COMPARATIVE EFFICACY OF TOBACCO LEAVE POWDER AND ACTELLIC DUST FOR THE CONTROL OF COWPEA WEEVILS, *(Callosobruchus maculatus)*

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ABSTRACT

Experiments were conducted at the Agronomy Laboratory of Cereal Department, Lake Chad Research Institute, Maiduguri Borno State. The objectives of the experiments were to determine the efficacy of different concentrations of tobacco plant products and compare their performances with actellic dust in controlling cowpea weevil (Callosobruchus maculatus F.) on stored cowpea grain (Vignia unguiculata Walp.). Both the plant products and actellic dust were tested at the concentrations of 1, 2, and 3g per 100g of cowpea grain. The experiments were laid down in a completely Randomize Design (CRD) and each treatment was repeated three times. Damage was assessed based on number of adult cowpea weevil mortality, number of eggs laid and damaged (holes) caused by C. maculatus on the cowpea grain in each treatment. The result of the research revealed that, all the three application rates (1, 2 and 3g) of the plant products and synthetic treatments were significantly (P=0.05) better than the control treatment in causing mortality of adult weevils, reduced number of eggs laid and decreased number of holes made on the grains. However, 3g actellic dust was the most effective treatment followed by 2g actellic dust, 1g actellic dust and 3g tobacco leave powder. Therefore based on the findings of this research, application of 3g of tobacco leave powder on 100g of cowpea grain is recommended for maximum protection of cowpea grain against damage by C. maculatus in storage.

Keywords: Tobacco leaves powder, Actellic dust, “kanannado”,Cowpea weevils *(C. maculatus)* and oviposition.

INTRODUCTION:

Cowpea (*V. unguiculata* (L.) Walp.) is one of the most widely adopted, versatile and nutritious legumes (Ethlers and Halla, 1997). The crop belongs to the family leguminiseae and is one of the most important grain legume grown in West Africa. It is an annual crop which matures within 3–4 months from planting to harvesting and produce large qualities of yield on good soil under appropriate rainfall areas. It is one of the major cash crops particularly in the Northern part of Nigeria (Doughty, 1990) and is consumed by humans since the beginning of Agriculture in developing countries like Africa, Asia and Latin America, where it is specially valued as a good source of protein, vitamins and minerals (Singh *et al*., 2003). The crop is rich in protein and contains many other nutrients, it is popularly known as vegetable meat (Singh *et al*., 2005). Beside providing the cheapest source of protein, it is also a good source of carbohydrate (56.8%), calcium (0.23%), iron (1.8%), vitamin B (1.2%) and carotene (1.3%) (Oyenugu, 1987).

It is widely eaten in various forms; as boiled whole beans (“ewa”), mixed with corn, rice or millet (“adalu”), ground and fried into beans cakes (“akara”), or steam moulded in tins (“moimoi”) (Phillips, 1977).

increased production of the grain is being adversely affected by both biotic and abiotic factors. Insects pressure constitute the most significant biotic factor militating against increased prod uction of the crop. The cowpea weevil *C. maculatus* is known to be the the most dangerous insect pest of cowpea grain and its control is heavily dependent on the use of synthetic chemical pesticides like actellic dust, post toxin (bomb) etc. However, these synthetic chemical pesticides have proved to be toxic to our health, expensive to buy and in turn pollute our environment. Furthermore, it was considered vital and desirable to search for an alternative method of protecting grains (cowpea seed) which are environment friendly and cheap. Particular interest was focused on the use of plant products(Tobacco leave powdered) in controlling the menance of cowpea weevil on cowpea grains. The method has prooved to be environmentally friendly, in-expensive and not toxic to our health. The current research is designed to evaluate the effectiveness/ efficacy of different concentrations of tobacco leaf powders in controlling the menance of *C. maculatus* on cowpea grains.

RESEARCH METHODOLOGY:

The experiment was conducted at the Agronomy Laboratory of Cereal Programmes, Lake Chad Research Institute (L.C.R.I), Maiduguri, Borno State. Maiduguri is located on latitude 115 ^{0}N and longitude 135 ^{0}E. The experiment which comprises of 1, 2 and 3grammes (gs) of tobacco leaf powder and actellic dust together with control was laid down in Completely Randomize Design (CRD). Certain quantity of highly infested cowpea grain was purchased and cultured stocks were transferred into an earth pot (clay pot) containing 1kg of un-infested cowpea grains ('Kananado'). The clay pot was then covered with fine mesh cloth (white transparent cloth) and secured firmly with rubber band. The stock was maintained at temperature of 28 ^{0}C + 2 ^{0}C and 71% + 2% relative humidity (R.H) for ten (10) days. After 10 days, the 100 adult *C. maculatus* introduced into the earth pot were removed which in turn gives rise to the emergence of new F1 generation (experimental insects) . The experimental insects (F1 generation) were used in carrying out the experiments.

The set-up consists of 7 treatments and 21 repeatitions. Measured quantity of 100g of un-infested cowpea grain ("Kanannado") was initially transferred into each of the transparent plastic cups and different application rates (1g, 2g and 3g) of tobacco leaf powder and Actellic dust were transferred. Each treatment was repeated three (3) times. However, the control was prepared without tobacco leaf and or Actillic dust. Ten (10) numbers of Cowpea weevil, *C. maculatus* were introducedto each of the transparent plastic cup. These were thereafter shaken thoroughly to ensure equal distribution of the treatments and the weevils (*C. maculatus*). Data were recorded on adult mortality, number of eggs laid and grain damage.

The adult mortality and number of Eggs laid by C. maculatus was collected by counting the number of dead weevils/eggs laid in each translucent plastic cups after exposure to treatment. (Asawallam and Arukwe, 2004; Jembere *et al.,* 1995). Percentage Grain damage was assessed on the 100g of uninfested Cowpea grain from each transparent plastic cups by counting the number of holes or attacked embryo from each jar. Data were recorded on weekly basis for about 12weeks and the percentage grain damage was calaculated using the formular recommended by Adedire and Ajayi (1996) ;

$$\text{Percentage Grain Damage} = \frac{G1}{G2} \times 100$$

Where, G1 = Number of grain with hole or attacked embryo

G2 = Total number of the randomly selected grain

All the data collected were subjected to analysis of variance (ANOVA) using computer software (SPSS 16.0 for windows) statistical package. Significant treatment means were separated using Student Newman Keuls (SNK) test.

RESULT AND DISCUSSION:

Effect of Different Treatments on Adult Mortality of *C. maculatus* on Stored Cowpea Grain

Data presented in Table 1 are effects of various treatments (Tobacco leaves powdered and synthetic chemical - actellic dust) on mortality of *C. maculatus.* The data shows that all the tested different application rates (1g, 2g and 3g) of the various treatments were significantly better than the control treatment throughout the period of observation (1 to 12WAT).

When the efficacy of plant products and synthetic treatments were compared at 1WAT, 3g, 2g, and 1g of actellic dust gave the highest mortality records of 3.67b, 3.00ab, and 2.87ab, respectively. Lowest mortality were observed in 1g (2.33ab), 2g (2.67ab), and 3g (2.67ab) of tobacco leaves powdered treatments. The order of increase in mortality records was as follows 3g actellic dust(3.67b) > 2g actellic dust (3.00ab) > 1g actellic dust(2.87ab) > 3g tobacco leaves powdered(2.67ab) > 2g tobacco leaves powdered(2.67ab) > 1g tobacco leaves powdered(2.33ab).

Similarly, when the plant products and synthetic treatments were compared and evaluated at 2 weeks after treatment application, lowest mortality rate was obtained in 1g tobacco leaves powdered (4.00b) and highest mortality was observed in 3g actellic dust (8.67d). However, there was no significant difference between 2g tobacco leave powdered, 3g tobacco leaves powdered and 1g actellic dust.

Statistical analysis of the data obtained at 3WAA shows that mortality ranges from 10.00e in 3g actellic dust to 5.00ab in tobacco leaves powdered. Mortality recorded/observed in control treatment was 4.67a and was significantly lower than all the other plant product and synthetic treatments. Treatments with significantly higher mortality were 3g actellic dust (10.00e), 2g actellic dust (9.33de) and 3g tobacco leaves powdered (8.33cde).

At 4 weeks after treatment application, 3g actellic dust treatments (1g, 2g and 3g) were significantly better than the remaining plant product treatments. Highest mortality of 10.33c was observed in 3g actellic dust treatment while 1g tobacco leaves powdered provided the lowest mortality rate of 7.67ab. However, they were all significantly better than control treatment.

At the completion of statistical analysis 5 weeks after treatment application, shows that all the treatment plant products and synthetic treatments were significantly better than control treatments. However, the highest rate of adult mortality of 10.67a was observed in 2g actellic dust while lowest mortality record of 9.33a and 9.33a were observed in 1g tobacco leaves powdered and control treatments, respectively.

Based on the effectiveness of various concentrations of plant products and synthetic products, 3g actellic dust was observed with highest mortality of 11.67a and 1g tobacco leaves powdered was observed with lowest mortality of 10.00a which happens to be statistically the same with 2g tobacco leaves powdered, 3g tobacco leaves powderd and control at the 6WAT.

Data obtained 7WAT shows that, no significant difference exist among the treatments. Significantly higher adult mortality of *C. maculatus* was observed in 3g actellic dust 13.33a with least mortality record of 11.67a and 10.33a in 1g tobacco leaves powder and control respectively.

At 8WAT, highest mortality of 18.67c was recorded in 3g actellic dust and the lowest mortality of 12.00a was obtained in 2g tobacco leaves powder. There was no significant difference between 1g tobacco leaves powder 12.33a, 2g tobacco leaves powder 12.00a, 3g tobacco leaves powder 13.00a and control 12.67a.

Statistical analysis of the data at 9, 10, 11 and 12WAT shows that there was significant difference between the various concentrations of the treatments. However, at 9WAT, lowest mortality rate was obtained in 1g tobacco leaves powder 14.00a followed by 2g tobacco leaves powder 15.33a and 3g tobacco leaves powder 17.33b. High mortality of *C. maculatus* was observed in 3g actellic dust 25.00e.

Table 1: Effects of plant products and synthetic chemicals (Actellic dust) on adult mortality of *C. maculatus*

Treatments	Mortality after											
	1wk	2wk	3wk	4wk	5wk	6wk	7wk	8wk	9wk	10wk	11wk	12wk
Tobacco leaves powder (1g)	2.33ab	4.00b	5.00ab	7.67ab	9.33a	10.00a	11.67a	12.33a	14.00a	16.00a	18.67a	21.00a
Tobacco leaves powder (2g)	2.67ab	5.00bc	6.67abc	9.00abc	10.00a	10.00a	11.67a	12.00a	15.33a	18.33b	21.67b	25.00b
Tobacco leaves powder (3g)	2.67ab	6.00bc	8.33cde	10.00bc	10.00a	11.00a	11.00a	13.00a	17.33b	20.67c	24.33c	28.00c
Actellic dust (1g)	2.67ab	5.33bc	7.33bcd	9.00abc	10.00a	10.00a	11.67a	15.33b	19.00c	22.67d	26.33c	29.33c
Actellic dust (2g)	3.00ab	7.33bc	9.33de	10.00bc	10.67a	10.67a	12.00a	16.67b	22.00d	25.67e	29.00d	32.00d
Actellic dust (3g)	3.67b	8.67d	10.00e	10.33c	10.33a	11.67a	13.33a	18.67c	25.00e	28.33f	31.67e	36.00e
Control	1.33a	1.67a	4.67a	7.00a	9.33a	10.00a	10.33a	12.67a	15.33a	15.67a	17.33a	18.67a
S.E	0.03	0.07	0.07	0.05	0.02	0.03	0.04	0.08	0.12	0.14	0.16	0.18
L.S	*	*	*	*	NS	NS	NS	*	*	*	*	*

Means within a column followed by the same letters are statistically not significant at P = 0.05% from each other using Student Newman Keul (SNK) test.
* = Probability level at 0.05%
WK = Weeks
NS = Not Significant

Effect of Tobacco leaves powdered and Actellic dust on Oviposition of *Callosobruchus maculatus* (F.) on stored Cowpea grain ('Kanannado')

Table 2 consist of result accessed on differevt concentrations of treated and untreated Cowpea grain against insecticidal activity (Number of eggs laid) of *C.maculatus*. Throughout the period of the observation (1 to 12WAT), the result shows that all the treatments gave better result than control.

Treating Cowpea grain with 3g and 2g application of Actellic dust drastically reduces the rate of egg laid by *C. maculatus* at 1WAT. The result shows that the effective (18.00a) and less effective (325.00e) treatments observed for the reduction in number of eggs laid by *C. maculatus* were 3g Actellic dust and 1g Tobacco leaves powdered respectively. However, 1g Actellic dust (68.33c) and 3g Tobacco leaves powdered (76.66c) were recorded to be not significantly different.

After the statistical analysis of the data, 2WAT, the result recommends that, least number of eggs laid by *C. maculatus* (25.33a) was obtained in 3g Actellic dust while the highest record of 425.00f was observed in 1g Tobacco leaves powdered.

3WAT, the comparism of plant and synthetic product indicates that, no significant difference exist between 1g Actellic dust (123.66c) and 3g Tobacco leaves powdered (130.66c). The highest performance of *C. maculatus* on eggs laid was determined in 1g Tobacco leaves powdered (492.00e) and it's lowest performance was observed in 3g Actellic dust (32.00a).

Statistical analysis of the result at 4, 5and 6WAT shows that there was significant difference between the various concentrations of the treatments. However, in each of the weeks (4, 5 and 6), higher and lower oviposition rates were recorded as; 515.00f, 563.33f, 611.33f and 40.00a, 50.66a, 60.33a respectively and also, no significant difference exit between 1g Tobacco leaves powdered (563.33f) and control (566.66f) at the 5th week.

At 7WAT, highest number of eggs laid was observed in 1g Tobacco leave powder (647.33f), and there were significant differences among the treatments. However, lowest number of eggs laid were observed in 3g Actellic dust (64.33a), 2g Actellic dust (147.67b), 1g Actellic dust (276.00c) and 3g Tobacco leaves powder (287.00d).

Result of statistical analysis of the data at 8WAT indicated that, 3g Actellic dust was the most effective among all the treatments with lowest number of oviposition of 71.66a while 2g Tobacco leave powder and 1g tobacco leave powder were least effective with highest number of eggs laid of 611.67e and 695.33f respectively. However, at 9WAT, 3g Actellic dust was significantly better than the remaining plants and synthetic treatments with lowest number of eggs laid of 73.67a, the remaining treatments also gave significantly lower number of eggs laid when compared with the control.

Number of eggs laid by *C.maculatus* ranged from 790.00g in control to 77.00a in 3g actellic dust at 10WAT. Significantly higher number of eggs laid were obtained in control and 1g tobacco leaves powder while significantly lower number of eggs laid were found in 3g actellic dust, 2g actellic dust and 3g tobaccco leaves powder.

Similarly, statistical analysis of data at 11WAT showed that lowest number of eggs laid was obtained in 3g actellic dust (79.00a) while the highest number of eggs laid was obtained in 1g tobacco

leaves powder (798.33f) which was significantly different with the control (832.67g). This was followed by 2g tobacco leaves powdered (731.67e) and 3g tobacco leaves powdered (438.33d) which were statistically greater than 1g actellic dust (408.67c) and actellic dust (228.00b).

At 12WAT, 3g actellic dust was the most effective among the plant product treatments with least number of eggs laid of 79.33a while 1g tobacco leaves powder gave the highest number of eggs laid of 803.00f which was significantly different from the control (865.33g). the result also shows that there were significant different among all the treatments.

Table 2: Effects of plant products and synthetic chemicals (Actellic dust) on Number of Eggs laid by *C. maculatus*

Treatments	Number of Eggs laid After											
	1wk	2wk	3wk	4wk	5wk	6wk	7wk	8wk	9wk	10wk	11wk	12wk
Tobacco leaves powder (1g)	325.00e	425.00f	492.00e	515.00f	563.33f	611.33f	647.33f	695.33f	747.33f	766.33f	798.33f	803.00f
Tobacco leaves powder (2g)	154.33d	218.33e	252.66d	338.00e	372.33e	461.00e	532.67e	611.67e	664.33e	692.67e	731.67e	737.00e
Tobacco leaves powder (3g)	76.66c	108.00d	130.66c	172.33d	199.66d	238.66d	287.00d	337.67d	391.00d	421.67d	438.33d	442.00d
Actellic dust (1g)	68.33c	98.00c	123.66c	159.66c	191.33c	226.00c	276.00c	326.67c	351.67c	390.00c	408.67c	411.00c
Actellic dust (2g)	33.33b	48.66b	60.66b	80.00b	99.00b	120.33b	147.67b	179.00b	194.33b	219.67b	228.00b	228.00b
Actellic dust (3g)	18.00a	25.33a	32.00a	40.00a	50.66a	60.33a	64.33a	71.66a	73.67a	77.00a	79.00a	79.33a
Control	350.00f	466.00g	518.00f	534.33g	566.66f	622.66g	668.67g	705.67g	748.67f	790.00g	832.67g	865.333g
S.E	4.07	5.32	5.93	5.98	6.27	6.81	7.13	7.53	8.04	8.23	8.68	8.90
L.S	*	*	*	*	*	*	*	*	*	*	*	*

Means within a column followed by the same letters are statistically not significant at P = 0.05% from each other using Student Newman Keul (SNK) test.
* = Probability level at 0.05%
WK = Weeks
NS = Not Significant

Effect of Tobacco leaves powdered and Actellic dust on Percentage Grain damage caused by *C. maculatus*

Table 3 shows the damage done to treated and untreated Cowpea grains (kanannado) by cowpea weevils (*C, maculatus*). The analysed data shows that there were significant difference among the plant and synthetic treatments over the control in reducing damage caused by *C. maculatus* throughout the period of observation (1 to 12WAT).

Statistical analysis of data at 1WAT shows that, higher grain damage was observed in 1g tobacco leaves powdered followed by 2g tobacco leaves powdered, 3g tobacco leaves powdered and 1g actellic dust with recorded damages of (84.00e), (42.33d), (19.33c) and (9.00b) respectively while lowest grain damage of (0.00a) and (0.00a) was obtained in 3g actellic dust and 2g actellic dust.

At 2WAT, 3g actellic dust was significantly better than the remaining treatments with lowest grain damage of 0.00a. 1g tobacco leaves powdered gave the highest grain damage of 121.33e with other treatments arrranged in ascending order of efficacy of grain damage as; control (143.00f), 2g Tobacco leaves powdered (60.66d), 3g Tobacco leaves powdered(29.00c), 1g Actellic dust (18.33b and 2g Actellic dust (5,33a).

Treating Cowpea grain ('kanannado') with 3g, 2g and 1g concentrations of synthetic product drastically reduces the rate of damage done to the grain by *C. maculatus* at 3WAT. The result shows that 3g actellic dust, 2g actellic dust and 1g actellic dust with grain damage of 0.00a, 9.67b and 26.33c respectively were significantly better than 3g tobacco leaves powdered, 2g tobacco leaves powdered and 1g tobacco leaves powdered with grain damage of 48.33d, 98.67e and 191.00f respectively.

At 4WAT statistical analysis of the data shows that highest grain damage of 218.66f was obtained in 1g tobacco leaves powdered and the lowest grain damage of 1.33a was recorded in 3g actellic dust. The order of increase in grain damage was as follows: 1g tobacco leaves powder, (218.67f), 2g tobacco leaves powdered (112.33e), 3g tobacco leaves powdered (55.00d), 1g actellic dust (28.66c) and 2g actellic dust (9.66b).

At 5WAT, 3g actellic dust was the most effective among the treatment with least grain damage of 4.67a while 1g tobacco leaves gave the highest grain damage of 268.00f.

Similarly, the activities of the Cowpea weevil (*C. maculatus*) at 6 WAT shows that, least record of damage was recorded in 3g Actellic dust (6.00a) while highest result was obtained in 1g Tobacco leaves powdered (321.66f). However, all the treatments were significantly different from each other from the result.

Statistical analysis of the data at 7, 8, 9 and 10WAT shows that, there was significant difference between the various application rates of synthetic chemicals and plant products. However, treating cowpea ("kanannado") with 3g actellic dust, 2g actellic dust, 1g actellic dust and 3g tobacco leaves powder drastically reduce the rate of damage done to the grain by *C.maculatus* at 11WAT. The result shows that 3g actellic dust, 2g actellic dust and 1g actellic dust with grain damage of 16.67a, 29.00b, 79.00c and 205.67d respectively were significantly better than 2g tobacco leaves powder, 1g tobacco leaves powder and control with grain damage of 376.00e, 428.33f and 436.00g respectively.

At 12WAT,3g actellic dust was the most effective among all the treatments with least damage of 16.67a while 1g tobacco leaves powder gave the highest grain damage of 437.00f which is significantly different from the control (448.33g)

Table 3: Effects of plant products on Grain Damage

Treatments	Grain Damage After											
	1wk	2wk	3wk	4wk	5wk	6wk	7wk	8wk	9wk	10w	11wk	12wk
Tobacco leaves powder (1g)	84e	121.33e	191.00f	218.67f	268.00f	321.66f	366.67f	384.33f	399.67f	411.33f	428.33f	437.00f
Tobacco leaves powder (2g)	42.33d	60.67d	98.67e	112.33e	131.67e	158.67e	318.67e	336.00e	353.00e	368.00e	376.00e	386.33e
Tobacco leaves powder (3g)	19.33c	29.00c	48.33d	55.00d	65.67d	81.67d	157.00d	169.67d	184.67d	193.67d	205.67d	220.67d
Actellic dust (1g)	9.00b	18.33b	26.33c	28.67c	32.00c	43.33c	56.00c	61.00c	70.00c	73.33c	79.00c	84.33c
Actellic dust (2g)	0.00a	5.33a	9.67b	9.67b	11.67b	14.67b	17.67b	19.67b	24.33b	26.33b	29.00b	30.00b
Actellic dust (3g)	0.00a	0.00a	0.00a	1.33a	4.67a	6.00a	9.67a	12.66a	16.00a	16.33a	16.67a	16.67a
Control	103.33f	143.00f	201.67g	231.67g	277.00g	338.00g	376.67g	388.67g	404.67g	425.00g	436.00g	448.33g
S.E	1.23	1.70	2.50	2.87	3.46	4.16	4.89	5.06	5.21	5.42	5.56	5.69
L.S	*	*	*	*	*	*	*	*	*	*	*	*

Means within a column followed by the same letter are statistically not significant at P = 0.05% from each other using Student Newman Keul (SNK) test.
* = Probability level at 0.05%
WK = Weeks
NS = Not Significant

RECOMMENDATION

The result indicated that, there was significant difference between plant product treatment over the control throughout the period of the experiment (1 – 12weeks). Among the various concentrations of the plant products used, 3g tobacco leave powder per 100g of cowpea grain was the most effective in the controlling of adult mortality of Cowpea weevils, number of eggs laid and adult emergence of *C. maculatus* after 12weeks of storage. However, summary of the result confirms that, 3g of tobacco leave powder was the most effective treatment in the control of damage caused to cowpea grains by *C. maculatus* and therefore may be suggested to farmers.

CONCLUSION

In conclusion the result of the study revealed that, the plant product tested at different levels of concentration displayed some potential as antifeedant, food poison, contact poison and repellants. The result clearly indicated the potential values of using plant products as complementary to chemical pesticides in controlling *C. maculatus* on cowpea grain.

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