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RESPONSE OF COWPEA (*Vigna unguiculata* WALP.) TO SIMULATED DAMAGE ON FLOWER AND POD IN SAHEL SAVANNAH OF NIGERIA

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ABSTRACT

An experiment was conducted at Ramat Polytechnic Maiduguri Teaching and Research Farm in 2014 to determine the responses of cowpea to simulated damage on flowers and pods. Cowpea variety IT98k-131-2 was sown to $4m^2$ plot laid in a randomized complete block design. The trial was conducted in three separate experiments; experiment 1 consists of four treatments (removal of 25, 50 and 75% of flowers and a control), experiment 2 (removal of 25, 50 and 75% of pod and a control) and experiment 3 (complete removal of flower and pod at 7, 14 and 21 days from anthesis and a control). Parameters measured include number of seeds per pod, pod per plant, pod weight, 100 seed weight and grain yield. Results revealed that, removing up to 50% of either flowers or pods had no effect on the parameters measured. Similarly, continuous removal of flowers and pods for up to second week after anthesis had no effect on all the parameters measured either. However, when 75% of flowers or pods were removed at peak flowering and pod stages, grain yield was significantly reduced. Consequently, severe damage to flowers and pods in the 21 days after anthesis could affect grain yield. Therefore, if insecticide must be applied, it should be applied in the third week after anthesis i.e. late-flowering and early pod filling stages.

Keywords: Cowpea; simulated damage; IT98k-131-2; Sahel savannah

INTRODUCTION

Cowpea (*Vigna unguiculata* L. Walpers) an annual legume crop is also commonly known as southern pea, black eye pea, beans. It is a warm-season, annual, herbaceous legume with plant type often categorised as erect, semi erect, prostrate (trailing) or climbing. Cowpea performs in a wide variety of soils conditions, but performs best on well drained sandy loam, or sandy soils with pH in the range of 5.5- 6.5. Most cowpeas are grown on the African continent, particularly in Nigeria and Niger which account for 66% of world cowpea production (FAO, 2012). Nigeria produces 62% of world's cowpea (Adeola *et al.*, 2008) and most are produced in northern part of the country (Kamara *et al*., 2007). Insect pest attack is the single most important constraint to cowpea production (Maina *et al*., 2014). In particular, insect pests cause between 70 and 100 % grain yield loss in unprotected cowpea (Raheja, 1976; Onyibe *et al*., 2006). The avoidable losses in yield due

to insect pests have been recorded in the range of 66 to 100% in cowpea (Pandey *et al*., 1991).

For a successful integrated pest management (IPM) program, insect pest lifecycle and behaviour in relation to cowpea phenology and the resultant loss of grain yield is paramount. The population dynamics of insect pests of cowpea is largely determined by weather conditions and cowpea growth stage. The activities of major insect pests on cowpea is initiated after one month of seed germination and the stage at which the crop is most vulnerable to pest is found to be one and half months after sowing (Patel *et al*., 2010). These pests include; larvae of pod borer (*Maruca vitrata*), flower thrips (*Megalurothrips sjostedti*) pod sucking bugs, *Anoplocnemis curvipes*, and *Clavigralla tomentosicollis* are among the important pests of flower and pods (Maina *et al*., 2014). Similarly, every life stage of cowpea plant has an associated insect pest that attack it. However, cowpea response to these attacks vary due to the prevailing weather condition, extent of damage and growth stage of the plant. More than 70% of total grain loss in cowpea is caused by insects resulting from damage at flowering and pod formation stages (Raheja, 1976). Lack of economic threshold level (ETL) for the major cowpea insect pests is one of the causes of indiscriminate use of insecticide by cowpea farmers in developing countries.

Establishing a threshold level that is based on the natural infestation of the pest is difficult because of the dynamics of insect pest population and varietal differences among cultivated cowpea plant. However, simulated damage has been used to estimate the response of cowpea plant to injury by insect pests (Abudulai and Shepard, 2003) in the USA. Although, application of this result is limited by weather conditions which play a significant role in determining cowpea response to insect pest injury. This study was conducted to determine the cowpea response to simulated damage to flower and pod for an effective pest management that will require less synthetic insecticide.

MATERIALS AND METHODS

The Study Area

The trial was conducted at the research farm of the Department of Agricultural Technology, Ramat Polytechnic Maiduguri, Borno State, Nigeria. It was conducted under rain fed conditions in 2014. The soil of the area is Sandy loam.

Source of Materials

The Cowpea variety IT 98k-131-2 was obtained from IITA Kano substation. The insecticide cymbush super EC (Cypermethin 30g + dimethoate 250g) was purchased from accredited agro-chemical dealer in Maiduguri. IT98k-131-2 is erect type with brown medium sized seeds and has moderate level of resistance to pod sucking bugs and Maruca. It has medium duration of maturation (70 – 80 days) and non photosensitive (Onyibe *et al.*, 2006).

Treatments and Experimental Design

The treatments consisted of hand-removal of 25, 50 and 75% of flowers and pods separately at peak flowering and pod stages. Also hand-removal of 100% of flowers and

pods at 7, 14 and 21 days after anthesis and a control (undamaged plot) was included. The trials were in three separate experiments laid out in a randomised complete block design (RCBD) each. Removal of flowers and pods was done by hand in the morning between 8:00 and 11:00am. Each treatment was allocated to a 2 x 2 m plot and replicated four times. The plots were separated by 1 m alley and 1.5 m alley between replicates. Seeds were sown at spacing of 50 x 50cm and later thinned to two plants per stand two weeks after germination. Each plot had 12 stands arranged in 3 rows of 3 stands with 2 plants per stand. Sowing was conducted on 26 July, 2012. Cymbush super EC at the rate of 30g + 250g /litre was applied in a mixture containing 75 ml of the chemical and 15litres of water using a knapsack sprayer. The insecticide application was started from the budding stage and applied at an interval of 5 days to ensure that insect pests of flowering and pod stages did not interfere with the results of the treatment. Weeding was done twice (10^{th} and 24^{th} July, 2014).

Data Collection

Number of pods per row was counted and divided by the number of plants within the row to obtain the average number of pods per plant. Pod weight was obtained by weighing randomly selected 50 pods from each and the average weight was determined**.** From the harvested pods of each plot, 15 pods were selected and the number of seeds were counted and divided by 15 to obtain the average number of seeds per pod**.** From each plot, 3 samples of 100-seeds were weighed separately and the average of 100 seed weight was obtained. Matured and dried pods from cowpea plants on the two randomly selected rows were harvested, shelled, winnowed and the grain weighed and recorded for each plot.

Data Analysis

Data were subjected to analysis of variance (ANOVA). The analysis was done using statistix 8.0 software. Significant differences between means were determined using LSD test at 5% level of significance.

RESULTS

Results of experiment 1 showed that removal of 25-75% of flowers at peak flowering period did not have any significant ($P>0.05$) effect on the pod weight, number of seeds per pod and 100 seed weight (Table 1). However, the number of pods per plant and grain yield were significantly lowered by removal of 75% of flower than the control. Removal of 25-50% of flowers did not have any significant effect on the pod weight, number of pods per plant, number of seeds per pod, 100 seeds weight and grain yield compared with the control.

In experiment 2, removal of 25-75% of pods had no significant ($P>0.05$) effect on the pod weight and number of seeds per pod (Table 2). However, the number of pods per plant and grain yield were significantly lower where 75% of pods were removed than the control. Conversely, 100 seeds weight was significantly higher in plots where 75% of pods were removed than the control.

In experiment 3, complete removal of flowers and pods from anthesis to 7, 14 and 21 days had no significant ($P>0.05$) effects on the pod weight, number of seeds per pod and

100 seed weight (Table 3). However, the number of pods per plant and grain yield were significantly lowered by a complete removal of flowers and pods from anthesis up to 21 days than the control. This indicates that damage to flower and pod by flower thrips, legume pod borer and pod-sucking bogs could seriously affect grain yield.

Table 1: Effect of simulated damage of flower at peak flowering stage on yield parameters of rain fed cowpea.

Treatment	Pod weight (g)	No. of seed/pod	100 seed weight (g)	No. of pod/plant	Grain yield (kg/ha)
25% Deflower	2.50[b]	11.80	17.02[ab]	17.63[ab]	1321.50[a]
50% Deflower	2.80[ab]	11.78	16.15[b]	18.38[ab]	1280.20[a]
75% Deflower	3.10[a]	10.60	17.28[a]	14.70[b]	864.80[b]
Control	2.95[a]	12.48	17.00[ab]	19.01[a]	1645.00[a]
S E	0.18	1.20	0.40	1.89	163.66
LSD	0.41	2.92	1.10	4.29	370.22

Table 2: Effect of simulated damage of pods at peak podding stage on the yield parameters of rain fed cowpea

Treatment	Pod weight (g)	No. of seed/pod	100 seed weight (g)	No. of pod/plant	Grain yield (kg/ha)
25% Depod	2.80	11.23	16.54[b]	16.43[ab]	1400.40[a]
50% Depod	3.00	11.33	17.63[ab]	13.41[b]	1221.31[ab]
75% Depod	3.02	11.93	19.04[a]	12.10[b]	1057.20[b]
Control	3.20	12.48	16.78[b]	22.03[a]	1485.00[a]
SE	0.24	0.89	0.89	3.65	21.29
LSD	0.54	2.03	2.01	8.26	232.61

Table 3: Effect of simulation damage of flower and pods on the yield parameters of rain fed cowpea.

Treatment	Pod weight (g)	No. of seed/pod	100 seed weight (g)	No. of pod/plant	Grain yield (kg/ha)
7 days	2.60	11.20	16.19	20.10[ab]	1351.80[ab]
14 days	2.45	10.95	16.99	16.20[ab]	1101.50[bc]
21 days	2.90	11.45	16.36	11.08[b]	1006.40[c]
Control	2.95	12.48	17.08	21.98[a]	1445.00[a]
SE	0.29	1.28	0.66	4.29	156.62
LSD	0.67	2.89	1.49	9.71	332.12

DISCUSSION

Removal of up to 75% of either flower or pod at peak flowering and pod period respectively, had no significant ($P>0.05$) effect on the pod weight, number of seed per pod and 100 seed weight. However, the number of pod per plant and grain yield was lowered by removal of 75% of flowers at peak flowering period. This indicates that up to 75% flower damage by flower thrips and legume pod borer would have no effect on the pod weight,

number of seed per pod and 100 seed weight. This corroborate the findings of Abudulai and Shepard, (2003), who reported that removal of flowers at levels of 20, 50 and 80% did not affect pod weight or number of seeds per pod. Conversely, up to 75% removal of flower or pods by flower thrips, *Maruca vitrata* and pod sucking bugs caused grain yield reduction. Wein and Tayo, (1978) noted that removal of pod at 10 and 20 days after anthesis had lowered grain yield relative to control.

There was a significant (P>0.05) increase in 100 seed weight after removal of 75% of pod, though the increase in weight was not enough to compensate for the total grain yield reduction. Continuous removal of flower and pod at 7 and 14 days after anthesis did not have any significant (P>0.05) effect on the yield parameters. However, complete removal of flowers and pods for up to 21 days had reduced the number of pods per plant and grain yield. This shows that cowpea's ability to recover from damage to the reproductive parts by insect pest is limited. Similar observation was made by Ojehomon, (1970) and Ndunguru *et al*., (1978) that recovery from damage to reproductive structures is limited, especially toward the end of the growth cycle due to senescence.

CONCLUSION

This study revealed that damage to flowers and pods of cowpea by pest in the first and second weeks after anthesis is tolerable. However, beyond this period it would require control measure to avoid economic loss of grain yield. Therefore, if insecticide must be applied, it should be applied in the third week after anthesis i.e. late-flowering and early pod filling stages.

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