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Effect of variety and apron star on incidence and severity of *cercospora* leaf spot disease of cowpea (*Vigna unguiculata*) in Sokoto, North-Western Nigeria

Abstract

Field study was conducted during the 2015 raining season, at the Usmanu Danfodiyo University, Dry land farm, to evaluate the effect of *Cercospora* leaf spot disease and seed dressing chemical (Apron star) on different varieties of cowpea viz. Sampea-7, Sampea-8, Sampea-9, Sampea-11, Sampea-15 and Ex-Yumfa. Randomize Complete Block Design was used for the study. Results revealed that all the varieties were infected by *Cercospora* leaf spot disease at varying level. Ex-yumfa had highest disease incidence and severity both at 9 WAS and at harvest (40.385% and 55.128% incidence at 9 WAS and at harvest respectively) and (35.537% and 65.186% severity at 9was and at harvest). Lowest disease incidence was observed both at 9 WAS and at harvest on Sampea-15 (19.911% at 9 WAS and 28.884% incidence at harvest) and (11.911% and 21.852% severity) and no significant difference was recorded between dressed and undressed. Ex-Yumfa had lowest 100 grain (g) weight and yield per ha-1 while Sampea-7,8,9 and 11 are statistically similar also, there was no significant difference between dressed and undressed seeds in 100 grains weight seed and yield.

Keywords: variety, seed dressing chemical, disease incidence, disease severity, cowpea yield

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Introduction

Cowpea (*Vigna unguiculata* L.) Walp is known to be affected by several fungal, bacterial and viral diseases. One of such fungal diseases reported to cause serious yield loss in the cowpea is the *Cercospora* leaf spot disease caused by two fungi namely, *Cercospora canescens* Ellis and Martin and *Cercospora cruenta*.[1] Yield loss attributed to *Cercosora* leaf spot in susceptible cowpea variety varies between 36% and 42%.[2] Out of 75 cowpea varieties evaluated in 1999 and 2000, about 42% of the germplasm was found to be susceptible to *Cercospora* diseases,[3] with Ife brown having 80% *Cercospora* incidence on the field. According to Booker and Pathmanathan, a *Cercospora* leaf spot disease is a serious limitation to cowpea production, resulting in yield loss of as much as 42 percent. Due to the high cost of chemicals used in the control of *Cercospora* leaf spot disease of cowpea, equipment, and misuse of these chemicals, which cause a harmful effect in the environment, has been the major factors that necessitate the search for other methods of disease management. It therefore, the use of resistance varieties, thus, can help to reduce the incidence and severity of *Cercospora* leaf spot disease of cowpea.

Therefore the objectives of this study are

i. To evaluate cowpea varieties for resistance to *Cercospora* leaf spot disease of cowpea.

ii. To determine the effect of seed dressing chemical (Apron star) on *Cercospora* leaf spot disease of cowpea.

Materials and methods

The experiment was carried out at the Dry land Teaching and Research Farm of Crop Science Department, Usmanu Danfodiyo University, Sokoto, during the 2015 cropping season. The farm is located along Usmanu Danfodiyo University Model Secondary School. Sokoto is located in Sudan savanna on latitude 13^0 01^1 N and longitude 5^0 15^1E; The soil is sandy and lies at an altitude of 350m above sea level, with minimum and maximum temperature of 15°C and 40°C respectively[4] and 645mm of rainfall.[5]

Treatments and experimental design

The treatment consists of five improved cowpea varieties. Sampea-7, Sampea-8, Sampea-9, Sampea-11 and Sampea-15. The cowpea varieties were sourced from Institute of Agricultural research Samara, Zaria (IAR), Department of Crop Science, Seed production unit, and one local variety, Ex-gidan Yunfa which were obtained from Gidan yumfa Village.

The Experiment was laid out in a Randomized Complete Block Design (RCBD) made up 36 plots, with three (3) replications, each block having 12 plots; each plot measured 4x3m($12m^2$). Each plot consists of four (4) rows spaced at 75cm and 30cm intra row. The blocks and plots were separated by an alley way of 1m and 0.5m respectively.

Cultural practices

Land preparation: The land was cleared of shrubs and stubbles, and ploughed with a tractor. The soil was prepared to provide sufficient tilth for good root growth.

Seed dressing: Seed dressing was carried out according to the treatment with undress as control.

Sowing: Sowing was carried out on 06/07/2015 at a spacing of 75cm between rows (inter-row spacing) and 30cm intra-row spacing. The sowing was carried out with the use of thread and pegs to make straight lines and to plant the seed at regular intervals.

Fertilizer application: Fertilizer was applied at the rate of 15kg/ha N as a starter dose for good crop and phosphorus in the form of single super phosphate, at the 30kg p/ha recommended for cowpea production to help the crop to nodulate well and fix its own nitrogen from the air.

Weeding: Weeding was carried out at two, five, and nine weeks after planting.

Insecticide application: Cowpea plant was protected from insect attack by application of Cypermethrin+Dimethoate insecticide at the rate of 50g a.i./ha. It was done at flowering and podding stages.

Data collection: Growth parameters, Stand establishment count, Plant establishment count was taken for each plot using the following formula:

$$Establishment\ count = \frac{\text{Established plants}}{\text{Number of seed sown}} x100$$

Plant height (m): This was done at nine weeks after sowing (WAS) and at harvest, five plants were randomly selected and were measured from the soil level to the terminal bud using meter rule.

Days to first flowering: Number of days to first flower was noticed by regular visiting to experimental area after planting.

Days to 50% flowering: Number of Days at which 50% of the plants have produced flower was counted per plot. This was done by regular visit to the field and visual observation.

Number of branches per plant: Number of branches was determined by visual counting of the number of leaves per plant.

Disease parameters

Disease incidence: Data on incidence of the disease was taken at 9 weeks after sowing, number of stand showing symptoms of the disease in each plot was counted and expressed as percentage of the number of stand in each plot using the following formula.

$$Disease\ incidence = \frac{\text{Number of infected stands}}{\text{Number of total stand in the plot}} x100$$

Disease severity: Severity of the disease was determined using a scale of 1-9. Five plants were selected at random which were observed and scored based on the extent of disease establishment on each, a scale number was assigned.

Disease severity scale

0=Not infected

1=slightly infected

3=slightly moderately infected

5=moderately infected

7=less severely infected

9=severely infected

$$Disease\ Severity = \frac{\sum n}{NX9} x100$$

Where,

DS =*Cercospora* leaf spot severity (%)

$\sum_n$ =Summation of Individual ratings

N =Total number of plant assessed

9 =Highest score on the severity scale

Yield parameters: Number of pods per plant. At the end of trial, five cowpea plants were randomly selected and their number of pods was taken, average obtained.

Harvesting: Harvesting was carried out by harvesting all the pods and cutting the main plant. Weight of 100 Seed (g). At the end of the study 100 seeds of cowpea from each plot were counted, weighed for each treatment.

Seed yield: At the end of the study seed yield per plot was obtained by weighing the seeds from each treatment and projected to per hectare.

Data analysis: Data collected were subjected to analysis of variance (ANOVA) based on Randomized Complete Block Design, while significant means were separated using the Duncan's multiple range test (DMRT), at 5% level of significance.

Results and discussion

Establishments count

The effect of seed dressing chemical and variety on stand establishment count during 2015 cropping season is presented on Table 1. The result reveal that, the treatments were at per statistically different ($P<0.05$) Seeds dressed with Apron star gave highest number of established plants than undressed. This could be as a result of the effect of Apron star, which helped in germination by controlling seed borne and seedling disease, as stated by Ebofin.[6] The table also reveal the effect of variety on establishment count, where Ex-Yumfa had highest number of established plants and lowest was recorded on Sampea-9. Sampea-7, Sampea-8, Sampea-11 and Sampe-15 are statistically similar. The observed varietal differences in germination percentage may be related to differences in seed size. Borji et al.[7] observed that inhibition of establishment may be related to seed coat thickness, number of seed coat pores and seed size. Also there is no significant different between the interaction of variety and fungicide.

Plant height

Result of effect of fungicide and variety on plant height at 9WAS and at harvest is presented in the Table 2. Both fungicide and variety produced significant ($P<0.05$) effect on plant height. Seed dressed with Apron star differed significantly ($P<0.05$) both at 9WAS and at harvest. The highest mean of plant height was recorded on seeds treated with the fungicide both at 9 WAS and at harvest. The differences observed both at 9WAS and at harvest may be due to protection offered by Apron star against soil, foliar diseases and pest. This is in agreement with Richards et al.,[8] who reported that seed dressing with Apron star gave protection against soil and foliar diseases which may hinder crop growth.

Citation: Muhammad AS, Sajo AY, Bello I, et al. Effect of variety and apron star on incidence and severity of *cercospora* leaf spot disease of cowpea (*Vigna unguiculata*) in Sokoto, North-Western Nigeria. *J Appl Biotechnol Bioeng.* 2018;5(1):11–15. DOI: 10.15406/jabb.2018.05.00110

The Table 2 also revealed the result of plant height as influenced by variety both at 9WAS and at harvest with Sampea-15 having highest plant height both at 9WAS and at harvest and lowest plant height at 9WAS was obtained from Sampea-11 and Sampea-11 at harvest. While Sampea-7 and Sampea-8 are statistically similar at 9WAS, and Sampea-7 and Sampea-8 are similar at harvest. The varietal differences observed on plant height under the same environmental condition may be an inherent trait peculiar to each of the varieties.

Disease incidence at 9 weeks after sowing and at harvest

Table 3 indicates the effect of fungicide and variety on disease incidence at 9WAS and at harvest. The result from the table revealed that, there was no significant difference (P>0.05) on disease incidence at 9WAS and at harvest between dressed and undressed seeds, but significant difference(P<0.05) exists between the verities, where Ex-Yumfa had highest disease incidence both at 9WAS and at harvest, and lowest was observed on Sampea-15 both at 9WAS and at harvest, followed by Sampea-7 at 9WAS, and Sampea-8, Sampea-9, and Sampea-11 are statistically similar at 9WAS and Sampea-7, Sampea-8 and Sampea-9 are similar at harvest. The differences observed in disease incidence between the varieties may be due to the inherent genetic make-up of the varieties, which is supported by Allerd et al.[9] They reported that varieties react differently to diseases due to their different inherent genetic make-up. There was no significant effect between variety and fungicide.

Disease severity at 9 weeks after sowing and at harvest

Table 3 also indicates the effect of fungicide and variety on disease severity at 9 WAS and at harvest. The Table showed that seed dressing had no effect on disease severity both at 9 WAS and at harvest, but difference existed between the varieties. Highest severity was observed on Ex-Yumfa both at 9 WAS and at harvest, and lowest severity was observed on Sampea-15 at 9 WAS and at harvest respectively. Similarly Sampea-8 and Sampea-9 are statistically similar at 9 WAS, but differ significantly at harvest. The 6 varieties react differently on their level of disease incidence and severity to *Cercospora cruenta* and *canescens*, which indicated that varieties have different level of resistance to the disease. This may be due to the inherent genetic make-up of the varieties to resist the disease at different levels.[9,10]

Weight of 100 grains

The result of effect of fungicide and variety on 100 grains weight is presented in Table 4. The result showed that, there was no significant (P>0.05) difference between dressed and undressed seeds but significant (P<0.05) difference exist between the varieties. Highest mean of 100 grains weight was obtained on Sampea-9 and lowest was obtained from Ex-Yumfa, while Sampea-9, Sampea-8, Sampea-11 and Sampea-15 are statistically the same. This may be as a result of effect of *Cercospora* leaf spot on the performance of the variety[11] coupled with the ability of varieties to accumulate assimilates under the disease condition.

Seed Yield

The result of effect of variety and fungicide on Seed yield is presented in the Table 4. Table showed that there was no significant (P>0.05) difference between dressed and undressed seeds on seed yield per ha^{-1}. But significant (P<0.05) difference exist between the varieties, where Ex-Yumfa produced significantly (P<0.05) lower than Sampea-7, Sampea-8, Sampea-9, Sampea-11 and Sampea-15 in terms of yield per ha^{-1}. Which might be due to high leaves defoliation on Ex-gidan yumfa. This was in agreement with the finding of Booker and Pathmanthan who reported that, *Cercospora cruenta* and *canescens* have a serious effect on yield under severe infestation up to 42% loss in yield. Furthermore, Plantwise[11] also reported that seed yield of cowpea was correlated with *Cercospora* leaf spot disease severity from artificially and naturally occurring epidemics at Ibadan.

Table 1 Establishment count of cowpea as influenced by variety and seed dressing during 2015 cropping season in Sokoto

Treatments	Establishment count (%)
Fungicide	
Dressed	94.132
Undressed	84.373
SE±	1.716
Significance	*
Variety	
Sampea-7	88.717^{ab}
Sampea-8	87.306^{ab}
Sampea-9	79.724^{b}
Sampea-11	83.872^{ab}
Sampea-15	89.231^{ab}
Ex-Yumfa	91.667^{a}
SE±	2.972
Significance	*
Interaction	
VXF	NS

Means bearing the same superscript along the same column are statistically the same at 5% level of significance.

NS, Not significant;

*=Significant

Table 2 Plant height of cowpea as influenced by variety and fungicide at 9 WAS and at harvest

Treatments	Plant height At 9 WAS (cm)	Plant height At 14WAS (cm)
Fungicide		
Dressed	165.3	259.5
Undressed	135.6	209.9
Significance	*	*
SE±	0.12	1.7
Variety		
Sampea-7	165.6^{b}	258.5^{ab}
Sampea-8	160.0^{c}	247.6^{abc}
Sampea-9	130.0^{d}	206.6^{cd}
Sampea-11	127.0^{d}	200.0^{d}
Sampea-15	173.6^{a}	273.4^{a}

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Table Continued

Treatments	Plant height At 9 WAS (cm)	Plant height At 14WAS (cm)
Ex- Yumfa	146.1^{cd}	221.7^{bcd}
Significance	*	*
SE±	0.104	0.147
Interaction		
VXF	NS	NS

Means bearing the same superscript along the same column are statistically the same at5% level of significance according to DNMRT.

* =significant

NS, not significant; WAS, Weeks after sowing

Table 3 Influence of variety and fungicide on Cercospora leaf spot of cowpea at 9 WAS and at harvest

Treatments	Disease incidence		Disease severity	
	At 9 WAS	At Harvest	At 9 WAS	At Harvest
Fungicide				
Dressed	25.427	37.393	26.204	43.704
Undressed	30.987	41.453	27	47.624
Significance	NS	NS	NS	NS
SE±	1.334	1.622	1.627	1.002
Variety				
Sampea-7	23.718^{c}	38.982^{bc}	21.602^{c}	35.463^{e}
Sampea-8	26.282^{bc}	34.936^{cd}	31.037^{a}	47.037^{c}
Sampea-9	25.962^{c}	34.296^{cd}	29.916^{ab}	50.741^{bc}
Sampea-11	33.013^{b}	44.551^{b}	29.611^{b}	53.704^{b}
Sampea-15	19.85^{c}	28.884^{d}	11.911^{d}	21.852^{e}
Ex-Yumfa	40.385^{a}	55.128^{a}	35.537^{a}	65.186^{a}
Significance	*	*	*	*
SE±	2.311	2.809	2.817	1.736
Interaction				
VXF	NS	NS	NS	NS

Means bearing the same superscript along the same column are statistically the same at 5% level of significance according to DNMRT.

NS= Not significant

*= Significant

WAS, Weeks after sowing.

Table 4 Effect of fungicide and variety on 100 grains weight

Treatments	100 grain weight (g)	Seed yield (kg/ha^{-1})
Fungicide		
Dressed	12.419	2456.869
Undressed	11.739	2838.756
Significance	NS	NS
SE±	0.322	642.83
Variety		
Sampea-7	12.332^{a}	1135.783^{b}
Sampea-8	12.563^{a}	1381.267^{a}
Sampea-9	12.713^{a}	1382.583^{a}
Sampea-11	13.208^{a}	530.025^{c}
Sampea-15	12.847^{a}	1113.100^{b}
Ex-Yumfa	8.813^{b}	574.117^{c}
Significance	*	*
SE±	0.278	113.414
Interaction		
VXF	NS	NS

Means bearing the same superscript along the same column are statistically the same at 5% level of significance (DMRT).

NS, not significant

* = significant

Summary

Field study was conducted to evaluate Six Cowpea varieties for their resistance to *Cercospora* leaf spot disease of cowpea at the Dry land Teaching and Research farm of Crop Science Department Usmanu Danfodiyo University, Sokoto during 2015 cropping season, and also to evaluate the effect Apron star on incidence and severity of the *Cercospora cruenta* and *canescens*. Randomized Complete Block Design (RCBD) was used for the study. A scale 1-9 was used, five Plants were randomly selected from each treatment which were observed and scored based on the extent of disease establishment. From the result obtained in the study Ex-Yumfa had highest disease incidence and severity both at 9 WAS and at 14 WAS respectively. Lowest disease incidence and severity was observed on Sampea-15 at 9 WAS and at 14 WAS. The results also revealed that, fungicide had no significance effect on number of branches per plant, 100 grains weight and seed yield. Significance differences were however, observed between the varieties both interns of number of branches per plant, 100 grains weight, and seed yield, with Sampea-9 having the highest and lowest was observed on Ex-Yumfa.

Conclusion

From the result obtained in this study, it could be concluded that, all varieties were susceptible to *Cercospora cruenta* and *C. canescens* with Ex-Yumfa, Sampea-11 and Sampea-9 recorded with high level of susceptibility. The least susceptible variety is Sampea-15, therefore may be regarded as tolerant to *Cercospora cruenta* and *C. canescens*. Furthermore seed dressing with Apron star has no any effect on incidence and severity of the disease.

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None.

Conflict of interest

The author declares no conflict of interest.

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