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Use of Cassava Peels and Scarecrows to Control Rodent Damage in Groundnut Fields

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Abstract

Rodents are a big threat in groundnut production. This study was carried out at the Agriculture Unit, Mountains of the Moon University Western Uganda in 2020 to determine the rodent damage using cassava peels and scarecrows in groundnut fields. The experiment was designed in randomized complete block design with three treatments and five replications. Treatment 1 as cassava peels, Treatment (2) as scarecrows, and Treatment (3) as 'no treatment applied (control)' have been used. Data were obtained by collecting harvest of pods, numerous burrowing activities, injured pods, and plants. The GenStat 10th edition was used for data analysis. The results showed that number of rodent species within groundnut field was highly significant. The significant and the highest pod damage (103.33 pods) were observed in control plots and the lowest damage (65.33 pods) was observed in the plots of scarecrows. The highest plant damage was occurred in control plots (8.00 plants) and the lowest damage in scarecrow plot (4.42 plants). The highest harvest of ground nut seeds was obtained from scarecrow plots (2 kg/m^2) and the lowest harvest in control plots (1.16 kg/m^2). Control plots experienced the highest rodent burrowing every week at a rate of 7.11 activities per week per plot. While the scarecrow plot experienced the least rodent burrowing at a rate of 3.11 activities per week per plot. This study showed that use of scarecrows was found effective measure for control of rodent damage in groundnut field.

Keywords: Cassava peels, Groundnut, Peanut field, Rodent damage, Scare crows

Introduction

The name of groundnut (*Arachis hypogaea* L.) is derived from two Greek terms in the Fabaceae family. Arachis means legume and hypogaea means under the ground which refers to the forming of pods under soil (Pattee and Young, 1982; CABI, 2019). This crop is generally referred to as the nut of a poor man. It is an important oil seed and food crop.. Groundnut is one of the commonly cultivated oilseed crops in more than 100 countries including China, India, United States, Nigeria, Indonesia, Mayanmar, Malaysia, Sudan, Senegal, Argentina, United Kingdom and Vietnam. The highest production of groundnut is found in China (32.95%), followed by India (18%) and the USA (6.8%) (Pound and Phiri, 2010).Groundnut is one of Uganda's and world's most grown oilseed crop (Okello et al, 2013; Sharma et al., 2011). This crop is important for food security; its seeds contain 40-50% oils, 20-50% proteins, and 20-10% carbohydrates depending on the variety (Okello et al., 2010). In addition to this, it contains Vitamin E, calcium, phosphorous, magnesium, zinc, niacin, falacin thiamine, and potassium (Savage and Keenan,1994). Calcium is essential for growth and development of bone, teeth, phosphorous, helps in blood sugar level monitoring as well as protect from heart related disease, magnesium serves in formations of bones and muscles. Zinc is vital for growth and repair of body tissues, and potassium maintained the water level in human body (Modi et al., 2020). Groundnut seeds are the raw materials for the processed products such as peanut butter, roasted seeds, pounded seeds, cooked seeds with their pods, and groundnut cake for livestock. For the businesses, it is important source of income since groundnut production generates employment opportunities for young people (Nyamweha, 2016). So it is a both food crop and a cash crop for the farmers in sub-Sahara Africa.

Farm losses are caused by unfinished harvest, heavy field rain, insufficient drum stock, improper hygiene of farming, and by the attack of many harmful pathogens like fungus, rodents, insects (Shah et al., 2021; Tiwari et al., 2021). These pests are major causes of the productivity losses, economic damages and risky production (Tripathi et al., 2020). Rodents are an important component of the agricultural lands' ecology. They have been recognized as harmful mammalian pests worldwide; they cause significant direct and indirect damage to various crops by scratching, spoilage, pollution, and hoarding activities. Groundnut, is particularly vulnerable to rodent attacks (Parshad, 1999). *Bandicota bengalensis, Millardia meltada* and *Tatera indica* are common species of rodents responsible for groundnut damage (Bharati, 2010). Groundnuts are one of the important crops in some arid and semi-arid countries, but there is little information on rodent losses that can exceed 100% locally (Meehan, 1984). The loss in yield of groundnuts ranged from 12-31 kg/acre with an average 20 kg/acre (Bindra and Sagar,1971). The losses of the groundnut crop due to rodents (4-26% loss) were recorded by Prakash and Mathur (1988) in India, The loss of the groundnuts of 3.86% due to this pest was reported by Parshad et al. (1987).The researchers of Philippines and the Sudan have also recorded poor yields of groundnuts due to rat damage (Baltonado and Bongolan, 1985; Ishaq et al., 1980). In China, the rat-like hamster *Cricetulus triton* has caused 14.8-19.6% damage in the groundnut (Zhang et al., 1998). The groundnut is planted last week of June or the first week of July and harvested at 120 days in October. In groundnut field rodent damage can begin in the middle of July (seedling stage) and continue through harvesting (Brooks et al., 1988). In the production process, preservation, manufacturing, packing, shipping improper handling, packing, postharvest techniques are employed. In developing countries, production losses range from 20 to50% during harvesting cycles (Tiwari et al., 2020). The rodents, that cause 9.11 % loss in the groundnut plantation, are unfortunately at risk for production (Khan et al, 2009; Kocher and Kaur, 2008).

Most of the research findings showed that the use of rodenticides such as flocomafen, coumateralyl, zinc phosphide, and bromadiolone as can be applied in the groundnut field (Singla and Babbar, 2015; Bharati, 2010; Khan et al., 2009; Kocher and Kaur, 2008). But rodenticides are harmful to non-target organisms i.e. earthworms, birds, and even children (Smith and Shore, 2015).

The cassava peels are wastes obtained after peeling the cassava tubers for cooking. These wastes are dumped as landfills in the environment (Handayani et al., 2018). Cassava peels can be used to control rodents. In our study we used the cassava peels and scarecrows in order to track the damage of rodents in the groundnut field.. The objective of this study was to assess the effectiveness of cassava peels and scarecrow on rodent damage in the groundnut fields.

Materials and Methods

Description of experiments

The experiment was carried in 2020 at the Agriculture unit, Mountains of the Moon University western Uganda (The coordinates of research location are: 0°41'15.0"N, 30°14'51.0"E (Latitude:0.6875; Longitude:30.2475)). The experiment was conducted in randomized complete blocks design (RCBD) with three treatments and five replications. In relation to "control" with (untreated) plots, two treatments were tested: scarecrows and cassava peels in groundnut at a pre-harvest stage. The space of 2 meters was maintained between the plots. Groundnut seeds were (2 seeds) were sown in 30 cm between rows and 10 cm within the row at a planting depth of 10 centimeters in the experimental plots of 4 x 4 meters. This experiment was conducted on field with a history of rodent problems which was observed in previous seasons.

Application of cassava peels

Cassava (*Manihot esculenta* Crantz) is an erect, short-lived shrub, grown vegetatively from hard wood stem sections. It is an important crop in tropical environments and a major component of cultivation systems (Rajeswarisivaraj et al., 2001). Fresh cassava peels were spread over groundnut plots by hand when the crop was at flowering stage (Figure 1).

Figure 1: Spreading of cassava peels in groundnut plot

Use of scare crows

Snake-like scarecrows of 60 cm long were weaved by hand (Figure 2). Providing the scarecrow the black color because black snakes, which are the scariest reptiles, chase the rodents (Collins and Taggart, 2008). Only one crow was placed in each experimental plot (4 x 4 meters). Changing the position or direction of the crow was done once a week. This method was also applied when the crop had reached the flowering stage.

Figure2: Use of black snake-like scarecrow under groundnut plants

Data collection and analysis

Field monitoring was done one week after experimental setup. Burrows were counted and recorded. During groundnut harvesting, plant and pod damages were counted. An electronic kitchen scale was used to measure the amount of harvest after damage. Gen Stat 10th edition was used to perform one-way ANOVA to identify the significant differences in the number of burrows, harvest, damaged pods, and plants among the treatments at 0.05 significant level.

Results

Rodent observed in the field

The commonest rodent observed in the field of groundnut was *Rattus rattus* and total of 16 different rodent species (Table.1). The number of rodent species found was highly significant. A similar report was demonstrated by Billeter et al. (2014), *Cricetomys gambianus, Apodemus sylvaticus, Rattus norvegicus, Mus domesticus* were common in the groundnut field which was the major reason for low production.

Table 1: Rodents observed in the experimental field.

Rodent species	Number caught in the field
Apodemus sylvaticus	3
Arvicanthis niloticus	2
Cricetomys gambianus	3
Mus domesticus	1
Rattus norvegicus	0
Rattus rattus	6
Tachyoryctesankoliae	1
Mean	2.29
SEM	0.891
LSD(0.05)	1.941
F test	**

** Highly significant at 0.01 level of significance

Pod damage

The highest pod damage (103.33 pods) was recorded in control plots and the lowest damage in scarecrow plots (65.33 pods) (Figure 4). There were significant differences ($p<0.05$) in pod damage among the treatments as indicated in different letters in Figure 3. The pod damage was recorded higher in the findings of Singla and Babbar (2015); they reported that with the use of zinc phosphide and 0.005% bromadiolone the pod damage of 0.00% was achieved. Therefore rodenticide was more effective method.

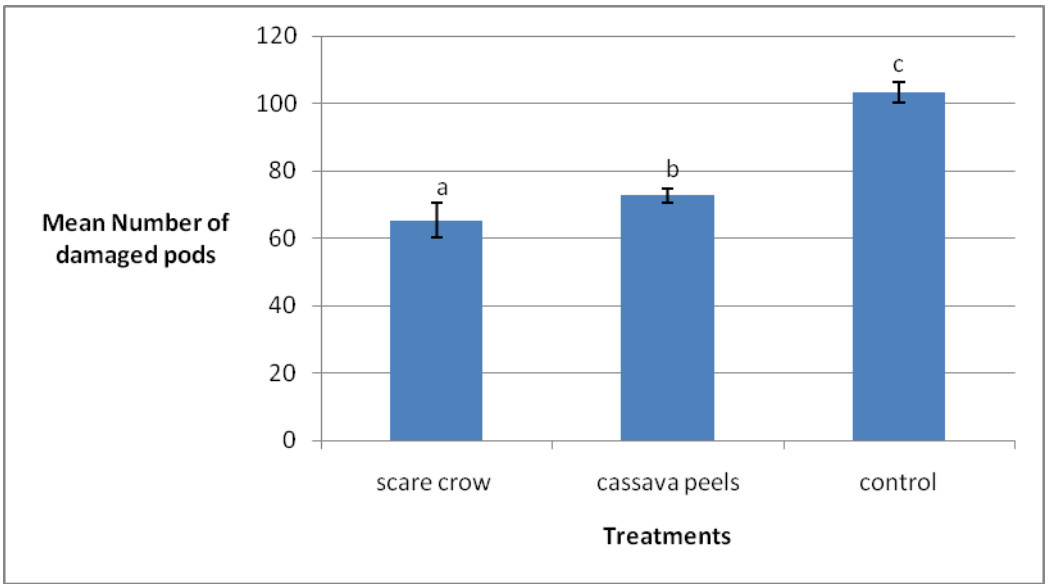

Figure 3: Mean number of damaged pods with error bars standing for standard deviation and different letters for significant differences among the treatments

Plants damage

The highest plant damage (8.00 plants) was observed in control plots and the lowest in scarecrow plot (4.42 plants) (Figure 5). There was no significant difference ($p > 0.05$) in plant damage among the treatments as indicated by the same letters in Figure 4. The scarecrows and cassava peels experienced lower damage. This finding was similar to the findings obtained by Brooks et al. (1988) they found 76% plant damage in their experiments.

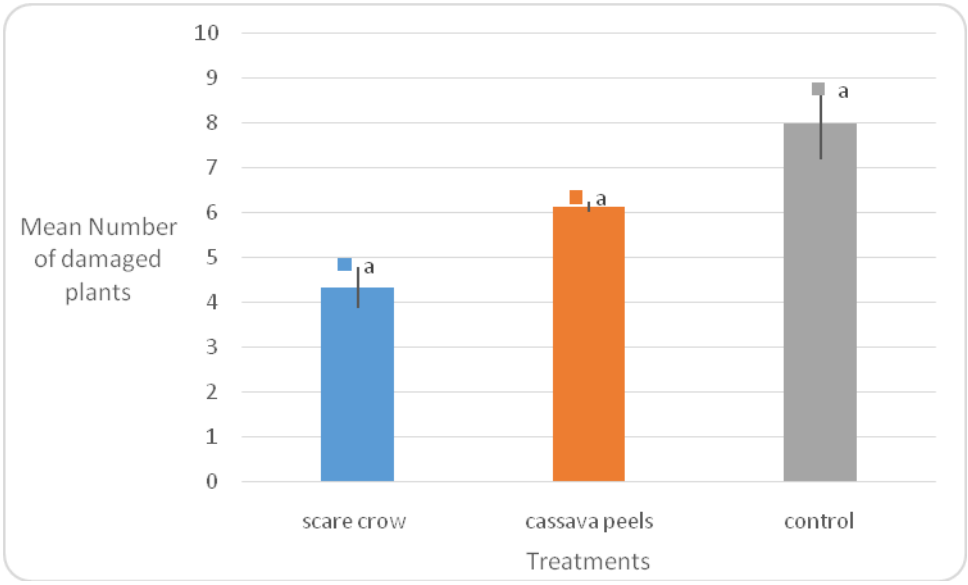

Figure 4: Mean number of damaged plants with error bars standing for standard deviation and same letters for no significant differences among the treatments

Harvest of groundnut seeds per square meters

The highest groundnut seed harvest (2 kg/m^2) was recorded from scarecrow plots and the lowest in control plots (1.16 kg/m^2). No significant differences ($p > 0.05$) in harvest among the treatments as indicated by the same letters in Figure 5.

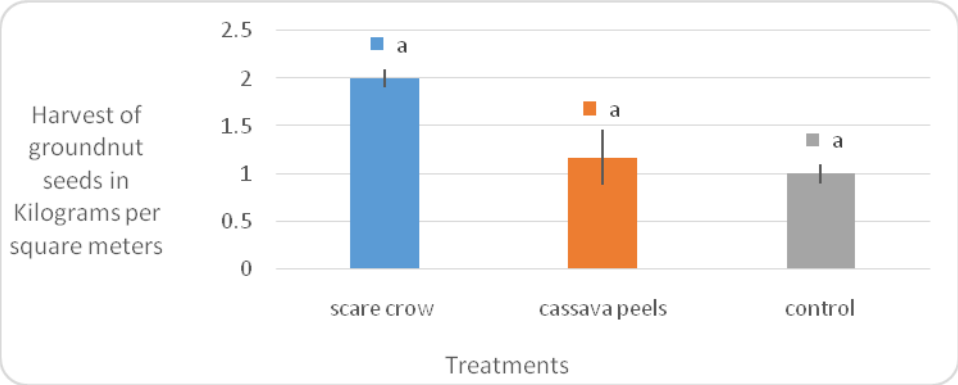

Figure 5: Harvest of groundnut seeds from treated and control plots with error bars standing for standard deviation and same letters for no significant differences among the treatments.

Burrowing activities

Control plots experienced the highest rodent burrowing every week (Figure 6) at a rate of 7.11 activities per week per plot. While the scarecrow plot experienced the least rodent burrowing at a rate of 3.11 activities per week per plot. There was a significant difference in rodent burrowing among the plots in all the weeks of sampling as indicated by a different letters (Figure 6)

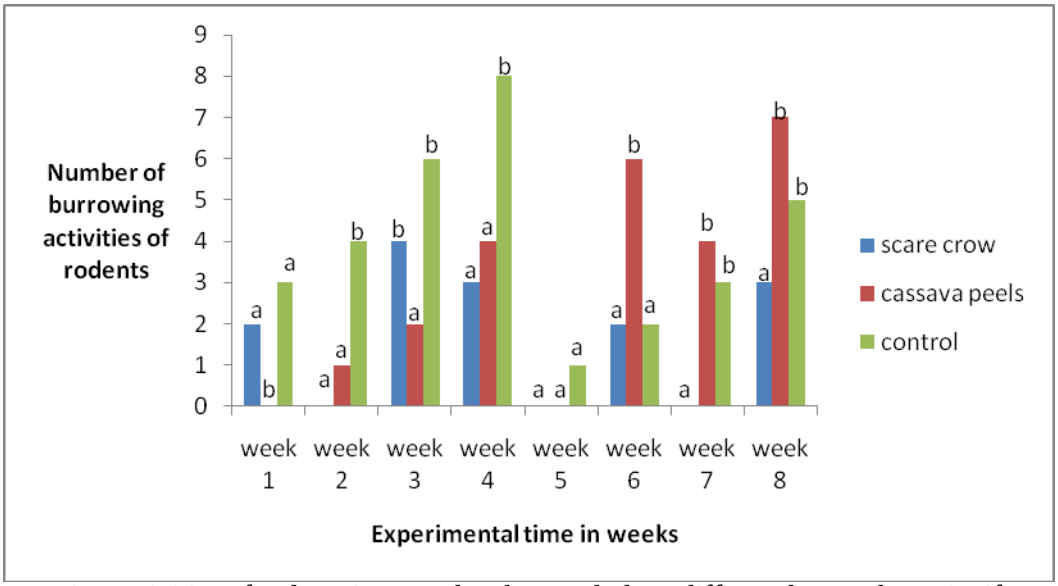

Figure 6: Burrowing activities of rodents in treated and control plots, different letters show significant differences in burrowing activities.

Discussions

Cassava peels are capable to reduce rodent damage in groundnut field as indicated by fewer pod and plant damage. Cassava tubers are targeted crops for rodents in the field (Lal and Pillai, 1981; Cudjoe, 1994) as their peels may contain the residues of tubers for rodents to feed and spare the nuts. When the remains of tubers are exhausted then rodents start burrowing around the groundnut plants so burrowing activities increased in weeks 3 to 4. In week 5, weeding is done and fresh cassava peels are applied,. At end of the experiments, plots of cassava peels experienced the highest burrowing activities as compared to control plots. Because residues of tubers were exhausted so rodents started burrowing in peels. Where cassava peels were fresh, the rate of rodent burrowing becomes lower and in the process, the rodent damage in the field is minimized. Cassava plots incurred 72.6 pods, 6.13 plants damaged in comparison with 103.33 pods, and 8 plants damaged in control plots (Figure 4, 5, and 6).

Snake-like scarecrows were the most effective measure as compared to cassava peels as indicated by lower pod and plant damages (Figure 4 and 5) with higher seed harvest (Figure 6). This would imply that snake scarecrows can minimize rodent damage in the groundnut field; snakes are natural enemies of rodents (Shlomo et al., 2018; Loop and Bailey, 1972). The rodent burrowing activities occurred minimum in the scarecrow plot. The few burrows in the plots indicated that some rodents were able to respond to snakes (Shlomo et al., 2018) Atta et al. (2018) found that field rodents are destructive at all stages of crop establishment starting from sowing to harvest. So control measures should be applied even at sowing time. It is applicable to apply scarecrows from sowing to harvest which is not possible for cassava peels. Since they need to be harvested and decomposed early in the season by a significant number of cassava peels per acre.

Conclusion

The lowest pod damage along with high harvest of groundnut seeds was recorded with the use of scarecrows. Thus the use of scarecrows was found effective method of rodent control in groundnut field.

Conflict of interests

The authors declared that there is no conflict of interests.

Author contributions

N.B, A.G. and C.G. conceived the designed the study and collected data. K.K. analyzed data interpreted the results and write up the manuscript. Final edits: A.S., I.T. J.S. and N.W. All the authors have approved the final version of the manuscript and agreed on submission for publication.

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