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EFFECT OF DIFFERENT PLANTING DATES ON ANTHRACNOSE OF SORGHUM

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ABSTRACT
The main aim of this study was to investigate the effect of different sowing dates on the severities, infection rates and AUDPC of Sorghum anthracnose, caused *by Colletotrichum graminicola* on two varieties of Sorghum (*Sorghum bicolor* L., Moench). The varieties were: PC-6 and MP- Chari.The investigations were undertaken during 2009-10 and 2010 -11 cropping seasons at Livestock research centre, G.B.P.U.A &T Pantnagar. The experimental trial was laid out in split-split plots, arranged in a randomized complete block design withthree replications.The results obtained showed thatEarly planted (1st July) PC-6 and MP –Chari had higher disease severity and infection rate than late planted (30th July) sorghum cultivars.Plant grown from seed sown on the first sowing date (1stJuly) had significantly higher grain yield. Early planted PC-6 and MP Chari cultivars appeared to increase anthracnose disease. This study revealed that both cultivars could be planted between medium 20th&30th July for less disease severity and maximum grain yield.

INTRODUCTION

Anthracnose of sorghum (*Sorghum bicolor* L., Moench) is caused by *Colletotrichum graminicola* is often a major constraintespecially in tropical and subtropical sorghum growing areas. Numerous diseases have beenreported in sorghum such as charcoal rot, fusarium root andstalk rot, rough leaf spot, downy mildew, sorghum red stripeand anthracnose (Tarr, 1962). Among them,sorghum anthracnose occurs worldwide, but is more typically observed in tropical and subtropical regions where frequent rainfalls and high humidity contribute to the development and spread of the disease (Pande *et al.*, 1994; Thakur and Mathur, 2000). *Colletotrichum graminicola* is the fungal pathogen responsible for sorghum anthrac-nose (Crouch *et al.*, 2006). The damage caused by this disease ranges from deterioration of grain to peduncle breakage, stalk rot and foliage damages and may occur at different stages of plant growthleading to crop losses depending on the severity of infection and the crop cultivar (Warren & Nicholson,1975; Gwary *et al.*, 2003). Disease de-velopment before anthesis can have the greatest effect on grain yield with reported losses ranging from 30% to 67% (Ali *et al.,* 1987; Thomas *et al.,* 1996). The use of fungicides is very limited because of the associated costsof these chemicals as well as handling issues and safetyconcerns to the users and to the environment. Theytherefore rely mainly on cultural practices as an importantaspect for their disease control. The practices used includecrop rotations, intercropping and crop spacing (Adebitanand Ikotun, 1996). Sowing dates have been reported toreduce the effects of diseases such as anthracnose(*Colletotrichum lindernuthianum*), brown blotch (*Collectrichum capsici*) and web blight (*Thanatephoru scucumeris*) on cowpeas (Yayock *et al.,* 1988). It can be an effective means of control in many instances where other control measures are not available or impracticable (Pratap *et al.*, 1993). Theuse of different planting date has been observed toreduce or delay the development of anthracnosediseases was reported by (Gwary *et al.,* 2005). Keeping in view this study was conducted to determine the best planting dates for management of anthracnose in sorghum.

MATERIALS AND METHODS

The research was conducted at Livestock Research Centre G.B.P.U.A & T Pantnagar during 2009-10 and 2010-11under natural field conditions.Fertilizers dose applied was (N: P:K,160:100:120 kg/ha) .Nitrogen as urea was applied in two split doses, half as basal dose. Two sorghum varieties M.P.Chari and Pant Chari -6 were sown on four dates1,10,20 and 30th July. The experiment was laid out in Randomized Block Design in a split – split plot design with three replications. The field layout consisted of 4mx1.5m plots, replicated three times and giving a total of 24 plots. A space of 1m was allowed between replicates. The sorghum seeds were sown at a spacing of 30 cm in 5 rows per plot. Disease severity data wasrecorded from at 15-daysinterval up to 90 DAS starting from the first appearance of anthracnose symptoms at 30 DAS. The data was collected from 5 plantsin the three middle rows in each plot. The followinginfection parameters were recorded:

Per cent disease severity

$$\text{Per cent disease severity (\%)} = \frac{\text{Sum of numercical rating}}{\text{Total no. sample x Maximum rating grade}}$$

Disease severity was assessed on 10–tagged plants on a rating scale of where: 1 = Highly resistant (0 to <1% intensity); 2 = Resistant (upto 5% intensity); 3= Resistant (6-10% intensity); 4 =Moderately Resistant (11-20% intensity); 5 = Moderately Resistant (21-30% intensity); 6 = Susceptible (31-40% intensity); 7 = Susceptible (41-50% intensity); 8 = Highly Susceptible (51-75% intensity); 9 = Highly Susceptible (above75% intensity.

Infection rate

Infection rate was recorded at weekly interval by using following formula (Vanderplank , 1963).

$$r = \frac{2.3}{t_2 - t_1} \log_{10} \frac{x_2(1 - x_1)}{x_1(1 - x_2)}$$

where x1 and x2 are the proportions of the disease on datest1 and t2 respectively.

Area under disease progress curve (AUDPC) was calculated by using following formula (Shanner and Finney, 1977).

$$\text{AUDPC} = \left[\frac{\left(\frac{D_1 + D_2}{2} \times T\right) + \left(\frac{D_2 + D_3}{2} \times T\right) + \left(\frac{D_3 + D_4}{2} \times T\right)}{n - 1}\right]$$

Where,

D = Per cent disease index at different dates (D1, D2, D3 and so on)

T = Time interval (days) between two observations

n = Total number of observations

Grain yield (t/ha)

Naturally dried sorghum grains from the individual plot was harvested, air dried and then the produce was threshed and cleaned. The clean seeds were dried upto 10 per cent moisture by weight. The grain yield per plot was recorded in grams and after adding the weight of 5 sample plants previously collected from the field of respective plot to get the net plot yield. This net plot yield in kg per hectare was converted into tons ha^{-1}.

RESULTS AND DISCUSSION

Effect of planting dates on disease severity

Data presented in (Table 1)revealed that maximum anthracnose severity 79.53% was recorded in early planted (1st July) MP-Chari while PC-6 planted had significantly less amount of disease (71.94%).On delay in planting from (10th & 20th) July MP-Chari showed significantly less amount of disease (50.16% and 43.99%) as compared to early planted crop. Similar trend was observed with PC-6 also. Late planted (30th July) both PC-6 and MP-Chari had lowest disease severity (34.38% and 41.12%). Early planted (1st July) crop showed fast progress of disease while (10th and 20th July) planted crop showed slow progress of disease. Late planted (30th July) crop showed late appearance of disease due to slow growth of crop and got advantages of four weeks as crop was lagging behind four weeks from early planted (1st July) crop and three weeks and one week from medium planted (10th and 20th July) during both the years. The influence of sowing date on severity of anthracnose was highly significant. Early sowing leads tohigher anthracnose than late sowing. Plants grown fromseeds sown on the first sowing date (1st July) had anincreased disease severity.. These findings are in agreement with Marley's (2004) report that early sowing increased anthracnose severity in susceptible cultivars. This may be attributed tolonger exposure to high relative humidity in the early sown materials. Similarly, Dodd *et al.* (1992) reported that dewcan also play an important role in extending the period ofwetness following rainfall and may be important inincreasing the rate of development.

Area under disease progress curve (AUDPC)

The results revealed that more AUDPC (781.48 mm2) was found in early planted (1st July) sorghum cultivar MP-Chari, which gradually decline in medium planting. Less AUPDC (645.67 mm2 and 565.80 mm2) was obtained in medium planted crop (10th and 20th July) while late planted (30th July) sorghum cultivar MP-Chari showed less AUPDC (480.90mm2) as compare to early planted (1st July).More AUDPC was related to more disease severity and duration. It is positively correlated with disease severity. PC-6 also showed more AUDPC (580.72 mm2) in early planted crop which declined in medium planted (523.33 and 498. 33 mm2) and less in late planted (420.13

Table 1: Effect on dates of sowing on disease severity and sorghum yield during 2010 and 2011 (pooled data)

Date of sowing	Cultivar	Disease severity (%)				
		30 DAS	45 DAS	60 DAS	75 DAS	90 DAS
1st July	PC-6	37.87	50.62	56.59	65.90	71.94
	MP-Chari	51.34	64.73	6451	72.30	79.53
10th July	PC-6	30.23	34.89	41.80	46.40	50.16
	MP-Chari	37.54	49.94	59.74	61.78	67.34
20th July	PC-6	21.97	27.78	33.14	38.07	43.99
	MP-Chari	26.42	37.60	50.80	53.53	49.62
30th July	PC-6	16.72	20.96	24.93	27.86	34.38
	MP-Chari	21.48	25.49	29.87	35.74	41.12
CD (0.05)						
A (Date of sowing)		0.9	0.8	0.8	0.7	0.9
B (cultivar)		1.3	1.7	1.1	1.0	0.4
A×B(Date of sowing × cultivar)		0.9	0.8	0.8	0.7	0.9

Table 2: Effect of dates of sowing on infection rate recorded at 15 days intervals (2009-2010)

Date of sowing	Cultivars	Infection rate r 1	AUDPC(mm²) r 2	r 3	r 4	
1st July	PC-6	0.153	0.153	0.153	0.153	580.72
	MP-Chari	0.153	0.170	0.160	0.160	781.48
10th July	PC-6	0.140	0.153	0.140	0.154	523.33
	MP-Chari	0.152	0.153	0.150	0.153	645.67
20th July	PC-6	0.110	0.154	0.122	0.154	498.33
	MP-Chari	0.130	0.151	0.135	0.154	565.80
30th July	PC-6	0.130	0.120	0.120	0.121	420.13
	MP-Chari	0.120	0.139	0.150	0.154	480.90

Table 3: Effect of dates of sowing on infection rate recorded at 15 days intervals (2010 and 2011)

Date of sowing	Cultivars	Infection rate r 1	r 2	r 3	r 4	Average	AUDPC(mm²)
1st July	PC-6	0.153	0.153	0.133	0.154	0.148	578.75
	MP-Chari	0.153	0.154	0.153	0.154	0.154	748.49
10th July	PC-6	0.149	0.140	0.140	0.150	0.145	476.28
	MP-Chari	0.155	0.149	0.154	0.150	0.152	585.01
20th July	PC-6	0.135	0.130	0.154	0.130	0.137	401.70
	MP-Chari	0.150	0.153	0.150	0.120	0.143	570.07
30th July	PC-6	0.130	0.120	0.154	0.015	0.105	295.10
	MP-Chari	0.015	0.154	0.154	0.154	0.119	430.40

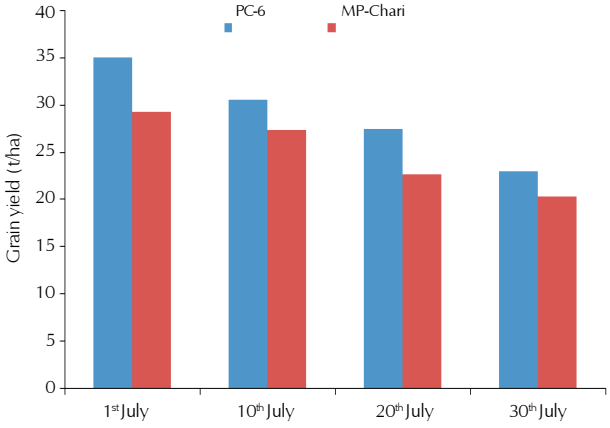

Figure 1: Effect of date of sowing of sorghum cultivars PC-6 and MP-Chari on grain yield of sorghum during (2009-10 and 2010-11)

mm2) during 2009 and 2010 respectively.

Effect of planting date on yield

Pooled data of two years revealed that, the maximum yield was observed with early planted sorghum cultivar PC-6and MP-Cheri (Fig. 1). Although the first sowing date (1st July) had higher disease severity yield were higher than of medium and late sown sorghum cultivars and thus did not cause significant yield loss. This could be due the fact that early sown crops have early access to soil nutrients such as nitrogen, are thus more vigorous and will thereby tolerate higher disease levels. While minimum yield was recorded with late planted sorghum cultivar MP-Cheri and PC-6.

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REFERENCES

Adebitan, S. A. and Ikotun, T. 1996. Effect of plantspacing and crop pattern on anthracnose (*Colletotrichum lindernuthianum*) of cowpea. *Fitopatologia Brasileira*. **21(1):** 5-12.

Ali, M. E. K., Warren, H. L. and Latin, R. X. 1987. Relation-ship between anthracnose leaf blight and losses in grain yield of sorghum. *Pl. Dis.* **71:** 803-806.

Blum, A. 1972. Effect of planting date on water-use and its efficiency in dry land grain sorghum. *Agron. J.* **64:** 775-8.

Crouch, J. A., Clarke, B. B. and Hillman, B. I. 2006. Un-raveling evolutionary relationships among the divergent lineages of *Colletotrichum* causing anthracnose disease in turfgrass and corn. *Phytopath.* **96:** 46-50.

Chaurasia, C. P. and Duveiller, E. 2006. Management of leaf blight (*Bipolaris sorokiniana*) Disease of wheat with cultural practices. *Nepal Agric. Res. J.* **7:** 63-69.

Dodd, J. C., Estrada, A. and Jegar, M. J.1992. Epidemiology of *Collectotrichumgloeosporioides* in the tropics. *In*: Bailey, J. A. and M.J. Jegar, (eds.),*Collectotrichum Biology, Pathology and Control,* C.A.B.International, Wallingford, pp. 308-25.

Gwary, D. M, Rabo, T. D. and Anaso, A. B. 2005. Assessment of leaf anthracnose caused by *Colletotrichum graminicola* on sorghum genotypes in the Sudan Savanna of Nigeria. *Agriculutura Tropica et Subtropica*. **35:** 53-8.

Gwary, D. M., Rabo,T. D. and Anaso, A. B. 2003. The development of anthacnose sympto ms on Sorghum genotypes in the NigerianSavanna. *J. Pl. Dis. Protection*. **111:** 96-103.

Kaigama, B. K. 1978. Report to the Cropping Scheme Meeting, February 1977, Feb. 1978, p: 10. *Institute for Agriculture Research, Samaru-Zaria,* pp. 7-9.

Marley, P. S. 2004. Diseases of *Sorghum bicolor* in West and Central Africa and their Management Approaches. *Trop. Agric.* **6:** 11-9.

Mbong, G. A., Akem, A. O.,Emechebe, A. M. and Alegbejo, M. D. 2010. Effect of sowing date on incidence, apparent infection rate and severityof scab on cowpea. *Asian J. Agri. Sci.* **2(2):** 63-68.

Pande, S., Thakur, R. P., Karunakar, R. I., Band yopad-hyay, R. and Reddy, B. V. S. 1994. Development of screen-ing methods and identification of stable resistance to anthracnose in sorghum. *Field Crops Research*. **38:** 157-166.

Pratap, M., Swamy, G. S. and Babu, R. S. H. 1993. Studies on optimum date of sowing and spacing for okra. *J. Res*. **21:** 222-226.

Shanner, G. and Finney, R. F. 1977. The effect of nitrogen fertilization on the expression of slow mildewing resistance in Knox Wheat. *Phytopath*. **67:** 1051-1056.

Tarr, S. A. J. 1962. Diseases of sorghum, sudan grass and broomcorn. The Commonwealth Mycological Institute, Kew, Surrey, England. pp. 137-141.

Thakur, R. P. and Mathur, K. 2000. Anthracnose. In: Frederiksen R.A., Odvody G.N. (eds): Compen-dium of Sorghum Diseases. The American Phyto-pathological Society, St. Paul, pp. 10-12.

Thomas, M. D., Sissoko, I. and Sacko, M. 1996. Development of leaf anthracnose and its ef fect on yield and grain weigh t of sorghum in West Africa . *Pl. Dis*. **80:** 151-3.

Warren, H. L. and. Nicholson, R. L 19 75. Kernal infection, Seed ling blight and wilt of ma ize caused by *Colletotrichum* on corn. *Phytopath*. **64:** 293-6.

Vanderplank, J. K. 1963. Plant Diseases: Epidemics and control. *Acedemic Press,* New Yor London, p. 349.

Yayock, J. Y., Lombin, G., Onazi, O. C. and Owonubi, J. J. 1988. Crop Science and Production in WarmClimates. *Macmillan Intermediate Agriculture Series*. p. 30.