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Efficacy of Various Neem Products in Control of Storage Pests (*Callosobruchusmaculatus*) of Cowpea (*Vignaunguiculata*)

[1]Rajab, Y.S.* and [2]Abdullahi, U.
[1]*Department of Crop Production Technology, Federal Polytechnic, Bali.*
[2]*Department of Agricultural and Bio-Environmental Engineering Technology, Federal Polytechnic, Bali.*
Corresponding author: Rajab, Y. S.

Abstract: *experiment was carried out in a storage cubicle at Department of Crop Production Technology, Federal Polytechnic, Bali to determine the efficacy of various neem products in the control of storage insect pests (Callosobruchusmaculatus) of cowpea (Vignaunguiculata). Three kilograms of the beans was put into three (25 cm x 30 cm) cotton bags and each treated with 75gram neem leaf, bark and seed powder respectively; and ten pairs of both sexes of Callosobruchusmaculatus were introduced into each bag and the set up replicated into 40 (a total of 120 treated bags). Another 40 bags which contained cowpea and the pests without treatment served as control. Each bag was tied with string. The treated and untreated bags (160 bags) were arranged in separate compartments of the cubicle and allowed to stay for three months. Parameter assessed was weight loss of the cowpea and data generated were subjected to one-way Analysis of Variance (ANOVA) using "R" statistical package. Least significant differences (LSD) were also used for mean separation at p = 0.05. The results showed significant differences among means of the treatments at p < 0.01. The control experiment recorded the highest mean of beans weight loss (1.16) while the least mean weight loss was observed in bags treated with neem seed powder (0.92); followed by those treated with bark powder (0.96), then leaf powder (1.03). Hence both the null hypotheses were rejected. Therefore, neem seed powder is most promising in the botanical control of storage pests (C. maculatus).*

Key words: Efficacy, neem, storage pest, cowpea

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I. Introduction

Cowpea is an annual legume crop which matures in 3-4 months, which also belongs to the family Leguminoceae(Inusa, 2019). It grows very well on a good and friable soil which receives moderate rainfall of 760 mm to 1500 mm; and this is why it is commonly cultivated in Semi-Arid northern Nigeria (Singh *et al*., 1997). Sigmund *et al*. (1991) reported that one-third of the world's population consume diet deficient in protein and this deficiency is more pronounced in humid tropical countries. Sigmund *et al*. (1991) further observed that these deficiencies could be balanced by combination of various food items; hence, it was suggested that a diet with 1/3 beans and 2/3 maize could give a biological value of 100. Being a cheap leguminous crop which provides good quality protein, cowpea augments the staple carbohydrate widely consumed in Nigeria (Muoneke*et al*., 2012). Maina*et al*. (2012) reported that before harvest and during storage cowpea seeds are prone to a large number of species of insect pests, which constitute a major setback in its production. Therefore, preserving agricultural products for future use is the most important post-harvest operation; however, this is impeded by the actions of storage pests.

Pests of Cowpea – bruchids in the family Bruchidae are serious pests of grain legumes in storage (Lale*et al*., 2002). They cause substantial losses through seed perforation, reduction in weight, market value and germination ability of seeds (El-Atta, 1993). For instance, the larvae of *Callosobruchusmaculatus*feed and develop exclusively on the seed of legumes (Fabaceae), while the adults do not require food or water and spend their life span (one-two weeks) mating and laying eggs on beans (Myers *et al*., 2006). Profit (1997) reported that about 5% of cowpea pods are infested by cowpea weevils in northern Nigeria and during inoculation, the larvae hatch directly from the egg and burrow through the pod wall and finally into the seed where they develop and puppet.

Pests Control –Cowpea is infected by various groups of insects from emergence to reproduction up to storage. Therefore, careful spray of insecticides is the most economic and reliable means of pest control (Agbato, 2011). However, environmental pollution and health hazard pose by synthetic pesticides makes it necessary for farmers to adopt the use of alternative and safer means of combating problems of insect pests. Several control measures were postulated by different workers, which include use of wood ash, solarisation, conventional insecticides to botanical insecticides (Zittler*et al*., 1997). For instance, neem products are botanical insec-

ticides which affect insect vigour, longevity and fecundity; and about 450-500 species of insects were tested with neem products globally, out of which 413 were reportedly susceptible at various concentrations (Dhaliwal *et al*., 2013). Furthermore, entomologists all over the world now proposed that neem has greater qualities for controllinginsect pests and is likely to offer itself in a new era of natural pesticides (Ghosh, 2014). However, which of the neem products (seed, leaf or bark) is most effective is yet to be established. Therefore, the objectives of this research are to:

Objectives of the Study:

1. Determine the efficacy of neem products for control of storage pests of cowpea.

2. Compare theefficacy of the various neem products in the control of the storage pests.

Null Hypotheses:

$Ho_{1=}$ Neem products have no effects in the control of storage pests of cowpea.

Ho_2 = No differences among the three treatments applied.

II. Materials And Methods

Materials – Materials used for the research include "Kanannado" beans, woollen/cotton bags (25 cm x 30 cm), scales, insect pests (*Callosobruchusmaculatus*), air-dried and ground neem leaf (powder), powdered neem seed and bark, double-compartment storage cubicle aligned with shelves, fumigant, spatula, petri dishes and beaker.

Methods – The shelves in the two storage compartments were first fumigated using Methyl bromide and kept air-tight for the first three days to ensure a microbe and pests free environment. Three kilograms "kanannado" beans were put into each of the 160 cotton bags. 75 gm of each of the three treatments was added separately into 40 bags containing the beans and thoroughly mixed. This gives a total of 120 bags with treatments. However, no treatment was added to the remaining 40 bags which serve as control. 10 pairs of the two sexes of the insect pest were introduced into each bag including the control and tied with strings. The fumigated cubicle remained open to allow ventilation for some hours before the bags were arranged on the shelves. However, the bags which served as control were arranged in a separate compartment to avoid the influence of odour from the treated bags. The setup was allowed to stay for three months; at the end of which the content of each bag was emptied to allow the pests to escape. The partly destroyed grains were sieved, winnowed and reweighed (differences between initial and final weight served as the response variables). Data obtained were subjected to one-way Analysis of Variance (ANOVA) and the means were separated using Least Significant Difference (LSD at 5% level of probability).

III. Results And Discussions

Table 1 shows the means and sum squares and their error terms. It shows that the F value (12.71) is greater than the probability of F (F tabulated) at < 0.01 level of significance. Hence, the null hypotheses which saidneem products have no effects in the control of storage pests of cowpea and that which said there is no difference in means of the treatments are rejected. It means that all the treatments do not have a common population means, as each of the treatments produced scores that are different from the rest. Therefore, in order to specify which population means is different from the other, further statistical analysis was carried out using standard errors for differences inmeans (SED) to arrive at the least significant difference (LSD) at $p = 0.05$. Table 2 shows the population means of each treatment and the least significant differences; and it is clear that while on one hand there are no significant differences in means between the bark and the leaf and between the bark and the seed treatments, on the other hand, significant differences exist between the means of bark and control, leaf and control, seed and control and finally leaf and seed treatments. On the overall, while the control experiment shows the highest loss in beans weight, the seed treatment recorded the least loss in beans weight (figure 1); probably due to the later's effect on the activities of the pests (*Callosobruchusmaculatus*). This concurred with the work of El-Atta (1993) who reported that the pests cause substantial losses through seed perforations and reduction in weight of the seed in storage. It also agrees with the work of Ghosh (2014) who proposed that neem had greater qualities for controlling insect pests and was likely to offer itself in a new era of natural pesticides.However, it was observed that total control of the pests was not achieved as perforations and weight loss was inflicted in all the setup and the palatability of the beans was also changed (bitter taste) except in the control experiment.

IV. Conclussion

In conclusion, significant effect was observed at $p < 0.01$ when beans inoculated with pests(*Callosobrochusmaculatus*) and treated with various neem products were kept instorage for three consecutive months as a means of controlling the pests. Similarly, significant differences exist between most of the means of the various treatments applied at $p= 0.05$. Hence both the null hypotheses which respectively said neem products exert no effects on storage life of cowpea and that no significant differences exist between the

various means of the treatments applied were rejected. Therefore, neem products possess the qualities of controlling insect pests in storage.

V. Recommendations

1. Research should be carried out on improving the level of control of the pests by the neem products there by reducing the percentage beans perforations.
2. Further experimentations at varying concentrations of neem products to develop their suitable lethal dose (LD).
3. Research should be carried out to ascertain and eliminate the causes of bitterness in the neem products.

Table 1: Summary of ANOVA for the treatments applied showing degrees of freedom, sum squares, mean squares, f-value and *p*-value

Variable	df	ss	ms	F	pr (>F)
Treatment	3	1.377	0.4590	12.71	1.79e-07***
Residuals (error)	156	5.636	0.0361		
Total		159	7.013		
Replications	(40)				

$F < 0.01$ (3, 150 df) = 3.91

Table 2: Means of the various treatments applied and their LSD showing which means differ from the other.

Parameter	Bark (B)	control (C)	Leaf (L)	Seed (S)
Means	0.9613	1.1613	1.0275	0.9150
Grand mean = 1.01625				
SED = 0.0425				
LSD = 0.084611 at *p* = 0.05				
Replication = 40				

Differences between means: B vs C =0.2*, B vs L = 0.07 (NS), B vs S = 0.05 (NS), C vs L = 0.13*, C vs S = 0.25*, L vs S = 0.11*

KEY: df = degree of freedom, ss = sum square, ms = mean square, B = bark, C = control, L =leaf, S = seed, SED = standard error of difference, LSD = least significant difference, NS = not significant, ***** = significant

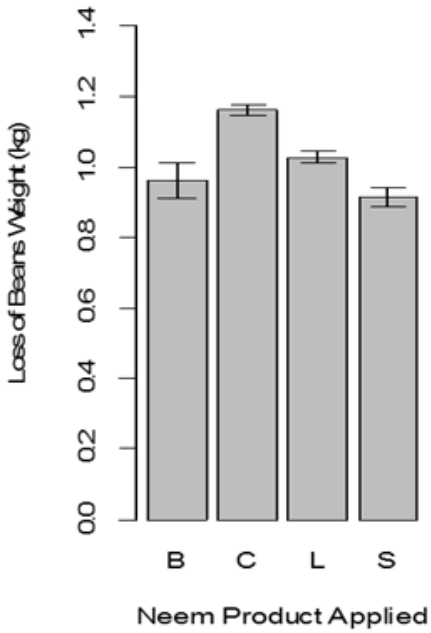

Figure 1: Weight loss in beans after the application of various neem products and error bars indicate the degree of normality or dispersion of the data.

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