Original Research Article

Influence of Dates of sowing and Spacing on Growth and Yield of Sorghum (*Sorghum bicolor* L.)

ABSTRACT

The present study aimed to investigate the influence of Dates of sowing and Spacing on Growth and Yield of Sorghum (*Sorghum bicolor* L.). A field experiment was carried out during *Zaid* season of 2022 at the Crop Research Farm, Department of Agronomy, Naini Agricultural Institute, Sam Higginbottom University of Agriculture, Technology And Sciences, Prayagraj (U.P.) India. The treatments consist of Dates of sowing 1stfortnight June,2ndfortnight June,1stfortnight July and Spacing of S_1- 20×15cm, S_2- 40×15cm, S_3- 60×15cm. There were 10 treatments each replicated thrice. The soil of experimental plot was sandy loamy in texture, nearly neutral in soil reaction (pH 7.8), low in organic carbon (0.35%) available N (163.42 kg/ha), available P (21.96 kg/ha) and available K (256.48 kg/ha). Results revealed that the higher plant height (207.41cm), higher plant dry weight (94.86 g/plant), higher number of Grains/ear head (1588.30), higher Test weight (14.93 gm), and higher Grain yield (5.57 t/ha) yield were significantly influenced with sowing time of 2ndfortnight June along with the spacing 40×15cm.

Keywords: *sorghum, dates of sowing, spacing, growth parameters, yield attributes.*

INTRODUCTION

The poaceae family includes sorghum, also referred to as "jowar" (Sorghum bicolor (L.) Moench). Two well-known sorghum varieties are sorghum bicolor and sorghum vulgare. “In terms of Sorghum production, according to the report of Ministry of Agriculture & Farmer Welfare GOI, Global production of jowar declined from 63.4 million tonnes in 2016 -17 to 57.8 million tonnes in 2017-18. USA is the largest producer with a share of 16 percent followed by Nigeria (10.9 %), India (8.6 %) and Mexico (7.9 %)”(Makokha et al., 2002). “Sorghum is a rich source of Protein

(4.40 - 21.10 %), Lysine (1.06 – 3.64 %), Fat (2.10 – 7.60 %), Ash (1.30 – 3.30 %), Calcium (11.00 – 586.00 mg), Phosphorus (167.00 – 751.00 mg), Iron (0.90 – 20.00 mg), Thiamine (0.24 – 0.54 mg), Niacin (2.90 – 6.40 mg), Riboflavin (0.10 – 0.20 mg), and Anti-nutritional factors like Tannin (0.1 – 7.22 %), Phytin Phosphate (875.00 – 2211.90 mg) etc". **(Makokha *et al.*, 2002).**

"Proper sowing time and planting geometry are the most important factors to augment higher crop yield per unit area. The proper sowing time exerts a marked effect on the growth and eventually on the yield of a crop. Sowing of the crop at right time ensures better plant growth and also inhibits weed growth" (Hipp et al., 1969. There are evidences that "optimum time of sowing is one of the several cultural manipulations and play vital role in boosting up the yield, particularly in Indian sub-continent where the optimum time of sowing varies to great extent due to varying agro-climatic conditions. The yield and quality of sweet sorghum has been reported to vary with different sowing dates" (**Hipp *et al.*, 1969 and Broadhead, 1972**).

"Row spacing is also one of the important factor for crop establishment technique that affects the crop stand and other yield parameters in different crops. Maintenance of optimum planting density is always a big problem to the farmers. Lower plant density results in higher weed infestation, poor radiation use efficiency and lower yields. On the other hand, dense plant population may cause lodging, poor light penetration in the canopy, reduction of photosynthesis due to shading of lower leaves and serious reduction in the yield" **(Lemerle *et al.*, 2006).**

Keeping these points in view, the present investigation was conducted during *Zaid*-2022, at crop research farm, SHUATS, Prayagraj (U.P).

MATERIALS AND METHODS

A field experiment was conducted during *Zaid* season of 2021-22 at the Crop Research Farm, Department of Agronomy, Naini Agricultural Institute, Sam Higginbottom University of Agriculture, Technology And Sciences, Prayagraj (U.P.) India. The soil of experimental plot was sandy loamy in texture, nearly neutral in soil reaction (pH 7.8), low in organic carbon (0.35%), The treatments consist of 1stfortnight June+ 20×15cm, 1stfortnight June+ 40×15cm, 1stfortnight June+ 60×15cm, 2ndfortnight June + 20×15cm,

2nd fortnight June + 40×15cm, 2nd fortnight June + 60×15cm, 1st fortnight July + 20×15cm, 1st fortnight July + 40×15cm, 1st fortnight July + 60×15cm and control plot. The experiment was laid out in Randomized Block Design, with 10 treatments replicated thrice. The observations were recorded for plant height, plant dry weight, Crop Growth Rate (g/ m^2/day), Relative Growth Rate (g/g/day), Grains/ear head (g), Test weight (g), Grain yield (kg/ha) and Stover yield(kg/ha). The collected data was subjected to statistical analysis by analysis of variance method **(Gomez and Gomez, 1976).**

RESULT AND DISCUSSION

GROWTH PARAMETERS

Plant height - At Harvest, the significantly higher plant height (207.41 cm) [Table.1] was observed in treatment-5 (2nd fortnight June + 40×15cm) However, treatment-6 (2nd fortnight June + 60×15cm) was found to be statistically at par with treatment- 5 (2nd fortnight June + 40×15cm).There may be a significant and increased number of plant heights. Early sowing allows crops to take advantage of favourable weather conditions. Sorghum plant height may have increased as a result of the favourable weather during the second fortnight of June. . Similar results were found by **Karhale *et al.*, (2014).** And also,Reduced spacing makes plants compete more fiercely for light. so that plants begin to grow vertically instead of horizontally. Early-sown crops had taller plants than those that were sown later. . Similar results revelled with **Sandeep *et al.*, (2021).**

Plant dry weight - At Harvest, the significantly higher plant dry weight (94.86g) [Table.1] was observed in treatment-5 (2nd fortnight June + 40×15cm) However, treatment-6 (2nd fortnight June + 60×15cm) was found to be statistically at par with treatment- 5 (2nd fortnight June + 40×15cm).Dry matter is the expression of various morphological elements, such as the stem, the quantity of leaves, the quantity of tillers, etc. This decrease in dry matter yield with delay in sowing may be caused by the crop being sown early and having a higher leaf area index, which may have provided more photosynthetic area and contributed more dry matter. Dry matter accumulation decreased with delay in sowing among sowing dates. . These results are with conformation with

Khatana *et al.*, (2020). And also, When compared to lower plant spacing, the accumulation of dry matter has a greater influence on plant spacing. Low plant densities promote greater photosynthesis, carbon dioxide assimilation because plants produce more, and dry matter production as reported by **Williams *et al.*, (1968) and Sangoi *et al.*, (2002)**.

YIELD ATTRIBUTES

Grains/ear head

The significantly higher number of Grains/ear head (1588.30) [Table.2] was observed in treatment-5 (2nd fortnight June + 40×15cm) However, treatment-6 (2ndfortnight June + 60×15cm) was found to be statistically at par with treatment- 5 (2ndfortnight June + 40×15cm). There could be a significant and higher amount of grains/ear heads due. Early sowing allows crops to take advantage of favourable weather conditions. This may be the result of earlier crop sowing having a higher optimal mean temperature, more sunshine hours, and favourable environmental conditions. These results conformity with **Premsekar *et al.*, (1981).** And also, The genetic component of this variation in the number of grains per head may be responsible for the variation in florets produced in the inflorescence, and the interaction of genetic and environmental factors may affect the nature of the number of grains in the head. Similar results were found out by **Ajaj *et al.* (2021).**

Test weight (gm)

The significantly higher Test weight (14.93 gm) [Table.2] was observed in treatment-5 (2nd fortnight June + 40×15cm) However, treatment-6 (2ndfortnight June + 60×15cm) was found to be statistically at par with treatment- 5 (2ndfortnight June + 40×15cm). The results revealed that the chronological compatibility with regard to heat and light, which was ideal for growth rates and the manufacture of photosynthetic products at the highest rates, was positively reflected in most of the vegetative growth characteristics, which may have contributed to the significantly higher Test weight observed. The weight of the grains in the head increased. Similar results conformity with **Bughdady (2016).**

Grain yield (t/ha)

The significantly higher Grain yield (5.57 t/ha) [Table.2] was observed in treatment-5 (2nd fortnight June + 40×15cm) However, treatment-4 (2ndfortnight June + 60×15cm) was found to be statistically at par with treatment- 5 (2ndfortnight June + 20×15cm). The significantly higher Grain

yield (5.57 t/ha) was observed with the onset of sowing. At the time when sorghum was filling its grain, more favourable climatic conditions were created, which improved the sink-source relationship and increased seed yield. It appears that the planting dates allowed for sufficient time for seed germination. Similar results confirmed with **Bandiougou (2012).** Along with that The ideal planting pattern is essential for making the best use of growth resources and, ultimately, for maximising crop productivity. The interaction effect of sowing dates and spacing resulted in a higher grain yield, which was noted. Similar findings were reported with **Manasa and Umesha c. (2022).**

Stover yield (t/ha)

The Maximum Stover yield (8.44 t/ha) [Table.2] was observed in treatment-5 (2^{nd} fortnight June + 40×15cm) However, the Minimum stover yield (2.24 t/ha) was observed in treatment-7 (1^{st}fortnight July+ 20×15cm) and there was no significant difference among the treatments. The Maximum Stover yield (8.44 t/ha) was observed This might be due to suitable plant population and high plant spacing which affects the interspecies competition in crop plants to the minimum level and proper use of natural resources viz. light, space, moisture and nutrients which might have more utilized the plant. This result has been reported by **Kumar and Gautam (2004).**

CONCLUSION

It was concluded that with the sowing time of 2^{nd} fortnight June and along with the spacing 40×15cm (Treatment-5), has performs positively and improves growth and yield parameters. Maximum grain yield was recorded with the sowing time of 2^{nd} fortnight June and along with the spacing 40×15cm (Treatment-5). These findings are based on one season therefore; further trials may be required for further confirmation.

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Table 1. Influence of Dates of sowing and Spacing on Growth of Sorghum.

S. No.	Treatment combinations	Plant height (cm)	Plant Dry weight (gm)
1.	1st fortnight June+ 20×15cm	197.33	84.66
2.	1st fortnight June+ 40×15cm	200.32	87.96
3.	1st fortnight June+ 60×15cm	198.74	86.10
4.	2nd fortnight June + 20×15cm	202.96	91.14
5.	2nd fortnight June + 40×15cm	207.41	94.86
6.	2nd fortnight June + 60×15cm	205.82	92.74
7.	1st fortnight July + 20×15cm	188.94	84.66
8.	1st fortnight July + 40×15cm	197.07	83.05
9.	1st fortnight July + 60×15cm	194.94	81.65
10.	Control	202.61	89.96
	F test	S	S
	S Em. (±)	1.27	0.39
	CD (p=0.05)	3.76	1.16

Table 2. Influence of Dates of sowing and Spacing on Yield attributes of Sorghum.

S. No.	Treatment combinations	Grains/ear head	Test weight (gm)	Grain yield (t/ha)	Stover yield (t/ha)	Harvest Index (%)
1.	1st fortnight June+ 20×15cm	1172.33	13.33	1.99	3.08	39.30
2.	1st fortnight June+ 40×15cm	1245.40	13.68	2.55	4.03	39.75
3.	1st fortnight June+ 60×15cm	1062.87	13.49	2.20	3.86	38.74
4.	2nd fortnight June + 20×15cm	1335.40	14.07	5.16	7.84	45.17
5.	2nd fortnight June + 40×15cm	1588.30	14.93	5.57	8.44	45.17
6.	2nd fortnight June + 60×15cm	1474.60	14.50	3.52	5.41	42.00
7.	1st fortnight July + 20×15cm	944.50	13.00	1.63	2.24	35.13
8.	1st fortnight July + 40×15cm	964.23	13.05	1.89	2.62	36.60
9.	1st fortnight July + 60×15cm	948.50	13.05	1.65	2.41	36.30
10.	Control	1267.37	13.70	3.12	5.41	41.90
	F test	S	NS	S	S	S
	S Em(±)	52.46	0.69	0.20	0.20	1.89
	CD (p=0.05)	155.87	2.05	0.61	0.61	5.61