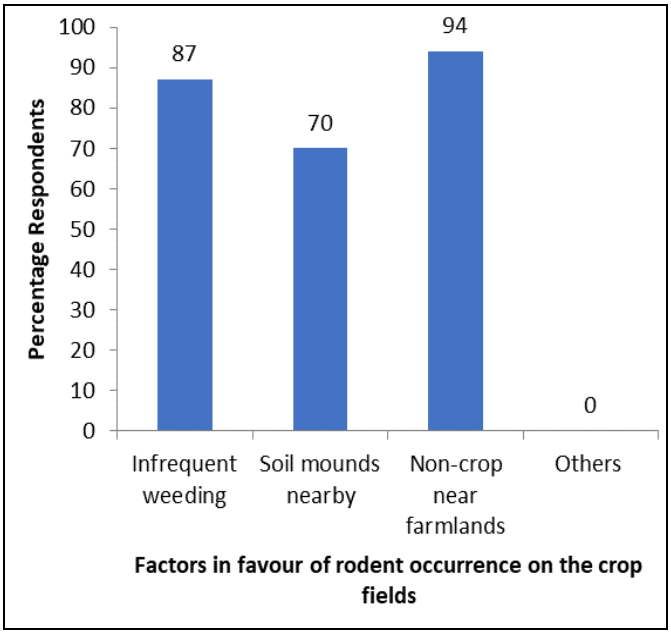

Fig 7: Percentage Respondents on the factors that favour rodent occurrence on the crop fields

Most susceptible stage to rodent damage in cereal crop production

Three stages were identified as the major stages susceptible to rodent damage which include seedling, maturity, and harvesting. Of all the three stages, seedling was identified as the most susceptible stage by the respondents (85.0%). Harvesting stage was not viewed by any of the farmers as being a susceptible stage (Figure 8). The difference in the major stages in cereal crop production in relation to rodent damage showed statistical significance ($\chi^2 = 123.5$, df = 2, $p<0.05$).

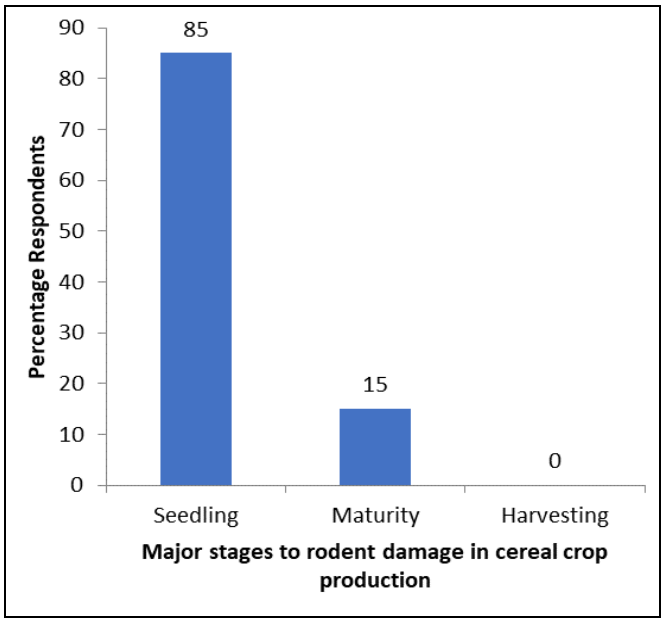

Fig 8: Percentage Respondents on the stage most susceptible to rodent damage in cereal crop production

Farmers' perception about rodent management

Source of information about rodent management

Regarding the farmer's source of information on rodent management which include personal experience, extension workers, informal pesticide traders, more than half of the farmers used personal experience to embark on rodent management followed by those that made use of informal pesticides traders (43.0%) as the source of information about rodent management (Figure 9). There was significant difference in the sources of information on rodent management ($\chi^2 = 59.81$, df = 3, $p<0.05$).

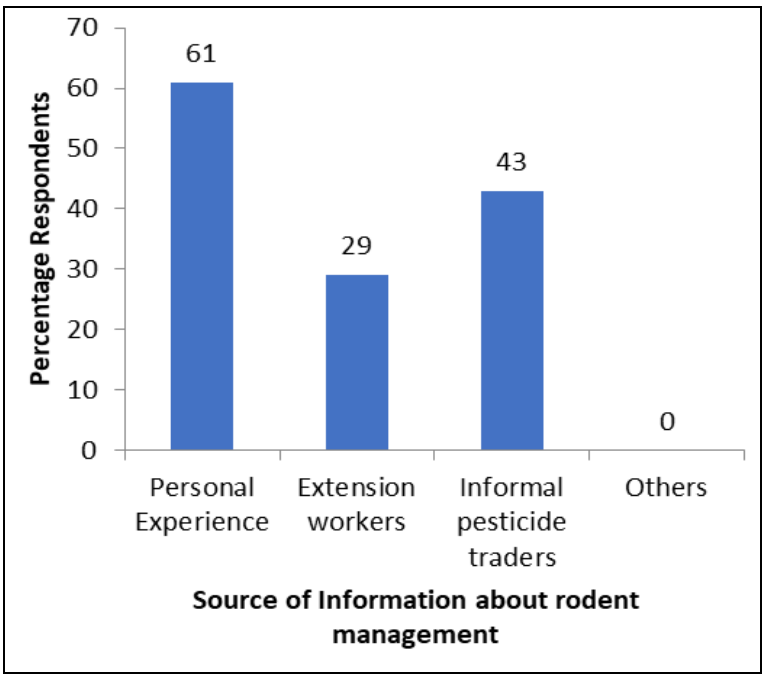

Fig 9: Proportion of respondents based on their source of information about rodent management

Source of input for rodent management

Figure 10 shows the proportion of respondents (farmers) based on their source of input for rodent management. More than half of the respondent source for their input from Agrovets (66.0%). 2.0% of the respondent source their input other than from village shops, local markets, and agrovets. There was statistically significant difference in the source of input for rodent management ($\chi^2 = 62.42$, df = 3, $p<0.05$).

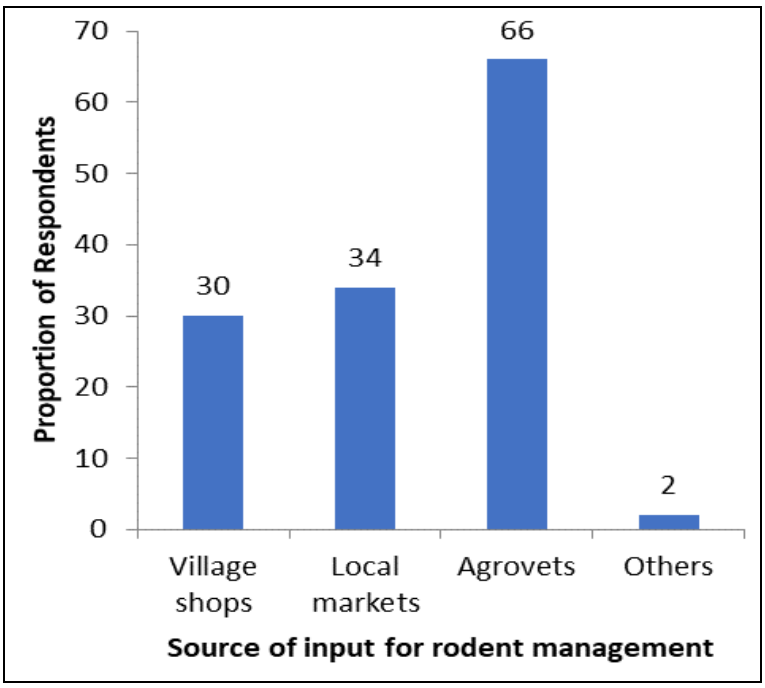

Fig 10: Proportion of respondents based on their source of input for rodent management

When to start rodent management

Responses received from the farmers showed that majority of the farmers (71.0%) start rodent management after noticing nuisance while the remaining farmers (29.0%) start rodent management after noticing damage (Figure 11). There was statistically significant difference in the time of commencement of rodent management ($\chi^2 = 135.28$, df = 3, $p<0.05$).

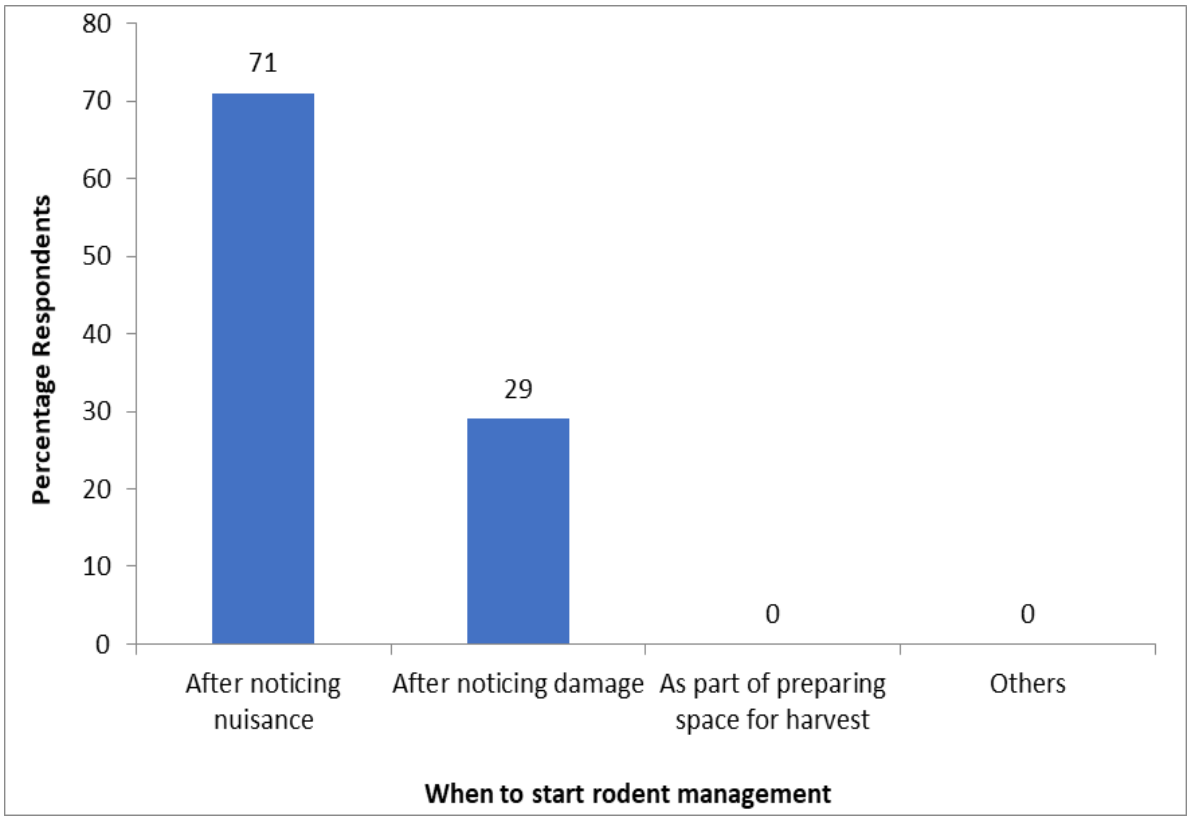

Fig 11: Respondents' views on when to start rodent management

Most frequently used rodent management method

Of all the rodent management methods used by the farmers, rodenticide was the most frequently used (52.0%) followed by Trap (43.0%) (Figure 12). The difference observed among the different rodent management methods was statistically significant ($\chi^2 = 128.90$, df = 4, $p<0.05$)

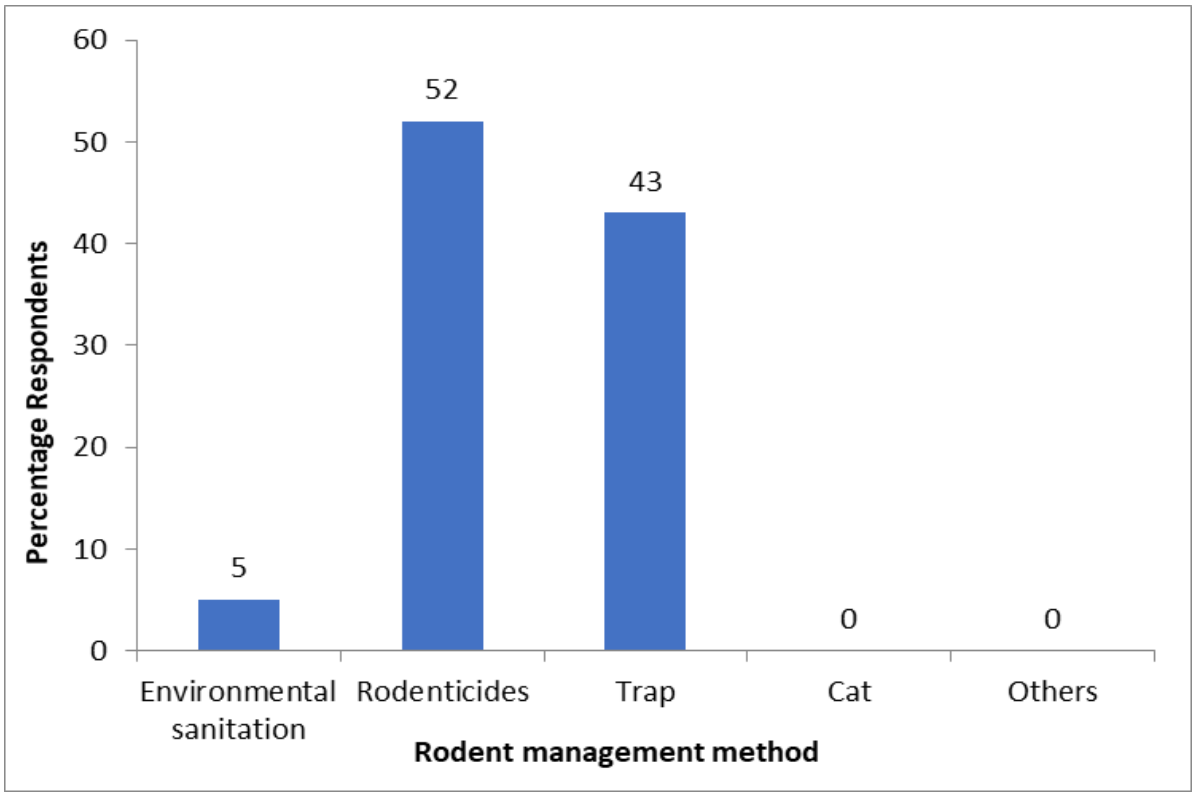

Fig 12: Respondents' most frequently used rodent management method

None of the farmers had employed indigenous practices of rodent management and only 20.0% of the farmers showed willingness to employ indigenous practices of rodent management (Table 3). Majority of the farmers (99.0%) never cooperated with neighbor for rodent management. However, 84.0% of the farmers showed willingness to cooperate with

neighbor for rodent management (Table 3). None of the farmers had benefitted from government support while majority of them (84.0%) were willing to be beneficiaries of government support in rodent management (Table 3).

Table 3: Farmers' indigenous practices, willingness to cooperate with neighbors and benefit from support on rodent management

Category	Frequency (Percent)
Use of Indigenous practices of rodent management	
Yes	0 (0.0)
No	100 (100.0)
Willingness to employ Indigenous practices	
Yes	20 (20.0)
No	80 (80.0)
Cooperation with neighbour for rodent management	
Yes	1 (1.0)
No	99 (99.0)
Willingness to cooperate with neighbour for rodent management	
Yes	84 (84.0)
No	16 (16.0)
Once a beneficiary of governmental or non-governmental support in Rodent management	
Yes	0 (0.0)
No	100 (100.0)
Willingness to obtain governmental or non-governmental support in Rodent management	
Yes	82 (82.0)
No	18 (18.0)

Discussion

Majority of the farmers who were involved in this present study were 35 years and above. Young people who participated in the study were very few. Similar result was reported by Tomass *et al*. (2020) [13] that the average age of the Respondents that participated in the survey was 62.46 years within the range: 35–100. More males participated in the study (60.0%) than females (40.0%). Earlier report by Badmus and Ala (2020) [3] similarly stated that more males, 70 (58.3%) took part in the study than females, 50 (41.7%).

More than half of the total number of farmers was of tertiary level of education. This is contrary to the results of the findings by Badmus and Ala (2020) [3] who reported that majority of the respondents, 107(89.2%) who participated in the study were in their tertiary level of education.

On average, the respondents spent 42.8 years (range: 10–80) in farming as an occupation. A contrasting report was given by Badmus and Ala (2020) [3] that majority of the respondents in the study were students, 93 (77.5%) while only 3 (2.5%) respondents were farmers.

Pests received the highest attention from the respondents (90.0%) as the most perceived constraint in the cereal crop production. This is in agreement with the study carried by Tomass *et al*. (2020) [13] who reported that the most perceived constraints for cereal crop production in the study area were pests (51%).

In the present study, seedling was identified as the most susceptible stage in cereal crop cultivation by the respondents (85.0%). This corroborates the findings as reported by Tomass *et al*. (2020) [13] that the seedling stage of maize was indicated as the most susceptible crop stage to rodent damage (64.8%).

Non-crop near farmlands was viewed by most of the farmers (94.0%) in the present study as the factor in favour of rodent occurrence on the crop field. Similar finding was reported by Tomass *et al*. (2020) [13] that over 50% of the farmers implicated the presence of non-cropped areas around farmlands to be more suitable for rodent pests.

Majority of the farmers (71.0%) start rodent management after noticing nuisance while the remaining farmers (29.0%) start rodent management after noticing damage. Meheretu *et al*. (2010) [10], however, reported that rodent management is usually initiated either by sighting of damaged crop or rodent movements in nearby fields and storage areas.

Rodenticides was the most frequently used (52.0%) followed by Trap (43.0%). This corroborates the earlier report by Badmus and Ala (2020) [3] who stated that rodenticides was the method mostly adopted method by the respondents to reduce rodents damage as 66 (55%) respondents were recorded, followed by setting of traps 37 (30.8%). However, Kasso (2013) [4], in his report, stated that biological control using cat was the most widely adopted method of controlling rodent damage which is only restricted to house or human residence.

In the present study, none of the farmers had previously employed indigenous practices of rodent management and only 20.0% of the farmers showed willingness to employ indigenous practices of rodent management. However, Tomass *et al*. (2020) [13] reported that the leaf extract of *Datura stramonium* baited with maize flour was frequently mentioned as an indigenous practice of rodent management in the study area.

Majority of the farmers (99.0%) never cooperated with neighbor for rodent management. However, 84.0% of the farmers showed willingness to cooperate with neighbor for rodent management in the present study. This report is consistent with the previous findings by Makundi *et al*. (2005) [9] who reported that rodent management was carried out on an individual basis and not by the whole community.

Conclusion

It can be concluded that there should be awareness creation regarding the attendant risks in continuous use of rodenticides and that other minimally damaging rodent management should be adopted in the study area. Moreover, efforts should be made in the community management of rodents especially among the farmers in order to make the management more effective in the study area. Government should support the farmers in rodent management in order to assist them in reducing the incessant rodent damage to cultivated crops.

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