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Research Article

EFFECT OF CYERMETHRIN PESTICIDE ON THE YIELD AND POD QUALITY OF OKRA IN ABAKALIKI SOUTHEAST NIGERIA

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ABSTRACT
Effect of different rates of hypermetric insecticidal spray on growth, yield and cyermthrin content of okra (*Abelmoschus escutentus*) in Abakaliki was studied during the 2011 planting season. The experiment was carried out at the Teaching and Research Farm of the Faculty of Agriculture and Natural Resources Management, Ebonyi State University, Abakaliki. The treatments evaluated were T1 (0ml/ha), T2 (600ml/ha), T3 (800ml/ ha) and T4 (1200ml/ ha) of hypermetric insecticide. Clemson spineless" also known as lady's finger was used as the best crop. The experiment was laid out in a randomized complete block design with four (4) treatments replicated 5(five) times. Treatments were applied at 2, 4, 6 and 8 weeks after planting. Agronomic parameters such as plant height, number of leaves, stem diameter, leaf area at 4 and 6 weeks after planting (WAP) were measured. Also fresh weight of pod, dry weight of pod, length of pod, circumference of pod, plant height and number of leaves at 9, and 12 WAP were measured. The results from the Agronomic parameters showed that there were significant differences when the different levels of treatments were compared with the control, during the sampling periods at 4, 6, 9, and 12 WAP. The results of the insecticide content on okra pod showed significant difference when the pod of the control plots were compared with the treated plots and when the treated plots were compared with one another. The result showed that T3 (800ml/ha) should be the only rate that farmer will apply during okra production to ensure effective pest control and avoid large amount of insecticide residue deposit in okra edible pod.

Key Words: *Cyermthrin, Okra, Pesticide, Pod, Southeast, Yield*

INTRODUCTION
A pesticide is any chemical used to kill or control populations of unwanted fungi, animals or plants often called pests (Enger and Smith, 2002). Pesticide is also any chemical that kill pest, drive away pests or prevent pest development (Cunningham *et al*., 2005). The use of cyermthrin insecticide helps prevent crop losses and potential human disease which could be acquired from eating infected crops. According to the Environmental protection Agency of Nigeria (EPAN), there are currently more than 865 registered pesticides. Less than half of these are used to protect our food crops including okra. Lot of insect pests attack Okra plant and they include; *heliothis (virescen*) rough boll worm *(Earias huegeliana*) aphids *(aphis gossypii*). Many of them can be controlled using endosulfan or methomyl at 1.5m/ l. Crop rotation and destruction of diseased plants are used as management options. Okra, *Abelmoschus escutentus* (L) Moench, is an annual commercial vegetable crop grows on limited acreage throughout the southeast. Pest management is one of the most important components in the production process of this vegetable, since this crops is attached by many pests. Okra is an herbaceous, hairy, annual plant of the mollow family grown for its edible fruit. Okra leaves are deeply notched; flowers are yellow with a crimson centre. The fruit or pod is a tapering, 10 –angled capsule 10-25cm long. Only the tender, unripe fruit is eaten. Because of its large amount of mucilage (a gelatinous substance, Okra is used to thicken broths. In some countries, the seeds are used as a substitute for coffee.
The problem of Okra production is the pest attack. Many pesticides used in Okra production may leave sufficient residue to harm consumers. The main objective of this research therefore was to determine the

effect of different rates of cyermthrin insecticide on growth, yield and cyermthrin content of Okra (*Abelmoschus escutentus*) in Abakaliki.

MATERIALS AND METHODS

Location

The experiment was conducted at the Teaching and Research Farm of the Faculty of Agriculture and Natural Resources Management, Ebonyi State University, Abakaliki. Abakaliki is the capital of Ebonyi State and lies in southeast zone of Nigeria. It is located between latitude $6^{o}19^{1}$ N and longitude $8^{0}\,06^{1}$E of the Greenwich meridian and the rainfall pattern is bimodal with peaks at July and September and a short spell in August. The total annual rainfall is between 1800-200mm within the period. The mean temperature range is about 24^{0} C and the relative humidity is between 60-80% during the rainy months. The soil type is sandy clay-loam, which in some areas is poorly drained.

Materials

The okra variety Clemson spineless also known as lady's finger was obtained from Enugu market garden and used as the test crop. The pesticide used for the treatment was Motrin 10 EC (Cyermthrin 10EC).

Field Methods

The experimental plot was manually prepared using matched and hoe. Debris was removed before making seed beds with hoe. The experiment started on the 22nd June 2011 which is the planting date and ended on 14th September 2011 which was when the plant stopped fruiting. The okra seed were planted 2 (two) seeds per hole 1 week after cultivation (WAC). The spacing was 50cm x 80cm while the planting depth was 2cm. The seeds were later thinned down to one plant per stand 1 week after emergence (WAE). The area of land used for the study was 19.0m x 13. 5 M (0.0256ha). The plots were separated by 0.5m alleys while each block was separated by 1m alley. Each plot measured $9m^2$. The fertilizer used was NPK15:15:15. The fertilizer was applied at the rate of 60kg/ha using the spot application method 2WAP.
The treatments were applied at the rate of 0ml/ha, 600ml/ha, 800ml/ha and 1200ml/ha which respectively were T1, T2, T3, and T4. Each treatment was replicated five (5) times. Treatments were applied at 2, 4, 6 and 8 weeks after planting.

Agronomic Data

Measurement of plant height, number of leaves, stem diameter and leaf area were taken at 4 and 6 WAP. Plant height was measured with meter rule, number of leaves was by physical counting, and stem diameter was measured with measuring tape while leaf area was measured by taking the length and width measurement of the leaves with meter rule. Weight of pod was measured with the aid of electric weighing balance, dry weight of pod was also measured with the aid of electric weighing balance, circumference of pod was taken with measuring tape, plant height was measured with meter rule, length of pod was measured with meter rule and number of leaves were taken by counting the number of leaves on each plant in each bed at 9 and 12 WAP.

Laboratory Methods

The okra pods were sliced and sundried and ground to pass through a 0.05mm diameter with moulineaux stainless blender before analysis. The residue content in the okra was analyzed by chromatograph method according to fishmen (1989).The withdrawal period for cyermthrin insecticide before consumption of crops harvested was 7 days.

Experimental Design and Data Analysis

The experiment was laid out in a randomized complete block design (RCBD) with 4 treatments replicated 5 times. Data collected were analyzed using analyses of variance procedure (ANOVA) for Randomized complete Block Design (RCBD).Means were separated by the fisher's least significance difference (F-LSD) 5% probability level according to Steel and Torrie (1980).

RESULTS AND DISCUSSION

The results of the effects of difference rates of cyermthrin treatment on plant height, number of leaves, stem diameter and leaf area at 4 WAP are presented in table 1.There was statistically significant

difference (p=0.05) in plant height of the plants in the control plot when compared with the plants that received treatments.

Table 1: Effect of Treatment on Plant Height, Number of Leaves Stem Diameter and Leaf Area at 4 WAP

Treatments (ml/ha)	Plant Height (cm)	Number of Leaves	Stem Diameter(cm)	Leaf Area(cm^2)
0	7.20^a	4.56^a	0.95^a	23.78^a
600	7.87^b	5.4^b	1.37^b	33.32^b
800	8.22^c	5.74^c	1.40^c	35.00^c
1200	8.84^d	5.8^d	1.52^d	40.98^d
FLSD(p=0.05	0.04	0.01	0.34	2.01

Note: Figures with the same superscripts are not statistically significant

There was also significant difference when 600ml/ha was compared with 800ml/ha and 1200ml/ha and when 800ml/ha was compared with 1200ml/ha. Treatment two, 600ml/ha produced 8.5% taller plant than 0ml/ha. Treatment three 800ml/ha and 1200ml/ha produced 12.4% and 18. 5% taller okra plant than 0ml/ha treated plots respectively. The higher values recorded by the treated plants may be due to pest controlling ability of the insecticide. The insecticide killed the pest and so allowed for effective leaf development which led to the elongation of the stem.

Number of leaves of the okra plant also revealed significant difference when the control was compared with the treatments. There was significant difference when 600ml/ha treatment level was compared with 800ml/ha and 1200ml/ha and when 800ml/ha was compared with 1200ml/ha. Treatment level of 600ml/ha had 15.5% number of leaves than 0ml/ha and 800ml/ha and 1200ml/ha produced 20.5% and 21. 4% higher number of leaves when compared with 0ml/ha respectively.

There was significant difference in stem diameter of the plant when the plants in the control plots were compared with those of the treatments. There was no significant difference when plants in 600ml/ha treated plots were compared with T3 and T4 and when T3 was compared with T4. Treatment 2 produced 30.7% thicker stem than T1. Also T3 and T4 produced 32.1% and 37.5% thicker stem than T1 respectively.

Furthermore, here was positively significant difference in leaf area when the control was compared with the treatments. There was no significant difference when T2 was compared with T3 but there was significant difference when T2 was compared with T4, and also when T3 was compared with T4. Treatment 2 recorded 28.6% wider leaf area than T1. Further T3 and T4 revealed 32.1% and 41.9% wider leaf area than plants grown under the control condition respectively. The increase in leaf area showed the effectiveness of the pesticide that lead to the killing of pests. The unattached leaves have high leaf area exposal to the sun for effective photosynthesis.

Effect of Difference Rates of Cyermthrin on Plant Height, Number of Leaves, Stem Diameter and Leaf Area at 6WAP

The results of the effect of treatment on plant height, number of leaves, and stem diameter and leaf area at 6 WAP are presented in table 2. The plant height at 6 WAP did reveal significant difference when T1 was compared with T3 and T4 but did not show any statistically significant difference when T1 was compared with T2. Also when T2 compared with T4 positively, but there was significant difference when T2 was compared with T4. At 4WAP then there was significant difference when T2 was compared with T3.Taller plants of the treated plots at this period showed a progressive increase in the height of the plant from the

4WAP. The result further revealed the effectiveness of the insecticide promoting the growth of the test crop. The insecticide killed the pests that could have prevented the elongation of the stem.

Table 2: Effect of Treatment on Plant Height, No of Leaves, Stem Diameter and Leaf Area at 6WAP

Trt (ml/ha)	Plant Height (cm)	Number of Leaves	Stem Diameter(CM)	Leaf Area(cm^2)
0(T1)	8.91^a	7.54^a	1.20^a	40.52^a
600(T2)	9.86^a	8.40^b	1.67^b	55.42^b
800(T3)	10.11^b	8.72^c	1.77^c	60.57^c
1200(T4)	11.03^c	8.78^d	1.85^d	67.26^d
FLSD(p=0.05)	1.09	0.64	0.02	3.62

Note: Figures with the same superscripts are not statistically significant

The number of leaves at 6WAP followed a trend of the increasing number of leaves of the 4th week recording. The plots treated with 1200l/ha did not show any difference between the 4th and the 6th week recordings. There was significant difference in number of leaves at 6 WAP when the control was compared with the treatments but there was no significant difference when the treatment was compared with one another. Treatment 2 revealed 10.2% increase in number of leaves than T1, while, T3 and T4 increased by 13.5% is 14.1% over T1. The increase in the number of leaves of the treated plots showed the okra plants do better with insect attacks. The effectiveness of the insecticide that prevented the pests from feeding on the leaves is further highlighted.

There was significant difference in stem diameter at 6 WAP when the control was compared with the treatments. There was also significant difference when the treatments were compared with one another. Treatment 2 produced 32.2% less thick stem than T3 while T3 revealed 4.32% less than T4. There were 28.1%, 32.2% and 35.1% increases in the size of stem diameter of plant on T2, T3 and T4 plots respectively when compared with T1. The increase in stem diameter of the plants in the treated plots showed the effectiveness of the insecticide that killed the pests and prevented them from attacking the plants.

There was significant difference in leaf area when the plants in the control plots were compared with the plants in the treated plots. There was also significant difference when T2 was compared with T3 and T4 and when T3 was compared with T4. There were 26.9%, 33.1% and 39.7% increases in size of leaf area for treatment T2, T3 and T4 plants respectively when compared with T1. The leaf area comparatively increased in the 6th week. There was higher percentage increase in the 6th week among the treatments than what obtained in the 4th week.

Effect Of Difference Rates Of Cyermthrin On Weight Of Pod, Dry Weight Of Pod, Length Of Pod, Circumference Plant Height & Number Of Leaves At 9 WAP

The result of effect of treatment on weight of pod, dry weight of pod, length of pod, circumference of pod, plant height and number of leaves at 9WAP are presented in table 3.

There was significant difference in weight of pod when the weights of pods from the control plot were compared with those of the treated plots.

There was also significant difference when T2 was compared with Treatments 3 and 4 and when Treatment 3 was compared with Treatment 4. Treatments 2, 3 and 4 produced respectively more pods than treatment 1 by 75.3%, 88% and 93.8%. The increase is as a result of insecticide used which prevents pests from attacking the plant that leads to greater yield of the treated plants.

There was significant difference in dry weight of pod when the control was compared with the treated plants. There was also significant difference when T2 was compared

With Treatments 3 and 4 when T3 was compared with T4.The results of the dry weight of the pod followed the same tend as the fresh weight of the pods. There were 55.1%, 78.5%, 88.7% increases for T2, T3 and T4 respectively over the dry weight production of the control. The increase showed the effectiveness of the treatment used which brought about the increase in the dry weight yield of the okra plant.

There was no significant difference in length of pod when the control was compared with T2 but there was significant different in pod length when the control was compared with T3 and T4, and also when T3 was compared with T4. The insecticides used bring about good yield that leads to increase in length of pod the treated plants.

There was significant difference in circumference of pod when the pods in the control plots were compared with those of the treated plots. There was also significant difference When T2 was compared with T3 and T4. The result also revealed significant difference when T3 was compared with T4. There was 66.9%, 81. 9% and 90.4% increase in the thickness of the pod respectively when compared with T1.

Table 4: Effect of treatment on weight of pod, dry weight of pod, length of pod, circumference, plant height & number of leaves at 9 WAP.

Trt (ml/ha)	Weight of Pod(g)	Dry weight of pod(g)	Length of pod(cm)	Circum-Ference(cm)	Plant height(CM)	Number of Leaves
0	21.65[a]	12.25[a]	1.06[a]	0.80[a]	2.80[a]	8[a]
600	87.80[b]	27.30[b]	2.70[b]	2.42[b]	9.96	23[b]
800	181.70[c]	57.20[c]	4.70[c]	4.42[c]	14.96[c]	38[c]
1200	349.40[d]	109.15[d]	11.94[c]	8.34[d]	27.30[c]	61[d]
FLSD(P=0.05)	20.40	12.10	1.98	0.98	10.00	13.00

Note: Figures with the same superscripts are not statistically significant

There was no significant difference in plant height when the height of plants in the control plot was compared with those in T2 plots but when there was significant difference when the control was compared with the plants in T3 and T4 plots. Treatment 2 did not differ from treatment 3 significantly, but there was significant difference when T2 was compared with T4. The comparism of T3 with T4 also revealed significant difference. Treatment 2 was 69. 6% taller than T1 while, T3, and T4 produced 81.3% 89.7% taller than plants than T1. The plants produced were as a result of the insecticide application that killed the pests that could have attacked the leaves which will prevent the elongation of the plants.

There was statistically significant difference in the number of leaves when the plants in the control were compared with those in the treated plots. Multiple comparism of the treated plots revealed that there was also significant difference when T2 was compared with Treatment 3 and T4 and when T3 was compared with T4. The higher percentage difference was recorded when T4 was compared with T1 followed by T3 and T2 in that order. The increase shows the effectiveness of the treatment applied. The differences in growth parameters revealed that the treatment produced more effect in the 9WAP than it did in the 6WAP.

Insecticide Content of Okra Pods

The results of the effect of treatment on quality of okra measured by the insecticide level in the edible pod are presented in table 4.

There was significant difference (p=0.05) in insecticide level when the control was compared with the treatments. There was also significant difference when the treatments were compared with each other. All the treatments were 100% higher in insecticide levels than the control. Treatment 3 was 23% higher than T2, while T4 was 31% higher than T2 and T4 was 11 % higher than Treatment 3.

Compared with the standard of insecticide levels allowable in food crops which is 20ug/g, T1, T2 and T3 pods contained safe levels except T4. Treatment 4 differed from the standard by only 8.2%. The result shows that the insecticide when used at the recommended rate of 800ml/ha will be safe but anything higher than that will likely cause health problems in humans and animals.

Table 5: Effect of treatment on levels of pesticide in okra pod

Treatment (ml/ha)	Insecticide level(ug/g)	Who(1993)Standard (ug/g)
0	0^a	20
600	15^b	
800	19.5^c	
1200	21.8^d	
FLSD(P=0.05)	0.08	

Note: Figures with the same superscripts are not statistically significant

Conclusion

The use of insecticide in okra production is of great importance since it increased the agronomic parameters that led to the increase in yield of the okra. The insecticide level in pods harvested from plots treated with1200l/ha it implied that produce are not good for human consumption due to the high level of insecticide in the pod.

Recommendations

Having compared the results with the standard, farmers should note that insecticide must not exceed the recommended high insecticide residue in food crops that will lead to health problems in human and animals.

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