

**THE EFFECT OF SOME BOTANICALS IN THE PRESERVATION OF SOME COWPEA
(*VIGNA UNGUICULATA* L. WALP) VARIETIES AGAINST WEEVILS
(*CALLOSOBRUCHUS MACULATUS*) DURING STORAGE**

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Abstract

A study on the effect of some botanicals in the preservation of some cowpea (*Vigna unguiculata*) varieties against weevils (*Callosobruchus maculatus*) during storage was carried out. The botanicals used included powdered bitter leaves, neem leaves and pepper leaves. Experimental design used was Completely Randomized Design (CRD) with three replicates. Data analysis was carried out using Analysis of Variance (ANOVA). The results obtained indicated a significant difference between cowpea varieties in their levels of resistance to *Callosobruchus maculatus* attack during storage. Aloka variety recorded the least weight loss with a value of (93.75g). The next was medium white (96.43g) then small white (98.82g), iron beans (99.87g) and finally Ife brown recorded (101.83g) and it also gave the highest weight loss against *Callosobruchus maculatus*. All botanicals used were also effective in the preservation of *Vigna unguiculata* against *Callosobruchus maculatus* but bitter leaves gave the best protection and the least was pepper leaves. The results of this work have shown that bitter leaves and neem leaves can be used as good control measures to reduce the damage done to cowpea by *Callosobruchus maculatus* during storage instead of using synthetic chemicals with their attendant hazards to the users and the environment. Therefore it is recommended that the cowpea users should promote and support the development and use of plant materials in the storage of cowpea seeds against *Callosobruchus maculatus* particularly the use of bitter leaves.

Introduction

Cowpea, *Vigna unguiculata* (L.) belongs to the family *Leguminosae* which is grown and consumed for its high protein content (23-25%) and contribute significantly to farm income (Ogbaji, 2002). In Nigeria, cowpea is grown extensively in intercrops with maize, millet, sorghum, yam or sometimes grown in rotation with cotton. The production of cowpea is estimated at about 700,000 to 800,000 tonnes annually (Ansa and Booth, 1978). Over 80 percent of the crop is grown in the savannah region of Northern Nigeria (Raheja, 1976). The high productivity of the crop in Northern Nigeria has been attributed to equitable climatic conditions.

All parts of the cowpea plants provide food for man and livestock (Lush, 1978). The grains contain 24% protein, 62% carbohydrates and small amount of other nutrients (Ebong, 1965). It is commonly eaten as boiled and spiced whole grains, spiced and fried paste (akara), steamed paste (moin-moin) or as bean soup. In East Africa, the tender leaves are periodically plucked and consumed fresh or cooked as a side dish to the staple maize meal.

Cowpea suffers considerable damage in storage due to attack by bruchids. Booker (1967) identified three species of bruchids infesting stored cowpea in Nigeria, namely, *Callosobruchus maculatus*, *Callosobruchus rhodesianus* and *Bruchidius atrolineatus*. *Callosobruchus maculatus* is the dominant pest, persisting longer in stored cowpea than *C. rhodesianus* and *B. atrolineatus* (Booker, 1967). *Callosobruchus maculatus* has been reported to cause 10% weight loss within 6 weeks and the loss of market and seed value of stored cowpea (IITA, 1989). For the reduction of *Callosobruchus maculatus* population and damage, there is heavy reliance on synthetic insecticides (e.g. phosphine, phostoxin) (Caswell and Akibu, 1980).

Cowpea cannot be stored profitably without taking appropriate measures to control insect. However, many insects have developed resistance to synthetic chemicals (Ogbaji and Osuman, 2011). Apart from the resistance of insects to the synthetic chemicals, first, they find the required inputs (insecticides and sprayers) costly, and secondly, they lack the necessary skill to safely apply the insecticides.

For the storage of cowpea as seeds and grains, traditional storage systems rely on the use of pepper. Information on the scientific testing of the effectiveness of pepper in the preservation of cowpea abounds in the literature (Dugje *et al.*, 2008). However information on the performance of other botanicals in Benue State is still scanty. There is therefore, the need to further investigate the effectiveness of some other botanicals and their forms in the control of cowpea against *C. maculatus*. Hence the objective of the study was to investigate the effectiveness of powdered bitter leaves, neem leaves and pepper leaves in the control of the insect pest during cowpea storage.

Materials and Methods

The experiment was conducted in the Botany laboratory of the Benue State University Makurdi between 12th of July to October, 2013. The materials used were five varieties of cowpea, plastic airtight containers, three plant products and weighing balance. The five different cowpea varieties were used included TVu 3629 (Ife brown), Aloka, big brown, IT87F-ITT2-2 (big white), medium white and iron beans (small white). These were all obtained from the Wurukum market in Makurdi Benue state. The different cowpea varieties were sorted out to remove, perforated and undersized seeds and was then sundried for two weeks to allow *Callosobruchus maculatus* escape. Sun drying, continued until there was cessation of reproduction to ensure that all the immature stages had been hatched. After sun drying the cowpea seeds were then stored in airtight plastic containers. Each variety had three replicates and a control.

The plant botanicals used were fresh leaves of Neem leaves (Dogonyaro) pepper leaves and bitter leaves (*Vernonia amygdalina*) and these were obtained from different locations. The pepper was obtained from Tser AGOOM Kasar village at Tombu in Buruku local government, the bitter leaves were gotten from Wurukum market and the Neem leaves were gotten in the school Benue state university. The botanicals were then sundried for two weeks to remove the moisture. They were then pounded in a mortar into powdery form.

Deep and colored containers with transparent plastic covers were used for the storage of the materials. The central portion of each cover was perforated using a stainless pin of 0.5mm diameter with five holes. This was done in order to allow aeration and breeding of *Callosobruchus maculatus*.

Equal quantity of the plant materials (50 g) of each test plant (Neem leaves, bitter leaves and pepper leaves) as recommended were measured with a digital sensitive weighing balance and 500g of seeds of each of the cowpea varieties were also measured and both were mixed into a litre size flat bottom colored plastic container. The experimental design used was a factorial laid out in a Completely Randomized Design (CRD) with three replications. They were then stored at the botany laboratory of Benue State University Nigeria at room temperature.

The weight of the containers was first taken and recorded and the weights of the plant botanicals were also taken. The data collected were progressive weight loss of the cowpea varieties at two weekly intervals. The weight loss measured was measured using a digital sensitive weighing balance. The mean weight of the cowpea variety was also determined at two weekly intervals. Percentage weight loss was calculated as follows: $\text{weight loss}/\text{initial weight} \times 100/1 = a-b/ax100/1$. For each variety, the percentage weight loss was calculated for the variety at two weekly intervals during the experimental period. From the initial weight, the mean percentage weight reduction of the cowpea varieties was also calculated.

Collected data was analyzed using Analysis of Variance (ANOVA). Treatment means were separated using Fishers Least Significant Difference at 5% level of significance.

Results and Discussion

Table 1 below shows main effects of varieties and botanicals on actual weight loss (grams) of Cowpea Seeds during Storage. From this research result, Aloka resisted *Callosobruchus maculatus* attack most during weeks of storage recording the least actual weight reduction of 93.75g during the entire storage period when compared with the control. Next was medium white which recorded actual reduction of 96.43g then small white which gave 98.82g then iron beans 99.87 and lastly Ife brown which recorded the highest weight reduction of 101.83g. Significant differences also existed among the botanicals used. Bitter leaf recorded the best preservative against weevils giving the overall cowpea varietal weight reduction of 89.50g followed by neem (94.17g) and then pepper leaf (96.86g).

The percentage weight loss of the different cowpea varieties (Table 2) also followed similar pattern as in Table 1. Aloka Cowpea variety resisted *C. maculatus* attack most thereby giving the least percentage reduction of 5.48%, iron beans (6.82 %) and then Ife brown (6.84 %). The interaction between cowpea varieties and botanicals was also significant (Table 3). While the percentage interactive effects between interactive effects between cowpea varieties and botanicals (Table 4) also followed similar trend and were significantly different from each other.

The results of this study have shown that some botanicals can offer good control just like synthetic chemicals in the control of *C. maculatus* particularly their forms of preparation. Importantly, the significant interaction between cowpea varieties and botanicals has indicated that more efficiency will be achieved with proper combination between the cowpea varieties and the botanicals. Similar results had earlier been reported by Ogbaji and Osuma (2011), Ebiamadon *et al.* (2011) and Ivbijaro and Agbeje (1986).

Based on the experimental result of this research work, the use of bitter leaves is most effective in the storage of cowpea against *Callosobruchus maculatus*. Therefore we recommend that the world at large should promote and support the development and efficient plant materials in the storage of cowpea seeds against *Callosobruchus maculatus* particularly the use of bitter leaf.

We also recommend that more research work should be carried out using other plant materials as there are still numerous plants which are yet to be tested and may even possibly give greater control to the damage of *Callosobruchus maculatus* on cowpea seeds. Farmers and consumers should be aware that the use of plant materials does not cause harm to both humans and the environment, the bitter leaf and neem leaf in addition also serve medicinal purposes to humans.

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Table 1: Main Effects of Varieties and Botanicals on Actual weight loss (grams) on some varieties of Cowpea during Storage.

Varieties	Weeks of Storage						
	2	4	6	8	10	12	14
Aloka	586.66	581.01	579.22	573.41	568.36	562.44	456.25
Medium White	585.77	580.55	577.42	571.95	566.30	559.92	453.57
Ife Brown	586.20	580.22	574.64	568.05	561.96	554.88	448.17
Iron Beans	587.73	581.52	577.95	571.77	563.90	557.22	450.18
Small White	587.09	583.51	578.85	573.19	565.11	557.03	451.18
S. E.	0.83	1.52	2.88	2.47	2.55	2.83	2.54
L.S.D (5%)	0.68	4.32	4.55	2.04	2.11	2.34	5.10
C. V (%)	0.1	0.1	0.3	0.4	0.5	0.5	0.5
Botanicals							
Bitter leaf	599.10	593.56	589.34	583.34	575.82	567.98	460.50
Neem leaf	598.97	592.73	588.56	580.51	572.22	563.32	455.83
Pepper leaf	597.39	591.58	584.40	576.70	569.13	561.44	453.14
Control	551.28	549.21	548.16	546.16	543.34	540.44	537.97
L.S.D (5%)	0.61	4.92	2.39	1.82	2.88	2.09	4.87

Table 2: Percentage Weight Loss (%) of Some Varieties of Cowpea and Botanicals During Some Weeks of Storage.

Varieties	Weeks of Storage						
	2	4	6	8	10	12	14
Aloka	0.38	0.91	1.63	2.60	3.44	4.44	5.48
Medium White	0.49	1.12	1.93	2.82	3.79	4.89	5.95
Ife Brown	0.44	1.21	2.39	3.50	4.52	5.71	6.84
Iron Beans	0.54	1.31	2.17	3.20	4.52	5.69	6.82
Small White	0.63	1.30	2.01	2.95	4.31	5.66	6.64
S. E.	0.11	0.15	0.30	0.41	0.42	0.49	0.44
L.S.D (5%)	0.09	0.12	0.25	0.34	0.34	0.40	0.36
C. V (%)	22.3	12.4	15.0	13.5	10.2	9.3	7.0
Botanicals							
Bitter leaf	0.443	1.157	2.065	3.062	4.311	5.609	6.856
Neem leaf	0.500	1.398	2.230	3.566	4.944	6.421	7.666
Pepper leaf	0.776	1.647	2.933	4.213	5.470	6.793	8.125
Control	0.260	0.0480	0.874	1.216	1.733	2.281	2.733
L.S.D (5%)	0.08	0.11	0.23	0.30	0.31	0.36	0.33

Table 3: Interactive Effect of Varieties and Botanicals on weight loss of Some Varieties of Cowpea during Storage

Varieties	Botanicals	Weeks of Storage						
		2	4	6	8	10	12	14
Aloka	Bitter leaf	598.72	595.12	591.92	584.89	580.14	580.14	469.01
	Neem leaf	599.33	593.32	589.08	581.48	574.54	574.54	455.78
	Pepper leaf	597.70	590.21	587.23	579.95	573.67	573.67	459.42
	Control	450.88	447.69	448.64	447.32	445.09	445.09	440.78
Medium White	Bitter leaf	598.67	596.35	590.34	587.01	584.06	577.40	469.11
	Neem leaf	598.25	597.38	589.36	581.34	572.39	564.78	458.83
	Pepper leaf	597.86	593.81	584.39	576.48	568.56	559.97	451.16
	Control	448.29	443.32	445.58	442.98	440.18	437.51	435.20
Ife Brown	Bitter leaf	599.03	590.32	587.85	580.56	571.42	562.71	455.74
	Neem leaf	597.93	587.11	587.70	580.05	571.20	562.71	452.75
	Pepper leaf	595.77	580.25	574.45	574.45	561.48	554.73	447.75
	Control	452.05	447.02	448.55	448.55	443.73	439.35	436.45
Iron Beans	Bitter leaf	600.50	597.22	587.35	580.89	572.72	565.12	451.10
	Neem leaf	600.94	590.11	589.71	580.83	571.47	561.15	458.89
	Pepper leaf	599.23	586.02	588.18	581.23	570.44	562.35	453.95
	Control	450.23	443.51	446.56	444.12	440.99	439.24	436.58
Small White	Bitter leaf	598.59	595.71	589.25	583.37	570.74	560.70	457.56
	Neem leaf	598.43	592.90	586.94	578.86	571.48	560.48	452.92
	Pepper leaf	596.38	589.52	587.74	580.58	571.49	563.35	453.41
	Control	454.95	450.41	451.45	449.95	446.72	443.61	440.84
L.S.D(5%)		1.37	3.18	3.09	4.07	4.21	4.67	5.19

Table 4: Percentage Interactive Effect of Varieties and Botanicals on weight loss of Some Varieties of Cowpea during Storage

Varieties	Botanicals	Weeks of Storage						
		2	4	6	8	10	12	14
Aloka	Bitter leaf	0.31	0.72	1.44	2.61	3.40	4.43	4.26
	Neem leaf	0.39	1.12	2.09	3.35	4.50	5.67	6.62
	Pepper leaf	0.65	1.42	2.39	3.60	4.64	5.95	6.01
	Control	0.18	0.37	0.59	0.83	1.23	1.70	2.01
Medium White	Bitter leaf	0.43	1.09	1.82	2.37	2.86	3.97	5.35
	Neem leaf	0.53	1.10	2.01	3.35	4.83	6.10	6.09
	Pepper leaf	0.60	1.57	2.84	4.15	5.47	6.90	8.36
	Control	0.39	0.72	1.06	1.41	1.98	2.59	3.00
Ife Brown	Bitter leaf	0.25	0.96	2.11	3.33	4.85	6.27	7.46
	Neem leaf	0.36	1.55	2.07	3.34	4.82	6.23	7.89
	Pepper leaf	0.80	1.74	4.35	5.88	6.61	7.63	8.79
	Control	0.34	0.57	1.04	1.45	1.91	2.70	3.22
Iron Beans	Bitter leaf	0.62	1.78	2.80	3.86	5.22	6.47	8.80
	Neem leaf	0.53	1.50	2.38	3.85	2.40	7.11	7.489
	Pepper leaf	0.823	1.64	2.66	3.81	5.59	7.00	8.32
	Control	0.18	0.35	0.85	1.29	1.86	2.18	2.66
Small White	Bitter leaf	0.61	1.23	2.17	3.14	1.86	6.91	7.43
	Neem leaf	0.69	1.72	2.599	3.94	5.24	7.00	8.24
	Pepper leaf	1.01	1.87	2.44	3.63	5.17	6.49	8.14
	Control	0.20	0.39	0.83	1.10	1.54	2.24	2.77
L.S.D(5%)		0.18	0.24	0.51	0.68	0.69	0.81	1.73