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DETERMINATION OF THE EFFICACY OF BEST ACTION, FURADAN, AND NEEM EMULSION IN THE CONTROL OF MAJOR INSECT PESTS OF COWPEA [*Vigna unguiculata (*L.) WALP]

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ABSTRACT

Field experiments to determine the efficacy of Best Action (30g/litre cypermethrine plus 250g/litre dimethoate) as water emulsifiable concentrates, Furadan 10G (carbofuran), Neem emulsion (*Azadiracta indica*) as insecticide treatments in the control of major insect pests of cowpea were conducted in two agro-environments simultaneously in Enugu Area, South Eastern Nigeria in 2014 cropping season using two cowpea varieties (Ife brown, and Potiskum) as test crops. The experimental design was a split plot in a randomized compete block (RCB) replicated three times. Best Action was more effective in controlling cowpea insect pests, followed by Furandan 10G, and Neem emulsion respectively and their effectiveness was not affected by climatic factors variations in the two agro-environments (Nsukka and Agbani). Ife brown and Potiskum did not significantly resist the attack of major insect pests of cowpea. Insecticides and cowpea varieties did not have a significant interaction effect on the control of major insect pests of cowpea.

Key words: Insecticides, cowpea varieties, cowpea insect pests, agro-environments.

INTRODUCTION

Cowpea (*Vigna unguiculata* L, *Walp)* is one of the most widely used legumes in the tropical world. The grain is used extensively for human nutrition, especially in Africa. It is one of the most important tropical dual-purpose legumes being used for vegetables (leaves and flowers), grains, as fresh cut and carry forage, hay and silage Olawole (2008). It constitutes the cheapest source of dietary protein and energy for most poor people in the tropical world. In addition, the haulm is fed to cattle in a number of countries, (Jackai and Daost 2009). Cowpea also plays an important role in providing soil nitrogen to cereal crops grown after it. It provides a high proportion of its own nitrogen requirement besides leaving a fixed nitrogen deposit of up to 60-79 $kgha^{-1}$ in the soil for the succeeding cereal crop (Moima 1991).

Cowpea in mixed cropping supplies fixed nitrogen to the nonlegume crops. However, Ezedinma in 1964, pointed out that there was no convincing evidence that intact legume plants excrete significant amounts of fixed nitrogen for the benefit of the companion crops, and that this seems to be especially true with regard to cowpea.

Agboola and Fayemi (1972), stated that cowpeas used as green manure could be an important source of Nitrogen for corn in the late cropping season in humid tropics.

Cowpea especially the spreading varieties, grow and spread very quickly thereby forming an effective ground cover which prevent soil erosion and protect valuable plant nutrients. Therefore, as a cover crop, the beneficial effect of cowpea to soil fertility is proved beyond any question. The same is true for cowpea grown as a green manure crop (Balasubramanian and Nnadi 1978).

In Nigeria, the greatest production of cowpea comes from the northern region. The yield of this crop is generally very low particularly in the southern parts of the country. The production of this crop in Nigeria is low and has not matched the demand of consumers

(Okelede and Ariyo 2000).

The production of this important crop is limited by various yield factors. Among those factors causing yield variabilities include;

- Location, climatic factors, soil types, nutrient status of the soil.
- Crop varieties.
- Incidence of insect pest and diseases.

In Nigeria, more studies need to be carried out especially on determining the efficacy of some synthetic and non-synthetic insecticides to control insect pests of this crop, screen some cowpea varieties for resistance to their major insect pests and to verify the influence of location on the efficacy of some insecticides against cowpea insect pests, hence the aim of this research work.

MATERIALS AND METHOD.

Experiment Locations.

The experiments were carried out in two locations (Nsukka and Agbani agro-environments) simultaneously in 2014 cropping season.

Nsukka Location: In Nsukka, the experiment was sited at the school farm of Enugu State University of Science and Technology (ESUT), Nsukka Campus. Nsukka lies within latitude 06^0 51'N, longitude 07^0 15'E, with a mean elevation of 400mm above sea level and an annual rainfall of 1600 – 1700mm, relative humidity of 44.77% – 74.94%, and a mean annual temperature of 19.76^0C (University of Nigeria Meteorological Station, Nsukka).

Agbani Location: In Agbani, the experiment was carried out in the Teaching and Research farm of the Faculty of Agriculture and Natural Resources Management, Enugu State University of Science and Technology (ESUT), Agbani. The area lies between latitude $06^0$52'N, longitude $07^0$15'E, with a mean elevation of 450m above sea level and an annual rainfall of 1800 mm to 2100 mm. The soil is of shale parent material and is classified as typic paleudult and is of sandy clay textural class (Anikwe *et al*. 2005).

Experimental Treatments.

The experimental treatments included:

- 26
- 24
- Two cowpea varieties (Potiskum and Ife brown).
- Spray of Best Action 280 EC. (30g/litre cypermethrine plus 250g/litre dimethoate) at two weekly intervals till harvest starting from two weeks after planting.
- Spray of Neem emulsion (Non-synthetic insecticide) at two weekly intervals till harvest starting from two weeks after planting.
- Soil treated with Furadan 10G (synthetic granular insecticide)
- No insecticide treatment.

Best Action 280 E.C.

The manufacturer's recommended those is 2 litres per hectare.

The rate of dilution was 80ml/20 litres of water or 4ml/litre of water. This was a standard volume spray. The standard volume of water to prepare a dilution for treating I hectare of land ranges from 200-500 litres of water. Therefore, 6 litres of water were used to dilute 24ml of Best Action for a single spray.

Neem:

Neem emulsion was prepared by harvesting and properly air drying Neem leaves to 12% moisture content which were also ground into powder. Water was added to the powder and left overnight after which it was filtered with sieve. Emulsion of the dose 1.15 kg of Neem powder to 20 litres of water was prepared, and used at 6 litres per spray. This was stored in a refrigerator at 3^{0c} for 2 hours daily and used in 14 days. Spraying intervals was two weekly till harvest, which gave a total of 6 sprays.

Furadan 10 G

This was applied around each plant one week after germination at the rate of 100 $kgha^{-1}$, using ring method. 5g/plant was applied.

Experimental Design:

The experimental design was a split plot in randomized complete block (RCB) with three replications and six treatments.

Field Layout and Treatment Combinations

The main plots contained 3 insecticide treatments and a control whereas the subplots contained cowpea varieties.

Experimental area measures 23m x 18.5m (425.5m^2).

Method of Planting.

The crops were spaced 0.5m within rows and 0.5m between rows. Main plots were separated by 1m pathway, whereas subplots were separated by 0.5m. Each main plot measured 5.5m x 5m (27.5m^2) and consisted of 12 rows of cowpea plants at 1 seed per stand. Weed control was carried out manually with a hoe at three weeks interval.

Data Collection and Assessments.

Data were collected on

- The number of cowpea aphids (*Aphis craccivora)* per plant after planting. A total of 10 plants were sampled per sub plot.
- The number of leaves damaged by leaf beetles (*Ootheca mutabilis* and *Luperodes lineata*) 60 days after planting.
- The number of flower thrips per flower. This was done by removal of 10 flowers every 2 days for 5 consecutive times starting from 1 week after flower initiation and counting the number of flower thrips in them.
- Number of *Maruca* larvae per flower. The same 10 flowers used for flower thrips count were used for this purpose.
- Percentage seed damage by pod sucking bugs was determined by calculating the percentage wrinkled and dimpled seeds at harvest.
- The percentage damaged seeds by pod borers.

Statistical Analyses

The data collected were analyzed using the Genstat Release 10.3 DE (PC Windows) 01 November 2012, 15:47:14.

RESULTS AND DISCUSSION

Mean number of aphids per plant of two cowpea varieties in Nsukka and Agbani agro-environments as affected by Best Action, Furadan and Neem

The results of the experiments in Nsukka and Agbani in 2014 cropping season showed a significant insecticides treatment effect on the mean number of aphids per plant of two cowpea varieties. Plots treated with Best Action had no aphid per plant indicating a hundred percent (100%) aphid control.

In both locations (Nsukka and Agbani), the mean number of aphids per plant in plots treated with Best Action differed significantly from the other treatment means. In Nsukka, plots treated with Furadan had a mean number of 13.38 aphids per plant which differed significantly from plots treated with Neem and no insecticide which recorded mean number of 20.08 and 23.39 aphids per plant respectively, whereas in Agbani, plots treated with Furadan with a mean number of 11.20 aphids could not significantly differed from plots treated with Neem that recorded a mean number of 10.48 aphids per plant, but significantly differed from plots treated with no insecticide that recorded a mean number of 15.96 aphids per plant. In both locations (Nsukka and Agbani), there was no significant difference in the mean number of aphids per plant between Ife brown and Potiskum treatments.

Also in both locations there was no significant interaction effect between insecticides and cowpea varieties on the mean number of aphids per plant. (Table 1).

Table 1. Mean number of aphids per plant of two cowpea varieties in Nsukka and Agbani agro-environments as affected by Best Action, Furadan and Neem

	Cowpea varieties			
Location	**Insecticides**	**Ife brown**	**Potiskum**	**Mean (Insecticides)**
	Furadan	14.61	12.15	13.38
	Best Action	0.00	0.00	0.00
Nsukka	Neem	21.20	18.96	20.08
	No insecticide	22.91	23.87	23.39
	Mean (varieties)	14.68	13.74	
	F-LSD (0.05)	NS		4.246
	Furadan	10.03	12.50	11.20
	Best Action	0.00	0.00	0.00
Agbani	Neem	9.48	11.48	10.48
	No insecticide	14.84	17.07	15.96
	Mean (varieties)	8.59	10.26	
	F-LSD (0.05)	NS		3.667
	F-SLD (0.05) for insecticides and cowpea varieties interaction in Nsukka and Agbani = NS.			

Mean percentage leaf damage by leaf beetles of two cowpea varieties in Nsukka and Agbani agro-environments as affected by Best Action, Furadan and Neem

The results of the experiment in Nsukka agro-environment showed a significant insecticides treatment effect on the percentage leaf damage by leaf beetles with plots treated with Best Action recording least percentage damage of 2.69%, followed by Neem with 3.89%, Furadan 4.08 and lastly no insecticide with 5.49%.

In Agbani, the result of the experiment showed a significant insecticides treatment effect on the percentage damaged leaves by leaf beetles with plots treated with Best Action 280EC recording least percentage leaf damage of 3.30%, followed by Furadan with 3.64%, Neem 3.78% and lastly no insecticide with 4.77%. Cowpea varieties had no significant effect on the percentage leaf damage by leaf beetles. There was no significant interaction effect between insecticides and cowpea varieties treatments on the percentage leaf damage by leaf beetles (Table 2).

Table 2. Mean percentage leaf damage by leaf beetles of two cowpea varieties in Nsukka and Agbani agro-environments as affected by Best Action, Furadan and Neem

	Cowpea varieties			
Location	**Insecticides**	**Ife brown**	**Potiskum**	**Mean (Insecticides)**
	Furadan	4.08	4.08	4.08
	Best Action	3.22	2.16	2.69
Nsukka	Neem	4.01	3.78	3.89
	No insecticide	5.57	5.42	5.49
	Mean (varieties)	4.22	3.86	
	F-LSD (0.05)	NS		0.994
	Furadan	3.52	3.77	3.64
	Best Action	2.87	3.73	3.30
Agbani	Neem	3.44	4.12	3.78
	No insecticide	4.54	5.00	4.77
	Mean (varieties)	3.59	4.16	
	F-LSD (0.05)	0.517	0.731	
	F-LSD (0.05) for insecticides and cowpea varieties interaction in Nsukka and Agbani = NS.			

Mean number of thrips per flower of two cowpea varieties in Nsukka and Agbani agro-environments as affected by Best Action, Furadan and Neem.

The result of the experiment conducted in Nsukka agro-environment showed a significant insecticides treatment effect on the mean number of thrips per flower of two cowpea varieties with Best Action recording the least mean number of 0.64 thrips per flower followed by Furadan with a mean number of 1.87 thrips per flower, Neem with a mean number of 2.67 thrips per flower, and lastly no insecticide with a mean number of 4.94 thrips per flower. The four insecticides treatment means were significantly different from each other.

The result of the experiment conducted in Agbani agro-environment showed a significant insecticides treatment effect on the mean number of thrips per flower with Best Action recording least mean number, followed by Furadan, Neem, and lastly no insecticide with a mean of 6.62 thrips per flower. The four insecticides treatment means were significantly different from each other.

In both Nsukka and Agbani agro-environments, there was no cowpea varieties treatment effect on the mean number of thrips per flower. Again, there was no insecticides and cowpea varieties significant interaction effect on the mean number of thrips per flower. (Table 3).

Table 3. Mean number of thrips per flower of two cowpea varieties in Nsukka and Agbani agro-environments as affected by Best Action, Furadan and Neem.

	Cowpea varieties			
Location	**Insecticides**	**Ife brown**	**Potiskum**	**Mean (Insecticides)**
	Furadan	1.80	1.93	1.87
	Best Action	0.56	0.72	0.64
Nsukka	Neem	2.97	2.37	2.67
	No insecticide	5.81	4.07	4.94
	Mean(varieties)	2.78	2.27	
	F-LSD (0.05)	NS		1.061
	Furadan	2.37	2.53	2.45
	Best Action	1.03	1.73	1.38
Agbani	Neem	3.83	3.11	3.42
	No insecticide	7.60	5.63	6.62
	Mean(varieties)	3.71	3.25	
	F-LSD (0.05)	NS		1.484

F-LSD (0.05) for insecticides and cowpea varieties interaction in Nsukka and Agbani = NS.

Mean number of *Maruca* larvae per flower of two cowpea varieties in Nsukka and Agbani agro-environments as affected by Best Action, Furadan and Neem.

The results of the experiments in Nsukka and Agbani showed a significant insecticide treatment effect on the mean number of *Marica* larvae per flower of two cowpea varieties with Best Action recording the least mean number of *Maruca* larvae per flower, followed by Furadan, Neem and no insecticide respectively. All the treatment means were significantly different from each other. Again there was no significant cowpea varieties treatment effect on the mean number of *Maruca* larvae per flower. Furthermore, there was no significant interaction effect on the mean number of *Maruca* larvae per flower between insecticides and cowpea varieties treatments. (Table 4).

In Agbani agro-environment, a similar result of significant insecticide treatment effect on the mean number of *Marcua* larvae per flower was obtained with Best Action recording the least mean number of 0.113±0.189, followed by Furadan 0.643±0.189. However, there was significant cowpea variety treatment effect on the mean number of *Maruca* larvae per flower. Again, there was no significant interaction effect on the mean number of *Maruca* larvae per flower between insecticides and cowpea varieties treatments (Table 4).

Table 4. Mean number of *Maruca* larvae per flower of two cowpea varieties in Nsukka and Agbani agro-environments as affected by Best Action, Furadan and Neem.

	Cowpea varieties			
Location	**Insecticides**	**Ife brown**	**Potiskum**	**Mean (Insecticides)**
	Furadan	0.647	0.497	0.572
	Best Action	0.107	0.107	0.107
Nsukka	Neem	0.713	0.613	0.663
	No insecticide	1.387	1.440	1.413
	Mean (varieties)	0.713	0.664	
	F-LSD (0.05)	NS		0.3577
	Furadan	0.723	0.563	0.643
	Best Action	0.120	0.107	0.113
	Neem	0.807	0.697	0.752
Agbani	No insecticide	1.573	1.633	1.603
	Mean (varieties)	0.806		0.750
	F-LSD (0.05)	NS		0.4074
	F-LSD (0.05) for insecticides and cowpea varieties interaction in Nsukka and \			
	Agbani = NS.			

Mean percentage dimpled and shrivelled seeds caused by pod sucking bugs of two cowpea varieties in Nsukka and Agbani agro-environments as affected by Best Action, Furadan and Neem.

The results of the experiments conducted in Nsukka and Agbani agro-environments showed a significant insecticides treatment effect on the mean percentage dimpled and shrivelled seeds caused by pod sucking bugs with Best Action recording the least mean percentage, followed by Furadan, Neem and no insecticide treatments respectively. Also there was no cowpea varieties significant effect on the mean percentage dimpled and shrivelled seeds. Furthermore, there was no significant interaction effect between insecticides and cowpea varieties on the mean percentage dimpled and shrivelled seeds (Table 5).

Table 5. Mean percentage dimpled and shrivelled seeds caused by pod sucking bugs of two cowpea varieties in Nsukka and Agbani agro-environments as affected by Best Action, Furadan and Neem.

	Cowpea varieties			
Location	**Insecticides**	**Ife brown**	**Potiskum**	**Mean (Insecticides)**
	Furadan	2.33	1.45	1.89
	Best Action	0.70	0.01	0.35
Nsukka	Neem	1.66	2.26	1.96
	No insecticide	3.23	4.39	3.81
	Mean (varieties)		1.98	2.03
	F-LSD (0.05)		NS	1.384
	Furadan	0.99	1.72	1.36
	Best Action	0.00	0.39	0.19
Agbani	Neem	1.89	2.52	2.21
	No insecticide	3.79	2.23	3.51
	Mean (varieties)		3.71	1.93
	F-LSD (0.05)		NS	0.914
	F-LSD (0.05) for insecticides and cowpea varieties interaction in Nsukka and Agbani = NS			

Mean percentage cracked seeds caused by *Maruca* pod borers of two cowpea varieties in Nsukka and Agbani agro-environments as affected by Best Action, Furadan and Neem.

The results of the experiments in both agro-environments (Nsukka and Agbani) showed a significant insecticides treatment effect on the mean percentage cracked seeds with Best Action having the least percentage cracked seeds followed by Furadan, Neem, and no insecticide respectively. There was no significant cowpea varieties effect on the mean percentage cracked seeds. There was also no significant insecticide and cowpea varieties interaction effect on the mean percentage cracked seeds. (Table 6).

Table 6. Mean percentage cracked seeds caused by *Maruca* pod borers of two cowpea varieties in Nsukka and Agbani agro-environments as affected by Best Action, Furadan and Neem.

	Cowpea varieties			
Location	**Insecticides**	**Ife brown**	**Potiskum**	**Mean (Insecticides)**
	Furadan	2.55	1.95	2.25
	Best Action	0.54	0.71	0.62
Nsukka	Neem	1.94	2.50	2.22
	No insecticide	3.37	4.50	3.94
	Mean (varieties)	2.10	2.41	
	F-LSD (0.05)	NS	1.153	
	Furadan	1.54	1.97	1.75
	Sherpa plus	0.97	1.19	1.08
Agbani	Neem	2.14	2.71	2.43
	No insecticide	3.92	4.02	3.97
	Mean (varieties)	2.14	2.47	
	F-LSD (0.05)	NS	0.685	

F-LSD (0.05) for insecticides and cowpea varieties interaction in Nsukka and Agbani = NS.

DISCUSSION

A hundred percent (100%) control of aphids by Best Action in both Ife brown and Potiskum varieties in Nsukka and Agbani agro-environments indicated that its insecticidal properties on aphids was not influenced by location. Again, the keeping of first position by Best Action in controlling major insect pests of cowpea can be relied on in Nsukka and Agbani agro-environments. The failure of either Furadan or Neem to maintain second position in their control levels against major insect pests of cowpea in the experiments in both locations indicate that their insecticidal efficacy may depend on location or climatic factors.

The non-significant interaction effect between insecticides and cowpea varieties could not effectively combine their action against the major insect pests of cowpea in both locations.

The non-significant cowpea varieties effect on all the parameters taken indicated that Ife brown and Potiskum did not resist the attack of major insect pests of cowpea in both locations (Nsukka and Agbani agro-environments).

RECOMMENDATION

For cowpea farmers in Agbani Area, the following insecticides; Sherpa plus, Furadan and Neem listed in order of effectiveness could be used to control insect pests of cowpea considering the cost implication.

More cowpea varieties need to be screened for insect pests' resistance in Agbani Area.

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