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EFFECT OF VARIETY, INTERCROPPING AND INSECTICIDE APPLICATION ON COWPEA LAMB'S TAIL ROT DISEASE *(CHOANEPHORA CUCURBITARIUM)*

S.O. OSUNLAJA
Department of Crop Production, College of Agricutural Sciences, Ogun State University, Ago-Iwoye

and

IDOWU, O. T. H. and OKELEYE, K.A.
Department of Crop Production and Crop Pretection, College of Plant Science and Crop Production University of Agriculture, Abeokuta.
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ABSTRACT

Ten cultivars of cowpea (vigna unguiculata) (L) Walp were planted in a randomized complete block design in split-split plots to evaluate the effect of two cropping systems and insecticide application on the incidence of lamb's tail pod rot disease of cowpea caused by *Choanephora cucurbitarium*. Intercropping maize with cowpea was more effective in checking the disease than under monocropping. Application of insecticide Sherpa plus reduced disease incidence indirectly by reducing the population of insect pod borer (*Maruca testulalis Gey)* and also gave the highest grain yield of 637.62kg/ha on sole cowpea plots. The cowpea cultivars IT 93K-513-2, IT 93K –734, IT 95K –1380, IT 89KD – 288 and a local check were the most resistant to the disease under both the monocropping and intercropping systems.

INTRODUCTION

Cowpea (*Vigna unguiculata* (L) Walp) an annual crop, is the most important legume crop growth throughout the tropical belt (Singh and Rachie, 1985). The crop is particularly vulnerable to attack by lamb's tail pod rot caused by *Choanephora cucurbitarum* (Cuthebert and Ferry, 1975). Initial symptom of the disease is characterized by a water soaked areas on pod subsequently developing into a wet rot affecting both young and mature pods. Diseased pods which later turn brownish black bear luxuriant whitish growth of the causal fungus with black headed pin

–like spring structures. This disease which could also be found on the stem and the flowers is favoured by high humidity and pod borer damage under the prevailing warm and humid conditions of the rain forest belt of southern Nigeria. Infection may result in total crop failture. (Singh and Allen 1979). The causal fungus causes disease on cowpea via feeding damage and oviposition puncture made by the insect *Chalcoderis aevious* (Cutherbert and Ferry, 1975) or other pest of beans such as *Maruca testulasis* (Irvine 1957, Karel amd Matary, 1983). Insecticide application has been considered to be a possible method of controlling the disease (Singh and Allen 1979). However, little data is available to support this proposition.

Mixed cropping systems are used commonly in subtropical and tropical areas of the world (Anon. 1991). This system has been reported to decrease pest and disease incidence (Kato, et al. 1982, Mukiibi 1976, Mukiibi 1982, Urgen and Wein 1996). There are also well authenticated cases of increased incidence of pests and diseases under mixed cropping systems (Karel, et al., 1982, Karel and Matary 1983).

The main objective of this investigation was to evaluate the effect of two cropping systems and insecticide application on incidence of lamb's tail pod rot of cowpea in the field.

MATERIALS AND METHODS.

Field Trial

The field experiment was conducted at the teaching and research farm, University of Agriculture, Abeokuta, Lat. 7^0N of the equator and $3^0$23' East, on a sandy loam soil in the early season (April – September) 1998. Thisfield has been under continuous cowpea cultivation for thre consective years and had a recent history of high (Choanephora pod rot disease of cowpea. Nine improved cowpea cultivars and one local check used in this experiment were obtained from International Institute of Tropical Agriculture (IITA) with one improved maize cultivar (DMSRW). The cowpea varieties were IT90K-76 IT 93K –452-1, IT 94K-437-1, , IT 93K –513-2. IT 93K –734, IT 95K – 1090-12, IT 93K –2046-2, IT 95K –1380, IT89KD-288 and a local check.
The insecticide used in this trial was Sherpa plus (30g/L. Cypermethrin and 250g/L. dimethoate EC).

The trials were laid out as randomized complete block design in split-split plots

arrangement with four replicates. The main plots considered of the varieties while the subplots were the cropping system (monocropping and mixed cropping) and the sub-subplots were insecticide treatments application. Each plot (5m x 5m) consisted of six rows of plants in sole cowpea plot while the cowpea/maize mixture consisted of four rows of cowpea and two rows of maize. Planting distance of 1mx25cm was used for both cowpea and maize. A spacing of 1m was maintained between plots and 2 metres between replicates. One hundred and twenty plants were maintained per plot. Pre-emergence herbicide galex (250g/L) metobromuron 250g/L metolachor) and gramozone (1, 1-dimethy 1-4, 4' bipyridinium dichloride) were sprayed on all plots immediately after planting at the rate of 70ml of gramoxone per 20 L of water and 100ml of galex in 20L of water. Supplementary weeding was done at 5 and 10 weeks after planting. Insecticide was applied four times at ten days interval to the sprayed plots at the rate of 50ml of the insecticide per 20 L of water beginning from 5 weeks after planting until pods began to mature for harvesting.

Evaluation of disease incidence was carried out from 35 days after planting until the time pods began to mature for harvesting. Disease incidence was taken by counting the number of cowpea plants with diseased pods in each plot and this was expressed as a percentage. Cultivars with an average incidence of 0-1 percent were categorized as highly resistant. Those with average incidence between 2-5 percent were regarded as resistant. Varieties with an incidence of between 6-10 were categorized as moderately susceptible while those with 11-30 incidence were classified as susceptible cultivars. Those which had more than 30 percents incidence were regarded as highly susceptible.

For insect damage assessment, the number of larvae of the pod borer *Maruca testulalis* in 20 flowers in $1m^2$ area of the cowpea plot was used. Insect population was recorded per metre square of cowpea plot both for the sprayed and the unsprayed plots under the cropping systems.

At dry pod stage, (9 weeks after planting) the four middle rows in the sole cowpea and the four rows in the intercrop cowpea plots were harvested for yield assessment. The harvested pods were dried, threshed and winnowed. Grains extracted

from the pods were dried to constant weight in an oven at 65°C for 48 hours and the grain yield taken by weighing in a balance. This was converted to kilogramme per hectare.

The experiment was carried out under a rainfed condition. The total rainfed during the growing season was 449.9mm and the average maximum temperature recorded was 29.9°C while the average minimum temperature for the same period was 13.8°C. the average relative humidity for the period was 91.6% while the average photo period was 11.5hrs.

Statistic al Analysis

The data obtained were subjected to analysis of variance and the means separated by using Duncan's Multiple Range Test (Peterson, 1985). Values in percentages were analyzed statistically after carrying out angular transformation.

Correlation coefficient was calculated for insect larval population and disease incidence under the two cropping systems. Also correlation analysis was carried out for disease incidence and cowpea grain yield.

RESULTS

Effect of cropping system on disease

Effect of cropping system on pod rot disease of cowpea revealed that plants grown under sole cowpea had higher disease incidence than when intercropped with maize (Table 1).

Table 1: The effect of cropping system on cowpea yield and incidence of lamb's tail pod rot of cowpea caused by *Choanephora cucurbitarum*.

Cropping system	Mean disease incidence	Mean grain yield kg/ha
Sole Cowpea (NS)	3.580a	388.31c
Sole Cowpea (S)	1.813b	637.62a
Cowpea intercropped with maize (NS)	0.247c	357.40d
Cowpea intercropped with maize (S)	0	507.09b

NS – No spray

S – Sprayed

Means with the same letters are not significantly different at $p < 0.05$ according to Duncan's Multiple Range Test.

Sole cowpea grown without insecticide application had the higher disease incidence than the one with insecticide. However disease incidence under maize-cowpea intercrop with or without insecticide were not significantly different from one another. Cowpea sprayed with insecticide had higher grain yield than their unsprayed counterpart plots. Sole cowpea treated with insecticide had the highest grain yield of 637.62kg/ha while the unsprayed cowpea in the maize cowpea intercrop had the least grain yield.

Performance of the different cowpea cultivars under the different cropping regimes showed that there were significant differences in the reaction of cowpea to the pod rot disease under sole cropping to cowpea whereas no Significant difference was observed when cowpea was intercropped with maize (Table 2). Cultivar IT93K –452-1 was moderately susceptible while IT95K 1380, IT 89KD-288 and the local check were highly resistant under cowpea monocropping.

Table 2: Interactions between cropping systems and insecticidal application on the incidence (%) * of Lamb's tail pod rot of ten cultivars of cowpea.

S/N	Cultivars	Sole Crop		Intercrop	
		Spray	No Spray	Spray	No Spray
1.	IT90K-76	3.067b	4.200b	0.000	0.000
2.	IT 93K –452-1	7.500a	8.000a	0.000	0.000
3.	IT 94 K –437-1	1.700bc	4.067b	0.000	0.000
4.	IT 93 K –513-2	1.233c	2.067c	0.000	0.000
5.	IT 93 K –734	0.433c	4.000b	0.000	0.000
6.	IT 95 K –1090 –12	1.533bc	4.033b	0.000	0.000
7.	IT 93 K –2046 –2	1.533bc	6.600a	0.000	0.000
8.	IT 95 K – 1380	0.333c	0.330d	0.000	0.000
9.	IT 89 KD – 288	0.000c	0.667cd	0.000	0.000
10.	Local	0.667c	0.833cd	0.000	0.000
				ns	ns

ns = Not significantly different

means with the same letters in any vertical column are not significantly different at $p < 0.05$ according to Duncan's multiple range test.

* Scale for scoring resistance

0 – 1 percent incidence	Highly resistant
1.1 – 5.0 percent incidence	Resistant
5.1 – 10.0 percent incidence	Moderately susceptible
10.1 – 30.0 percent incidence	Susceptible
30.1 – 100 percent incidence	Highly susceptible.

Effect of cropping system and insecticide on insect damage and yield

Effect of cropping system and insecticide application on larval population on *Maruca testulals* showed that insect population was considerably lower under maize-cowpea intercrop than under cowpea sole cropping without spraying (Table 3)

Table 3: Effect of cropping systems and insecticide application on Larva Population of *Maruca testulalis* and yield.

Cropping system	Population m2	Yield (kg/ha)
Sole Cowpea (NS)	1.50a	388.31c
Sole Cowpea (S)	0.5b	637.62a
Cowpea intercropped with maize (NS)	0.0c	357.40d
Cowpea intercropped with maize (S)	0.0c	507.09b

NS – No spray

S – Spray

Means with the same letters are not significantly different at $p< 0.05$ according to Duncan's multiple range test.

Cowpea yields were also higher in sprayed than unsprayed plots. Correlation coefficient calculated for *Maruca larval* population and disease incidence revealed a high positive correlation r = + 0.75 (Table 5

Effect of cropping system and insecticide application on yield

Table 4 shows the interaction effect of cropping systems, varieties and insecticide application on grain yield of cowpea. Variety IT95K-1380 gave the highest yield of 956.23kg/ha under sole cowpea with insecticide gave higher yields than their unprotected counterparts when planted under the same cropping system.

Table 4: Cropping system X varieties X insecticide, application interaction effects on grain yield* of cowpea cultivars (kg/ha)

	Sole Crop		Intercrop	
Varieties	Spray	No Spray	Spray	No Spray
IT90K-76	761.53a	365.20c	604.48a	408.48ab
IT 93K –452-1	588.05bc	452.38bc	334.17b	337.05b
IT 94 K –437-1	607.52bc	474.22bc	585.04ab	378.2ab
IT 93 K –513-2	696.22bc	362.12c	577.68ab	350.27b
IT 93 K –734	668.32bc	305.77c	545.33ab	347.75b
IT 95 K –1090 –12	511.48bc	302.00c	491.78ab	302.5b
IT 93 K –2046 –2	503.25bc	528.95bc	396.85ab	433.09ab
IT 95 K – 1380	956.23a	401.70c	512.07ab	324.90b
LOCAL	445.97c	304.47c	516.44ab	334.4b

Significantly at P< 0.05 probability level
Means with same alphabets are not significantly different from one another according to the Duncan's Multiple Range Test (DMRT).
Yield of cultivar IT 89KD –288 (Fodder variety) not included.

Correlation indices calculated for the diseases incidence grain yield showed that grain yield was not significantly correlated with diseased infection at five percent level of significance r= 0.29 (Table 5).

Table 5: Correlation coefficients between disease incidence, insect population and grain yield.

Items	Correlated	1	2	3**
1.	Disease incidence		0.75*	
2.	Insect population			-0.26*
3.	Grain yield	0.29		

* Significant at 0.05 level at probability
** Numbers corresponds to items listed on the vertical axis.

Correlation index calculated for insect population and grain yield showed a significant negative correlation (r=0.26) between insect population and yield (Table 5).

DISCUSSION

In the present study the low disease incidence of pot rot disease observed when cowpea was intercropped with maize compared with when grown as a sole crop suggests that intercropping may enhance disease control. The reduced disease incidence was probably attributable to the low *Maruca larva* population and damage observed under this system than under sole cropping to cowpea. This seems to be supported by the positive correlation observed between *Maeuca* population and disease incidence. Many previous workers (Irvine 1957, Steele and Mehra 1978) had observed that closely spaced cowpea intercropped with maize was very effective in reducing cowpea pests. This was attributed to the fact that some insect pests tend to avoid their preferred host crop when shaded by taller crops in the mixture.

On the effect of varetal reaction to the disease it is not clear what proportion of cowpea performance is due to insects and what proportion is due to disease. Therefore further works would be needed to be able to say precisely why some varieties performed better than the others.

On the effect of varietal reaction to the disease it is not clear what proportion of cowpea performance is due to insects and what proportion is due to disease. Therefore further works would be needed to be able to say precisely why some varieties performed better than the others.

The lower disease incidence observed on the insecticide treated plots under sole cropping to cowpea could be attributed to the indirect effect of the chemical on the disease through reduction of the insect population that causes damage to the plant. Singh and Allen (1979) observed that the spread of the pathogen is favoured by high humidity and borer damage.

The generally low incidence of lamb's tail pod rot disease recorded in this study in both sole and intercropped cowpea may be due to adverse weather factors. The dry spell experienced during the growing season may account for this. Karel and Matary (1983) observed a low incidence of *Maruca testulalis* larvae in both pure stand and intercropped beans.

It is suggested that intercropping could be practiced as an alternative to chemical spray

of cowpea for the control of lamb's tail pod rot disease of cowpea.

The higher yield observed in plots protected with insecticide as compared with the unprotected counterparts was due to low insect pest infestation on such treated plots hence the higher yield observed. Many workers have reported that insect pests are a major constraint to cowpea production and have shown that application of insecticide have been observed to increase cowpea yields by several folds (Taylor 1968, Booker 1965, Dina, 1973). The non-significant correlation observed between pod rot disease and cowpea grain yield probably suggests that apart from this disease other factors (nematode, other pests and diseases) may also be important in affecting cowpea yield. The negative correlation observed between insect population and yield suggest that insect damage may reduce yield considerably so in practical terms measures to control or reduce insect number 9spraying or intercropping with maize) should perhaps be the primary goal for producers. The resistant and high yielding varieties of cowpea observed under the two cropping systems could be planted in areas where the pod rot disease is highly destructive.

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