Influence of sowing date and cultivar on seed and seedling phases of collar rot disease in irrigated groundnut in the semi-arid zone of Northeastern Nigeria

Mallam Bukar Jidda* and Eunice Anjikwi Mshelia

Department of Crop Protection, Faculty of Agriculture, University of Maiduguri, PMB 1069, Maiduguri, Borno State, Nigeria

IJASR 2021
VOLUME 4
ISSUE 6 NOVEMBER – DECEMBER **ISSN: 2581-7876**

Abstract: Field experiment was conducted during the dry season (February to June, 2020) at the Teaching and Research Farm, University of Maiduguri, Borno State to assess the effect of sowing date and groundnut cultivar on the incidence of seedling damping-off induced by Aspergillus niger. Three groundnut cultivars (Ex-dakar, Kampala and Bomboy) and three sowing dates (4 February, 11 February and 18 February) were laid out in Randomized Complete Block Design (RCBD) with three replications. Varying sowing date within the month of February did not significantly affect seedling damping-off and yield components. However, the effect of sowing date was enhanced by its combination with cultivar. Ex-dakar sown on 11 February had significantly ($P \leq 0.05$) lower pre-emergence damping-off incidence than the other cultivars sown on the same or different dates. Number of emerged seedlings, pre-emergence damping-off, plant height and haulm yield varied significantly ($P \leq 0.05$) among cultivars. Pre-emergence damping-off ranged from 24.2 to 59.7 % among the cultivars. The least affected was Ex-dakar while the most affected was Kampala. Ex-dakar had the tallest (34.9 cm) plants and highest haulm yield of 2889 kg/ha. Kampala exhibited the shortest (14.1 cm) height and lowest haulm yield (1083.3 kg/ha). The results from this study suggests that Ex-dakar with the lowest pre-emergence damping-off and highest pod and haulm yield would be the first choice for dry season planting, especially in the second week of February in Northeastern Nigeria.

Keywords: sowing date, damping-off, Aspergillus, collar rot, cultivar

INTRODUCTION

Groundnut (*Arachis hypogaea* L.) is one of the most important oil seed crops cultivated for food as well as cash thereby contributing not only to the individual but also to the national economy. It is estimated that about 5million hectares are put under groundnut production in Nigeria every year with an average yield of 2 metric tones per hectare, and a total production of 10 million metric tones (F AO, 1992).A large percentage of this is produced in the North East part of the country (Ajeigbe *et al*., 2020).

Groundnut production is affected by seed as well as soil-borne diseases. Among these diseases is crown or collar rot caused by *Aspergillus niger*. The pathogen may attack the seed causing pre-emergence damping-off or invade germinating seed resulting in post-emergence seedling blight (damping-off). Collar rot is a regular disease of groundnut due to its seeds and soil borne nature. It is prevalent in almost all groundnut growing areas. It occurs in rainy as well as dry seasons resulting in reduced crop stand and post-emergence seedling blight causing yield losses up to 15 to 26 per cent (Narain and Kar, 1990; Mohanty and Mohapatra, 2015). This disease is more extensive in rainy than dry season (Rakholiya *et al*., 2012; Mustapha and Jidda, 2019).

The oilseed crops, particularly groundnut is very sensitive to climatic parameters such as radiation and temperature (Banik *et al*., 2009), though it can be successfully grown under a wide range of sowing times (Ijaz *et al*., 2021). Sowing date has been used as one of the disease management strategies and has shown remarkable effects on root rot complex of groundnut (Sekhon *et al*., 2019), *Cercospora* leaf spot of groundnut (Bwala *et al*., (2019), and spotted wilt of groundnut (Brown *et al*., 2005;Tillman *et al*., 2007; Nuti *et al*., 2014; Sidhu, *et al*., 2019). The objective of the present study was to examine effect of sowing date and cultivar on incidence of seed and seedling phases of collar rot disease in irrigated groundnut.

MATERIALS AND METHODS

Experimental site: The study was conducted at Teaching and Research Farm of the Faculty of Agriculture, University of Maiduguri, Borno State, Nigeria from February to June 2020. Maiduguri is located between latitude 11^0 50' and 12^0 North and latitude 13^0 05 and 14^0 East. The climate of the area falls within the semi-arid zone of West Africa characterized by short duration of rainfall (3-4 months) which varies from minimum of 478mm to 500mm and a maximum of 600mm to 621mm. The area has a long dry season of 8 to 9 months.

Experimental design and field layout: The land for the experiment was prepared manually with hoe, rake and cutlass and a 3 x3 factorial experiment was laid out in randomized complete block design. The factors used were three cultivars of groundnut (Ex-dakar, Kampala and Bomboy) three sowing dates (4 February, 11 February and 18 February 2020). All seed samples are popularly grown by farmers in the Northeastern part of Nigeria. They were acquired from major groundnut vendors in Maiduguri Monday Market, Borno State. This gave a total number of 9 treatment combinations which was replicated three times. Each treatment plot measured 1.0 x 1.0 m with space of 0.5 m between replicates. Groundnut planting space was 30 x 15 cm and a total of 28 plant stands per treatment plot. The crop was sown on the scheduled dates after pre-sowing irrigation. The plots were subsequently irrigated using watering can as and when necessary. Weeding was carried out two times using hoe.

Data recorded: Data recorded were percentage seedling emergence, pre- and post-emergence damping-off, plant height, number of pods per plot, and haulm weight per plot which was converted to weight per hectare.

Data analysis: Data obtained were subjected to analysis of variance and means were separated using Least Significant Difference at 5%.

RESULTS AND DISCUSSION

Sowing date did not significantly influence seedling emergence, pre- and post-emergence damping-off in the present study. But incidence of pre-emergence damping-off as well as amount of emerged seedlings varied significantly among cultivars (Table 1). The disease ranged from

24.2 to 59.7 % among the cultivars. The least affected was Ex-dakar while the most affected was Kampala. The seedling emergence was correspondingly higher in Ex-dakar than in Kampala.

Table 1. Effect of sowing date and cultivar on seedling emergence, pre- and post-emergence damping-off incidence

Treatment	Seedling emergence (%)	Pre-emergence damping-off (%)	Post-emergence damping-off (%)
Sowing date (A)			
4 February	52.0	48.2	14.7
11 February	58.7	41.2	17.1
18 February	57.9	42.0	13.5
SE±	6.5	6.6	7.4
LSD	13.8	14.0	15.7
Cultivar (B)			
Ex-Dakar	75.8	24.2	14.3
Kampala	40.5	59.7	10.3
Bomboy	52.4	47.6	20.6
SE±	6.5	6.6	7.4
LSD	13.8	14.0	15.7
Interaction (AxB)	*	*	NS

*significant at P≤0.05; NS = not significant

Likewise, Sekhon *et al.* (2019) reported that two varieties of groundnut differed significantly in the amount of root rot disease incidence they developed. The Spanish type variety (SG-99) showed more tolerance to the root rot complex disease than Virginia type (M-522) over all the locations and in all the sowing dates.

Sowing date x cultivar interactions for seedling emergence was significant (P≤0.05) (Table 2). The amount of emerged seedlings increased as sowing was delayed from 4 February 18 February in Ex-Dakar while delayed sowing resulted in reduced number of emerged seedling in Kampala. This was due to high incidence of pre-emergence damping-off in the late sown Kampala. Percentage of emerged seedlings in Bomboy was not consistent

Table 2. Sowing and cultivar interaction for seedling emergence

Sowing date	Cultivar		
	Ex-Dakar	Kampala	Bomboy
4 February	53.6	50.0	52.4
11 February	88.1	38.1	50.0
18 February	85.7	33.3	54.8
SE±		11.3	
LSD		24.0	

Pre-emergence damping-off significantly (P≤0.05) decreased in Ex-dakar as the sowing was delayed (Table 3). Ex-dakar sown on 11 February had significantly lower pre-emergence damping-off incidence than the other cultivars sown on the same or different dates. Brown *et al.*, 2005;Nuti *et al.,* 2014; Tillman *et al.,* 2007) similarly reported that spotted wilt of groundnut reduced with late planting and the risk of losses due to the disease increases with early plantings in the southeastern United States.

Table 3. Sowing date and cultivar interaction for pre-emergence damping-off

Sowing date	Cultivar		
	Ex-Dakar	Kampala	Bomboy
4 February	46.4	50.6	47.6
11 February	11.9	61.9	50.0
18 February	14.3	66.7	45.2
SE±		11.4	
LSD		24.2	

In other reports, sowing date has shown remarkable effects on various diseases of groundnut to the contrary. Sekhon *et al.* (2019) reported that early sown groundnut escaped root rot complex disease attack due to unfavorable weather for disease development, while the disease incidence progressed with delay in date of sowing. Similarly, early sowing of groundnut was found to have reduced incidence of pre- and post-emergence damping-off (Helal*et al.,* 1994; Atta-Alla *et al.,* 2004)), infection of *Aspergillus* (Craufurd*et al.,* 2006)), and Cercospora leaf spot (Bwala *et al.*, 2019) .

Delay in sowing from 4 to 11 February increased plant height, number of pods per plot and haulm yield per hectare but further delay in sowing decreased these parameters except haulm yield which increased by 138.9 kg/ha when sowing was delayed to 18 February (Table 4).

Table 4. Effect of sowing date and cultivar on plant height, number of pods per plot and haulm weight per hectare

Treatment	Plant height (cm)	Number of pods/plot	Haulm weight (kg/ha)
Sowing date (A)			
4 February	27.8	49.9	1722.2
11 February	28.0	51.4	2000.0
18 February	27.9	25.3	2138.9

SE±	0.3	16.6	468.1
LSD	0.6	35.1	992.2
Cultivar (B)			
Ex-Dakar	34.9	56.6	2889.0
Kampala	14.1	21.9	1083.3
Bomboy	34.6	48.2	1889.0
SE±	0.3	16.6	468.1
LSD	0.6	35.1	922.2
Interaction (AxB)	NS	NS	NS

NS = not significant

The highest haulm yield was recorded from plants sown on 18 February. The differences of the effect of sowing date on these parameters were, however, not significant. Sidhu (2019) similarly indicated that sowing date had no impact on peanut pod yield in two out of the three year trials. Only in the third year that peanut yield for all the cultivars was higher at later planting dates. However, variation in the date of sowing had resulted in significant variation in number of pods per plant, pod yield, kernel yield and leaf area index (Banik et al., 2009). The highest number of yield contributing characters, pod yield and oil content was recorded in early sown cultivars (Sogut *et al.*, 2016; Sekhon *et al.*, 2019; Oni and Lawal, 2019). Higher pod yield in early sowing dates accrued mainly from increased number of pods per plant and 100-seed weight (Sardana and Kandhola, 2007). The late sown crops mature earlier, resulting in a reduced pod number and 100-kernel weight (Reddy and Reddy, 2001) due to decrease in vegetative phase and also shortening in maturation (Caliskan *et al.*, 2008).

Cultivar influenced ($P \leq 0.05$) plant height and haulm yield in the present study. The haulm yield for Ex-dakar was the highest (2889.0 kg/ha) and Kampala exhibited the lowest (14.1 cm) height and haulm yield (1083.3 kg/ha). But number of pods per plot did not differ significantly among the cultivars. Significant effect of cultivar on number of pods and seed yield (Oni and Lawal, 2019), plant height and haulm yield (Shendage *et al.,* 2018), and pod yield (Sogut *et al.*, 2016) were reported. The differences between cultivars in respect of these characteristics were attributed to their growth habits (bunch or spreading types).

CONCLUSIONS

Varying time of planting alone from the first to the third week of February has no influence on seed and seedling diseases, growth and yield components of groundnut. But the performance of sowing date could be enhanced by its combination with cultivar. Ex-dakar performs better than Kampala and Bomboy in terms of development of disease incidence, pod and haulm yield when sown in the same or different dates in February. Ex-dakar can be the first choice for dry season planting in the second week of February in Northeastern Nigeria.

REFERENCES

1. Ahmad, F., Khan, A. A., Naeem, M. and Hussain, A. (2016). Yield performance of groundnut varieties as affected by sowing dates in lower Khyber Pakhtunkhwa. *Journal of Biology, Agriculture and Healthcare, 6(3):* 86-91.
2. Ajeigbe, H. A., Vabi, M. B., Inuwa, A. H., AbdulAzeez, T. andAkinseye, F. M. (2020). Handbook on improved agronomic practices of groundnut production in northeast . Feed the Future (FtF) Nigeria Integrated Agriculture Activity, 23pp.
3. Atta-Alla S. I., El-Samra I. A., El-Korany A. E., El-Sheikh M. A. and El-Nawam M. F. (2004). Management of the root rot of peanut in the newly reclaimed land in El-Behera governorate, Egypt. *Journal of Agriculture and Environmental Science Alexandria University, Egypt.* 3: 9-24.
4. Banik, N. C. Nath, R. and Chakraborty, P. K. (2009). Effect of dates of sowing on growth andyield of groundnut crop. *Journal of Crop and Weed, 5(2)*: 59-62.
5. Brown, S. L., Culbreath, A. K., Todd, W., Gorbet, D.W., Baldwin, J. A. and. Beasley, Jr. J. P. (2005). Development of a method of risk assessment to facilitate integrated management of spotted wilt of peanut. *Plant Disease, 89*: 348–352.

6. Bwala, R. I., Ekhuemelo, C. and Zacharia, D (*2018).* Influence of variety and sowing date on Incidence of *cercospora* leaf spots disease of groundnut *(Arachis hypogaea L.)* in Makurdi, Benue State of Nigeria. *Asian Journal of Research in Crop Science, 2(4*): 1-10.
7. Caliskan,S., Calsikan, M. E., Arsalan, M. and Arioglu, H. (2008). Effect of sowing date and growth duration on growth and yield of groundnut. *Field Crops Research, 105*:131-140.
8. Craufurd P. Q., Prasad P. V. V., Waliyar F. and Taheri A. (2006). Drought, pod yield, pre-harvest *Aspergillus* infection and aflatoxin contamination on peanut in Niger. *Field Crops Research,* 98: 20–29.
9. FA0,(1992). Food and Agricultural Organization of the United Nations, *Production yearbook*
10. Helal, A. A., Metwally, A. H., Khaled, S. A. and EI-Deeb, A. A. (1994). Evaluation of peanutcultivar, date of sowing and NPK as integrated control measures against soil borne diseases. *Zaging Journal of Agricultural Research,* 21: 1151-62.
11. Ijaz, M., Nawaz, A., Ul-Allah, S., Sher, A., Sattar, A. and Sarwar, M. (2021) Optimizing sowing date for peanut genotypes in arid and semi-arid subtropical regions. *PLoS ONE 16(6): doi:10.1371/journal.pone.0252393*
12. Mohanty, S. and Mohapatra, K. B. (2015). Integrated management of seed and collar rot of groundnut caused by *Aspergillus niger*. *International Journal of Tropical Agriculture, 33(2)*: 1631-1634
13. Mustapha, M. and Jidda, M. B. (2019). Assessing the effects of planting seasons on seedling damping-off (*Aspergillus niger*) for sustainable groundnut production in the semi-arid zone of northeastern Nigeria. *Journal of Agriculture and Agricultural and Technology, 17(1)*: 143-153.
14. Narain, A. and Kar, A.K.(1990). Wilt of groundnut caused by *Sclerotium rolfsii*, *Fusarium* spp. and *Aspergillus niger*. *Crop Research*, 3: 257-262.
15. Nuti, R. C., Chen, C.Y, Dang, P. M. and Harvey, J. E. (2014). Peanut cultivar response toTomato spotted wilt over five planting dates. *Peanut Science, 41*:32–41.
16. Oni, F. G. O., Lawal, B. A. (2019). Effects of sowing date on yield and yield parameters of some groundnut (*Arachis hypogaea* l.) cultivar under rainfed condition in Ogbomoso, Nigeria. *Journal of Natural Sciences Research, 9(18):* Abstract. DOI: 10.7176/JNSR/9-18-06.
17. Rakholiya, K. B., Jadeja, K. B. And Parakhia, A. M. (2012). Management of collar rot ofgroundnut through seed treatment. *International Journal of Life Science and Pharma Research, 2(1)*: 62-66.
18. Reddy, V. C., and Reddy, N. S. (2000). Performance of groundnut varieties at various sowing Dates during kharif season. *Current Research University of Agricultural ScienceBangalore,* 29(7-8): 107-09.
19. Sardana V., Kandhola S. S. and Sheron P. (2008). Influence of sowing Dates on the productivity of semi spreading and bunch type varieties of groundnut (*Arachis hypogeae*). *Indian Journal of Agricultural Science,* 78: 372-74.
20. Sekhon, A. S., Sandhu, P. S., Sharma, P., Sharma, K. K. and Belludi, R. (2019). Effect of date of sowing on development of root rot complex disease in groundnut (*Arachis hypogaea* L.). *International Journal of Current Microbiology and Applied Sciences, 8*(11): 1192-1205
21. Shendage, R. C. Mohite, A. B. and Sathe, R. K. (2018). Effect of sowing times and varieties on growth and yield of summer groundnut (*Arachis hypogaea* L.). *Journal of Pharmacognosy and Phytochemistry, 7(1)*: 720-722
22. Sidhu, S. S. van Santen, E. George, S. Small, I. and Wright, D. L. (2019). Effects of planting date and irrigation on yield and grade in runner-type peanut cultivars in north Florida. *Peanut Science, 46*:191–197.
23. Sogut, T. Ozturk, F. and Kizil, S. (2016). Effect of sowing time on peanut (*Arachis hypogaea* L.)cultivars: i. yield, yield components, oil and protein content. Scientific Papers. Series A. *Agronomy, 59*: 415 - 420.
24. Tillman, B. L., Gorbet, D. W. and Anderson, P. C. (2007). Influence of planting date on yield and spotted wilt of runner market type peanut. *Peanut Science, 34:* 79–84.
25. Virender, S. and Kandhola, S. S. (2007). Productivity of semi spreading and bunch type varieties of groundnut as influenced by sowing dates. SAT ejournal/ejournal. Icrisat.org. 5:1.