Differential Susceptibility of some Cowpea Varieties to Field infestation by Insect Pests in Mubi region of Sudan Savannah ecological zone of Nigeria.

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ABSTRACTS

Aim: To assess the comparative susceptibility of five cowpea varieties to field insect pest infestation.

Study Design: The design used for this study is the Randomized Complete Block Design (RCBD) in which the varieties are the treatments and were replicated four times (4x).

Place and Duration of the study: *S*tudy was carried out in 2011 cropping season (15th July-15th November) at Adamawa State University Research and Teaching Farm Mubi**.**

Methodology: Data were collected on days to 50% flowering, days to 50% pod setting, days to 50%pod maturity, mean number of flower producing pods, mean number of surviving pods, mean number of healthy pods produced and the total output per variety/cultivar.

Results: The result revealed that Iron beans had the least degree of susceptibility to field pest infestation and correspondingly recorded the highest yield of 2144g/plot and 1.34 metric ton ha^{-1}. While the highest degree of susceptibility was recorded with Samira which gave a yield of 728g/plot which is equivalent to a projected yield of 0.455 metric tone ha^{-1}. Four species of insects were also found on the plots.

Conclusion: It could be concluded that Iron beans and BOSADP cultivars have demonstrated the least level of susceptibility to field pest infestation, hence relatively more resistant to field pest attack. Therefore, Iron beans and BOSADP due to their low susceptibility to field pest infestations gave higher yield per plot when compared to other varieties. They could therefore be varieties of choice for cultivation in this locality.

Key words: *Susceptibility, Cowpea varieties, Field Pests infestation, Ecological zone, Differential*

1. INTRODUCTION

Cowpea, *Vigna unguiculata* (L.) Walp., is one of the most important grain legumes which are widely cultivated in semi-arid areas of the tropics and subtropics for human as well as animal consumption [20]. In west and central Africa, the most important cowpea growing regions in the world, cowpea constitutes the cheapest source of dietary protein for the low income sector of the population [16]. Cowpea leaves, green pods, green peas and dry grains are consumed as food by humans and the haulms which contain

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about 20% protein are fed to livestock. However, yields at farmers level are low averaging only 50-350kg/ha [16; 5; 11; 7]. The major causes of the low yields are insect pests, diseases, parasitic weeds drought and low soil fertility, of which insects constitute the major constraint [8; 12].

The presence of many insect pest species from seedling to harvest is a feature of cowpea production system. However, flower and pod attacking pests are the most important arthropod pest of cowpea [17; 10; 7;8; 9]. Losses in grain or foliage attributed to field pests of cowpea ranges from 20% to almost 100% [17; 19]. These high losses have contributed immensely to cowpea's subsidiary position in the farming systems of several countries in the tropics [6; 11]. Control of these pests is therefore crucial to sustainable production of cowpea.

Although there are several commercial insecticides available for the control of these pests with resultant increases in grain yield by several folds. Use of such insecticides is often too expensive for resource-poor farmers, unavailable in local markets and can also result in food contamination or environmental pollution [7]. In order to reduce both over dependence on insecticides and grain yields reduction due to insect pests damage, the search for cowpea cultivars resistant to these pests has been intensified by scientists in the international institute of tropical Agriculture (IITA) and others institutions notably Makerere University in Eastern Africa and Bunda College in South Africa. However, it has not, to date, been possible to find high levels of resistance and/or multiple pest resistance to certain major pests such as the legume pod-borer, *Maruca (testulalis) vitrata* Fab., the legume flower thrips*, Megalurothrips sjotedti* Troborn *and* the pod-sucking bug complex*, Clavinggralla tomentosicollis* Stal, *Mirperus jaculus* Thunberg, *Nezara viridula* L*. and Anoplocnemis curvipes* Fab.. Although, several high yielding early maturing cultivars well-adapted to different ecological zones have been developed with their associated degree of pest tolerance, integrated pest management (IPM) will remain the best option to reduce risks of crop losses due to insect pests and increases grain yield for the resource poor farmers who grow and derive a sizeable portion of their protein and part of income from cowpea [2].

In Nigeria, Cowpea (*Vigna unguiculata)* is a major food crop grown. Yields are however generally low, sometimes total yield losses occur [13]. Successful cowpea production should depend on correct time of

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planting, cultural, physical/mechanical practices and the resistance capability of the variety because most of these pest and disease bred on volunteer grasses and wild legumes species [20]. Therefore, there is possibility of high population of such pest around farmers' farm right from the onset of the crop. This has necessitated the persistent use of pesticide in all cowpea production enterprises. However, improper application of these pesticides have resulted in environmental pollution, human health problem and insect pests resistance problems [14]. Hence, this study on the comparative susceptibility of different varieties of cowpea to field pest infestation is to prospect for varieties that guarantee productivity in face of such infestations. The **objectives** of this study is therefore, to compare the susceptibility of some cowpea varieties (*Vigna unguiculata)* to infestation by field pest to ascertain the best cultivar that can be grown in this locality and similar systems with reduce insecticide application in an integrated pest management and good agricultural practice fashion.

2. MATERIAL AND METHODS

2.1 Study area

The study was conducted at the research and teaching farm of the Faculty of Agriculture Adamawa State University, Mubi, during 2011 cropping season (15th July- 15th November). The research farm is located on latitude $10^0$11N and longitude $13^0$19E at an altitude of 696 above sea level [1].

2.2.1 Land preparation

The land was prepared by ploughing and harrowing with a tractor in the early season i.e. onset of rainfall. The plots were prepared manually using shovels and hoes in the late season prior to sowing. Experimental plots measured 4m x 4m each with inter-plot space of 1m in-between plots were also marked out manually.

2.3 Source of planting material

Five varieties of cowpea namely Kanannado, Ife-brown, Samira, or English beans, Iron beans and BOSADP were compared in this experiment. The varieties were obtained from Mubi market (Kanannado, Ife brown and Samira) and Adamawa Agricultural Development Programme Mubi (BOSADP and Iron beans).

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2.4 Sowing and spacing

Planting where done at a space of 1m x 30cm. inter and intra row respectively on 4th August, 2011. Three seed were planted per hill and hill that did not germinate or destroyed by birds during sporting was supplied 6 days after planting. The seedlings were thinned to two plants per stand ten (10) days after sprouting. Each plot consists of 4 rows of 22 stands per row, making the total plant per plot to be 88 stands. Regular weeding of the farm was done 3 times before maturity to control weeds that harbour pest and disease.

2.5 Experimental design and layout

The experiment consisted of 5 treatment and 4 replicates fitted into a randomized complete block design (RCBD, the varieties were the treatments.

2.6 Data collection

Data was collected on the following:-

2.6.1 Days to 50% flowering

Numbers of days when 50% of the plants have flowered were taken for each plot of each variety and the means were recorded.

2.6.2 Days to 50% pod setting

Numbers of days when 50% of the plants have started podding were taken on each plot for each variety and their mean was recorded as the days to 50% poding setting

2.6.3 Days to 50% pod maturity

Numbers of days at which 50% of the plant have shown pod maturity were also taken for each plot of each variety and their mean was recorded as days to 50% pod maturity.

2.6.4 Mean number of flower set

Numbers of flower sets per plot for each variety were taken on every other day basis and average recorded.

2.6.5 Numbers of flowers producing pods

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Numbers of flowers producing pods were also taken and recorded.

2.6.6 Numbers of pods surviving

Numbers of surviving pods on tagged plants were also counted and their average taken.

2.6.7 Numbers of healthy pods

Numbers of healthy pods found on each variety were counted and recorded

2.6.8 Insect pest collection and identification

Observation (inspection) was done visually every three (3 days) during flowering stage which is the most critical stages in cowpea phenology with respect to insect infestation [17] to ascertain the presence of insect pests on each plot and for each variety. Insects species found on flowers were collected by beating and jarring method, using an improvised beating sheet. Available insect were transfer into collection bottles (killing jars) and were later observed under hand lens and images were compared with plates slides of photographs from a book "Cowpea Pest and Diseases" by Singh and Allen (1978) for identification.

2.6.9 Output per cultivar

Final yield (g/plot i.e. $16m^2$) for each cultivar was taken and interpolated to output per hectare (ton/ha).

2.7 Statistical Data Analysis

All data collected were subjected to one way ANOVA. Data on days to 50% flowering, days of 50% podding, 50% pod maturity and yield per plot were analyzed using Genstat statistical package, means were separated using Least Significant Difference (LSD). Data on number of flower set, number of flower producing pods, number of pods surviving and number of healthy pods were subjected to one way ANOVA using SAS statistical packages. Means were separated using Duncan's Multiple Range Test (DMRT). Mean yield for each variety under study was computed on plot and later extrapolated to hectare basis.

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3. RESULTS AND DISCUSSION

3.1 Days to 50% flowering, podding and Pod Maturity

The result for days to 50% flowering, podding and Pod maturity is presented on Table1. The result show that, there is no significant (*P*>.05) difference among the varieties in terms of days to 50% flowering and that of pod maturity. This implies that all the varieties have similar phenological productive stages and hence were prone to same levels of pest infestation at same period in their productive cycle.

The result equally indicate that, there is no significant (*P*>.05) difference in mean days to 50% podding for Iron beans, Samira and Kanannado, but they are significantly different from Ife brown and BOSADP. This also implies that Iron beans, Samira and Kanannado will sustain same level of damage at the podding stage while Ife brown and BOSADP pest infestation intensity will equally be same.

Table1 Means number of days to 50% flowering, podding and Pod Maturity

Variety	Mean ±SE		
	DOT 50% Flowering	DOT 50% Podding	DOT 50% pod maturity
Iron beans	77.50±2.50a	86.75±0.25a	91.25±0.25a
Ife brown	79.50±0.50a	80.50±3.59b	90.75±0.25a
BOSADP	76.00±3.00a	80.00±2.38b	90.00±0.58a
Samira	78.00±0.58a	85.00±3.33a	90.75±0.25a
Kanannado	76.00±1.00a	85.50±1.90a	90.00±0.57a

DOT= days to; (Means followed by same letters in each column are not significantly different at 5% probability level)

3.2 Mean number of flower set and flowers producing pods

The result for number of flowers set is presented on Table 2 The result shows that iron beans produced the highest mean number of flowers (85.00±2.86) while the least mean flower was set by Kanannado (65.00±2.86) significant (*P= .05*) difference however, exist among some means (Table 2). This means that, yield of Iron beans, BOSADP and Samira all other factors being equall wilSimilarly, mean number of flowers set on Ife brown and Kanannado were significantly different from each other, and hence yields from such varieties will as well differ in the same order all other factors influencing production remain unchanged under normal cropping circumstances.

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The result for number of flowers producing pods is also presented on Table 2. The result reveal that iron beans had the highest number of flowers producing pods (80.00±2.20) while the least mean flower producing pods was recorded on kanannado (55.00±2.08). Statistically significant (*P= 0.05*) difference were however observed among some means (Table 2).Therefore, the result indicate that differential susceptibility with respect to insect pest infestation exists among the varieties tested. Mean number for flower set (Table 2) shows that, there is no significant difference among the mean number of flower produced on Iron beans, BOSADP and Samira, but significant difference exist between mean number of flowers set on Ife brown and Kanannado.

But in terms of flowers producing pods, there is a drop in mean number of pods by 5% in iron beans, 10% in Ife brown 19% in BOSADP 7% in Samira and 10% in kanannado. The above percentage losses are an index of differential susceptibility of the respective varieties under study to the effects of infestation by flower pest (flower thrips and blister beetles). Therefore drop in number of pods produced will lead to low output, which is expected also follow in the same pattern.

Table 2 Mean Number of flower set and flowers producing pods

Variety	Mean ± SE	
	Flowers set	Flowers producing pods
Iron beans	85.00±2.86a	80.00±2.20a
BOSADP	84.00±2.86a	73.00±2.12a
Samira	80.00±5.08ab	65.00±1.87b
Ife brown	71.00±5.10 bc	61.00±3.24 bc
Kanannado	65.00±2.86c	55.00±2.08c

Means followed by the same letter(s) are not significantly different using Duncan's multiple range test at p= 0.05 (DMRT).

3.3 Mean number of pod surviving and Healthy pod produced

The result for mean number of pods surviving and healthy pod in each variety is presented in Table 3. The results shows that significant (*P=.05*) differences exist among some means. However iron beans recorded the highest number of surviving and healthy pods ((70.00±1.78 and 41.00±3.24) respectively,

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while the least surviving pods was recorded on Ife brown (40.00±1.47) with Kanannado producing the least mean number (1.00±0.71) of healthy pods as shown on (Table 3) indicating that Kanannado is the most susceptible variety among all varieties tested.

Table 3 Mean number of surviving and Healthy pods produced

Variety	Mean ± SE	
	Surviving pod	Healthy pods produced
Iron beans	70.00±1.78a	41.00±3.24a
Samira	61.00±2.34b	24.00±1.08b
BOSADP	50.00±1.83c	10.00±1.29c
Kanannado	49.00±2.16c	1.00±0.71d
Ife brown	40.00±1.47d	2.00±0.40d

Means followed by the same letter(s) are not significantly different using Duncan's multiple range test at P= 0.05 (DMRT).

The result therefore implies that, some varieties are more susceptible to insect infestation during pod formation. Percentages, pods surviving on iron beans dropped by 90% from pods produced in Table 3 Samira by 88%, BOSADP by 85%, Ife brown by 88% and kanannado by 85% respectively. Losses in yields are also expected to be sustained in each of the varieties in live with the above. It has been reported that, more than 70% of total loss, in yield of cowpea is attributable to insect as a result of damage during the flower and pod formation stages [10; 8; 9]. The implication of the results of this study are that, yield reduction occurs between flowering and podding stages in the phenology and control of field pest infestation during flowering and pod formation is the best way of combating field pest attack on cowpea. Similarly the associated loss in yield will equally be reduced drastically by such intervention at this point. This finding agrees with [4; 15] which says; some genotypes in cowpea varieties were found moderately susceptible to pest. Thus none of genotype was found in cowpea free from the incidence of pest attack. Therefore, spraying at these stages may produce more healthy pods, hence better yield.

Therefore, farmers in this ecological zone should go for varieties like iron beans, Samira and BOSADP, because they have shown some degree of resistance to some field pest, especially flowering insect pest attack, by producing highest mean number of surviving pods Table 3.

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The study have also shown that, number of healthy pods produced at the end of the cropping season shows that significant difference *(P=.05*) exist among iron beans, BOSADP and Samira but no significant difference between Ife brown and kanannado in terms of healthy pods produced. The rate of insects infestation to cowpea is affected by the degree of the resistance of a cultivar which through physical or mechanical barriers [18]. However iron beans and BOSADP used in this study are improved varieties expected to have some degree resistance to some pest. The use of these varieties along good Agricultural practices or management strategies will reduce field pest infestation [2]. Therefore result of this study reveal that resistance alone does not offer effective control against the entire insect pest attacking cowpea in this locality. However, where a given cultivar gives higher yield advantage in the face of pest infestation will imply that, the variety is less susceptible to the attack of the insect pests species in the locality and hence can be easily grown with less pesticide in an integrated pest management (IPM) fashion or programme.

The implication of the result with respect to number of healthy pods produced is that, iron beans recorded the highest number of healthy pods (41.00±3.24) while the least mean number of healthy pods was observes on kanannado (1.00±0.71) as shown on (Table 3).

3.4 Insect pests collected and identified

The result for insect collection and identification is presented on Table 4. The result indicates clearly that the pest identified belong to four different orders and families and they feed on either flower or pods (Table 4)

Table 4 Insects pest collected and identified

S/No	Common name	Scientific name	Order: family	Part of plant n
1	Flower thrips	*Megalurothrips sjostedti*	Thysanoptera: Thripidae	Feed on flower buds and flowers

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2	Legume pod borer	*Maruca testulalis*	Lepidoptera: Pyralidae	Feeds on tender part of stem, peduncles, flower buds, flower and pods
3	Blister beetles	*Mylabris spp*	Coleoptera: Meloidae	The beetle feeds on flowers
4	Pod sucking bug	*Anoplocnemis curvipes*	Hemiptera: Lygaeidae	They suck sap from green pods causing them to shriveled and dry prematurely

3.5 Yield per variety

The result for yield per variety is presented on Table 5. The result shows that, Mean yield differences obtained among all the varieties are highly significant (P<.001). However, Iron beans had the highest yield of 2144g and 1.340 metric tons per plot (16m^2) and per hectare respectively, and the least yield was obtained with Samira 728g/plot(16m^2) and 0.455 metric tons/ha.

Table 5 Yield per variety of cowpea tested

Variety	Mean Yield/plot(16m^2) (g)±SE	Projected Yield/Hectare (metric tons)
Iron beans	2144.00±1.45a	1.340
BOSADP	1600.00±1.54b	1.00
Ife Brown	1287.00 ±4.04c	0.804
Kanannado	994.00±2.30d	0.621
Samira	728.00 ±4.05e	0.455

Means followed different letters are significantly different from each other

Yield obtained from the varieties have shown that, iron beans produced the highest yield of 2144g/16m^2 and the least was produced from Samira with 728g/16m^2. This means that, in the face of pest infestation, the variety that produced the highest yield /plot or hectare could be concluded to be the less susceptible to infestation by cowpea insect pest found in the study area. Therefore, farmers using these varieties

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along other pest management strategies will have a better yield guarantee than those using the other varieties.

Therefore, a management strategy that involves other control tactics to complement resistance is needed. It should target the most important pest in the locality, taking into account the resistance of a cultivar or variety to pest. This result is consistent with report that plant resistance in cowpea reduces pest infestation and markedly increase crop yield [7; 8; 5].

4. CONCLUSION

It could be concluded that two varieties (Iron beans and BOSADP) out of the five varieties tested have demonstrated the least level of susceptibility to field pest infestation, hence relatively more resistant to field pest infestation. Therefore, Iron beans and BOSADP due to their low susceptibility to field insect pest infestations gave higher yield per plot and per hectare when compared to other varieties. They could therefore be varieties of choice for cultivation in this locality in an integrated pest management fashion.

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