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EFFECTS OF VARIETY AND INTRA-ROW SPACING ON CERCOSPORA LEAF SPOTS DISEASE OF GROUNDNUT IN THE SUDAN SAVANNA

A. S. Muhammad[1] and B. S. Bdliya[2]

[1] Department of Crop Science, Usmanu Danfodiyo University, Sokoto, Nigeria

[2] Department of Crop Protection, University of Maiduguri, Maiduguri, Nigeria

ABSTRACT

A field study was carried out at the University of Maiduguri Teaching and Research Farm during the 2006, 2007 and 2008 cropping seasons to evaluate the effects of variety and intra-row spacing on *Cercospora* leaf spot disease of groundnut. The experimental design used was Randomized Complete Block Design (RCBD) with nine treatment combinations of three varieties of groundnut (Ex-Dakar, RRB and ICGV-86024) and three levels of intra-row spacing (20, 25 and 30 cm) replicated three times. Disease incidence and disease severity were significantly higher in Ex-Dakar and 20cm, thus yielded lower than RRB, ICGV-86024, 25cm and 30cm. On the other hand, 20cm spacing recorded significantly higher kernel as well as haulm yield due to higher plant density per unit area.

Keywords: Groundnut; *Cercospora* leaf spots; Intra-Row Spacing; Yield

INTRODUCTION

In Nigeria leaf spot and rosette virus are the most serious damaging diseases of groundnut (Alabi *et al*., 1993). Worldwide losses as high as 50% of the seed yield and even higher for haulms due to *Cercospora arachidicola* and *Cercospora personata* have been reported (Nyval, 1989; Dewaele and Swanevelder, 2001; Salako, 1987).

Control of leaf spot diseases in Nigeria has depended on some cultural practices and on multiple applications of fungicides. Effective and long-term control of leaf spot disease can be achieved by applying recommended fungicides at the recommended time intervals. However, repeated application of fungicides could lead to reduced efficacy of the fungicides due to a gradual loss of sensitivity in the target pathogen population. It could also contribute to greater production costs and environmental pollution (Izge *et al*., 2007). Cultural practices that have been reported to reduce the incidence and severity of the disease include measures aimed at reducing the potential sources of pathogens such as destruction of crop residues and volunteers. Others include early sowing, wide spacing, crop rotation; host plant resistance as well as optimal fertilization (Acland, 1971; Hill and Waller, 1998; Nyval, 1989; Adipala *et al.*, 2000).

This paper reports the results of an experiment to identify the ideal intra-row spacing and variety of groundnut that will record the lowest incidence and severity of *Cercospora* leaf spot of groundnut in the Sudan savanna in north-eastern Nigeria.

MATERIALS AND METHODS

Site Description

The study was conducted at the Teaching and Research Farm of the Department of Crop Protection, Faculty of Agriculture, University of Maiduguri, Nigeria (Latitude 11º51'N; 13º15'E) during 2006, 2007 and 2008 cropping seasons. The soil type of the experimental site is sandy loam and has been classified as typic ustipsamment (Rayar, 1984). The area has been cropped with groundnut for several years ensuring build up of disease inocula. Natural epiphytotics in field were therefore relied upon as the source of inocula in all the seasons.

Treatments and Experimental Design

The treatments consisted of three spacings and three groundnut cultivars. The spacing comprised 20, 25 and 30 cm for intra-row spacing and a maintained 50cm of inter-row spacing, whereas the varieties of groundnut include Ex-Dakar, RRB and ICGV 86024. The treatments were laid out in a Randomized Complete Block Design (RCBD) and replicated three times. The layout consisted of three blocks each comprising nine sub-plots measuring 5 x 4 m^2 (i.e. 20 m^2) replicated three times giving a total of 27 sub-plots. A space of one metre (1m) was left between the blocks and that of half-metre (0.5m) was left between each sub-plot. However, the total area of experimental plot was 50 x 13.m^2 (650 m^2).

Cultural Practice and Data Collection

The land was ploughed mechanically by tractor followed by leveling with hoe before laying out of plots. The seeds were dressed with seed dressing chemical Aldrex - T before sowing. Sowing was done manually by hoe using dibbling method. Two seeds per hole were sown. The fertilizer applied was NPK (15:15:15) at the rate of 720 g/plot at sowing. Weeding was done manually and hand pulling at three weeks and six weeks after sowing. Ten plants were selected randomly in each sub-plot making a total of 90 plant stands from each block for data collection. Parameters taken were disease incidence, severity, number of pods as well as seed and haulm yield. Data on disease incidence was taken at 65 days after sowing and at harvest. The number of stands showing symptoms of the diseases in each sub-plot was counted and the percentage of disease incidence was computed. Disease severity assessment was carried out using a scale of 1 to 9 (Subrahmanyam *et al.*, 1995). Ten plants were selected at random which were observed and scored. Based on the extent of disease on each, a scale number was assigned.

Data Analysis

The data collected were subjected to statistical analysis of variance (ANOVA) based on randomized complete block design and the difference between means was determined using least significant difference (L.S.D) as described by Gomez and Gomez (1984).

RESULTS AND DISCUSSION

Disease Incidence and Severity

Only in 2007, variety significantly influenced disease incidence at 65 days after sowing. Ex-Dakar recorded disease incidence significantly ($P<0.05$) higher than that recorded by RRB and ICGV-86024. The two varieties recorded statistically similar disease incidences (Table 1). With the exception of 2007, there was significant ($P<0.05$) difference in disease severity at 65 days after sowing among the three varieties in all the years and their combined analysis. In 2006 and combined analysis, Ex-Dakar had disease severity significantly ($P<0.05$) higher than that of the remaining two varieties, while in 2008, the disease severity recorded by Ex-Dakar and RRB was statistically similar and that of RRB and ICGV-86024 was also similar. This could be due to difference in host resistance to the disease. Waliyar *et al*. (1995) as well as Bailey (2002) reported that commercial cultivars vary somewhat in their susceptibility to early leaf spots (ELS) and late leaf spots (LLS). Variation and reactions of groundnuts to *Cercospora* leaf spot disease were also reported by Knauft and Gorbet (1990). Izge *et al*. (2007) also reported a lot of variability existing among the groundnut varieties evaluated in all characters.

In 2006, increasing the spacing from 20 to 25cm resulted in a significant decrease in disease incidence. Further increase of the spacing to 30 cm did not significantly increase For the other years (2007 and 2008), increasing the spacing from 20 to 30 cm significantly reduced incidence (Table 1). This could be attributed to higher number of plants per unit area to the closer spacing. This result is in conformity with the report of Fowler (1971), who stated that increase in plant population is an aggravating factor for *Cercospora* leaf spot disease. Ihejirika *et al*. (2006) also suggested that dense foliage canopy provides conducive environment which favors development of the disease. Similarly, Hill and Waller (1988) proposed that plant diseases such as leaf spot are favored by warm-humid conditions, caused by very close spacing. FAO (1990) also observed that closer spacing favors many air borne diseases because of high humidity of crop canopy.

Number of Pods per Stand

There was significant ($P<0.05$) difference in number of pods per stand among the groundnut varieties only in 2006. Ex-Dakar recorded the lowest ($P<0.05$) number of pods compared to RRB and ICGV-86024, which had statistically similar number of pods per stand. Spacing produced significant ($P<0.05$) effect on number of pods per stand in 2007, 2008 and combined analysis. The results showed that, 20cm consistently recorded the lowest number of pods per stand. Increasing the spacing to 25 cm caused significant ($P<0.05$) increase in the number of pods in 2008 and combined analysis, but not in 2007. Increasing the spacing further to 30cm, caused further significant ($P<0.05$) increase in the number of pods per stand in 2008 and combined analysis (Table 2). The difference could be due to difference in disease incidence and severity among the varieties. According to Phillips (1977), number of pods per stand depends on cultivar, good management and appreciable nutrient status of the growing area. It could also be as a result of differences in *Cercospora* leaf spots severity and higher plant density, as reported by Adipala *et al*. (2000). Erbough *et al*. (2000) also reported that the lowest plant density had the lowest incidence and severity of *Cercospora* leaf spots which translated into higher yield.

Table 1: Effects of variety and spacing on incidence and severity of cercospora leaf spots of groundnut during 2006, 2007, 2008 and combined analysis at Maiduguri.

Treatment		2006	2007	2008	Combined
		Incidence of *Cercospora* (%) at 65 DAS			
Variety	Ex-Dakar	45.70	57.80a	50.71	49.43
	RRB	41.92	52.40b	48.67	48.92
	ICGV86024	39.78	52.51b	46.21	46.88
	SE±	3.184	0.719	2.205	0.478
	Significance	Ns	**	Ns	Ns
Spacing	20cm	46.47a	58.92a	54.30a	53.23a
	25cm	41.11b	53.64b	47.75b	47.50b
	30cm	39.83b	50.14c	43.55c	44.51c
	SE±	1.464	0.981	0.576	0.614
	Significance	**	**	**	**
		Severity of *Cercospora* (%) at 65 DAS			
Variety	Ex-Dakar	43.13a	39.89	41.66a	41.57a
	RRB	26.35b	37.36	38.08ab	38.03b
	ICGV86024	28.70b	34.54	35.45b	32.90b
	SE±	1.308	1.290	1.631	1.461
	Significance	**	Ns	*	**
Spacing	20cm	35.53a	39.80a	41.02a	38.78a
	25cm	32.69b	37.51b	38.64b	36.28b
	30cm	29.97c	34.49c	35.53c	33.33c
	SE±	0.497	0.328	0.599	0.475
	Significance	**	**	**	**

Means in a column followed by same letter (s) are not significantly different at 5% level., Ns=not significant, ** =significant at 1%, DAS= Days after sowing.

Table 2: Effects of variety and Intra-row spacing on number of pods per stand, seed and haulm yield of groundnut during the 2006,2007, 2008 and combined analysis at Maiduguri

Treatments		2006	2007	2008	Combined
		No. of Pods/Stand			
Variety	Ex-Dakar	28.41b	30.91	25.83	28.39
	RRB	34.83a	32.35	25.26	30.82
	ICGV-86024	35.35a	31.72	24.81	30.71
	SE±	0.5061**	1.728ns	1.728ns	0.614ns
Spacing	20cm	32.19	29.40c	23.55b	28.38c
	25cm	32.80	31.58b	24.52b	29.63b
	30cm	33.83	34.03a	27.84a	31.90a
	SE±	0.582ns	0.568**	0.603**	0.371**
		Seed Yield (kg/ha)			
Variety	Ex-Dakar	1398.9c	1166.6	1463.3	1342.9
	RRB	1554.9b	1161.0	1517.1	1411.0
	ICGV-86024	1738.3a	1148.4	1423.1	1436.3
	SE±	44.727**	73.78ns	100.33ns	100.33ns
Spacing	20cm	1858.8a	1419.3a	1771.3a	1683.1a
	25cm	1525.2b	1141.7b	1456.5b	1374.5b
	30cm	1307.1c	914.9c	1175.7c	1132.6c
	SE±	72.383**	49.891**	27.28**	22.28*
		Haulm Yield (kg/ha)			
Variety	Ex-Dakar	3800.4	4508.7	4871.7a	3982.7
	RRB	3678.4	5524.2	3774.6b	4325.7
	ICGV-86024	4757.4	4839.7	3639.2b	4822.9
	SE±	343.58ns	522.51ns	288.66*	284.80ns
Spacing	20cm	4316.4a	5624.8a	4377.3a	4772.8a
	25cm	4311.4a	4937.2b	4184.7a	4477.8b
	30cm	3608.3b	4310.6c	3723.5b	3880.0c
	SE±	248.77**	126.47**	214.11*	96.48**

For each parameter, means in a column followed by same letter (s) are not significantly different at 5% level, Ns= not significant, ** = significant at 1%, *= significant at 5%,.

Seed Yield

Variety of groundnut did not significantly ($P<0.05$) affect seed yield except in 2006. The variety ICGV-86024 significantly ($P<0.05$) had the highest seed yield, followed by RRB, while the lowest was recorded by Ex-Dakar (Table 2). Seed yield increased with decrease in spacing. The 20cm spacing significantly and consistently had the highest seed yield, followed by 25 cm and 30 cm had the lowest (Table 2). The results also revealed that seed yield was lowest in 2007. Furthermore, Ex-Dakar yielded higher in 2008, while RRB and ICGV-86024 yielded more in 2006. The differences obtained in kernel yield among the treatments was as a result of higher plant density as well as early planting as reported by Adipala *et al*. (2000).

Haulm Yield

Variety did not significantly ($P<0.05$) affect haulm yield except in 2008. Ex-Dakar yielded significantly ($P<0.05$) higher haulm than RRB and ICGV-86024. The haulm yields of the two varieties were statistically similar (Table 2). In 2006 and 2008, 20cm and 25cm had statistically similar haulm yield which were significantly ($P<0.05$) higher than that of 30cm. In 2007 and combined analysis, 20cm significantly ($P<0.05$) recorded higher haulm yield than 25cm. On the other hand 25cm also had haulm yield significantly ($P<0.05$) higher than that of 30cm. Haulm yield was generally higher in 2007 than in 2006 and 2008 (Table 2). This result could be attributed to disease tolerance of Ex-Dakar in 2008 which resulted in more vigorous plants.

CONCLUSION

In this study, it was discovered that, the varieties used did not differ much in the parameters assessed as indicated in the combined analysis, but generally ICGV-86024 and RRB outperformed Ex-Dakar in all respects. Generally, closer spacing resulted in higher disease incidence and severity of *Cercospora* leaf spot disease. Conversely, wider spacing resulted in lower disease incidence and severity. However, closer spacing means higher plant density, hence relatively higher yield per unit area and wider spacing means lower plant density, hence lower yield per unit area. Therefore, 20cm spacing and either RRB or ICGV-86024 appeared to be more promising and hence recommended.

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