Original Research Article

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

ABSTRACT

A field experiment was conducted 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. To study the Response of Dates of sowing and spacing on growth and yield of Sorghum. 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

Sorghum [*Sorghum bicolor* (L.) Moench] is also known as "Jowar" belongs to poaceaefamily. Sorghum bicolor and Sorghum vulgare are two famous varieties of Sorghum. 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 %). 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 %),

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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. 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 entitled **''Influence of Sulphur and zinc on growth and yield of Pearl millet. (*Pennisetum glaucum* L.)"** was conducted during *Zaid*-2022, at crop research farm, SHUATS, Prayagraj (U.P).

MATERIALS AND METHODS

A field experiment was conducted during *Rabi* 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 of1stfortnight June+ 20×15cm, 1stfortnight June+ 40×15cm, 1stfortnight June+ 60×15cm,

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2nd fortnight 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). Significant and higher number of plant height may be owing Because of early sown crop utilizes the favourable conditions of weather conditions. The increase in plant height of sorghum might be due to favourable climatic conditions in the 2nd fortnight of June. Similar results were found by **Karhale*et al.*, (2014).** And also, with reduced spacing, increases the competition in plants for light. So that plants stops grow in horizontal and grows in vertical. Early sown crop shown higher plant height than late sown crop. 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 different morphological components like stem, number of leaves and number of tillers etc. Among dates of sowing dry matter accumulation decreased with delay in sowing, this decrease in dry matter yield with delay in sowing could be due to exploitation of favourable climatic condition at important growth stages by the crop sown early and higher leaf area index which might have provided more photosynthetic area

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and contributed more dry matter. These results are with conformation with **Khatana *et al.*, (2020).** And also, the dry matter accumulation influence with the plant spacing higher as compare to lower plant spacing. The low plant densities to attain greater photosynthesis, assimilation of carbon dioxide due to more output per plant and greater dry matter production as reported in findings of **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). Significant and higher number of grains/ear head may be owing Because of early sown crop utilizes the favourable conditions of weather conditions. This might be due to higher optimum mean temperature, greater sunshine hours and favourable environmental condition when crop was sown in early. These results conformity with **Premsekar*et al.*, (1981).** And also, the reason for this difference in the number of grains per head may be attributed to the difference in the number of florets formed in the inflorescence, and this is due to the genetic factor, and the interaction of genetic and environmental factors may have an effect on the character 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 significantly higher Test weight was observed might be due to the difference between dates of sowing and the results revelled 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, which was positively reflected in most of the characteristics of vegetative growth. This led to an increase in the weight of the grains in the head. 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 and it creates More favorable climatic conditions created at grain filling stage of sorghum. caused a better sink-source relationship and higher seed yield. It seems that in planting dates there was enough time for seed filling. Similar results confirmed with **Bandiougou (2012).** Along with that Optimum planting pattern is that the necessity for proper utilization of growth resources and ultimately to use the potential productivity of any crop. The higher grain yield was recorded from the interaction impact of sowing dates and spacing. 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 (2nd fortnight June + 40×15cm) However, the Minimum stover yield (2.24 t/ha) was observed in treatment-7 (1stfortnight 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 2nd fortnight June and along with the spacing 40×15cm (Treatment-5), has performs positively and improves growth and yield parameters. Maximum grain yieldwas recorded with the sowing time of 2nd 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/earhead	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