EFFECT OF SPACING AND PLANT GROWTH REGULATORS ON GROWTH AND YIELD OF FINGER MILLET (*ELEUSINE CORACANA* L.)

Abstract - A field experiment was carried out during *Kharif* season of 2021 at CRF (Crop Research Farm) of SHUATS, Prayagraj to study about the Effect of Spacing and Plant growth regulators on growth and yield Of Finger millet (*Eleusine coracana* L.) The test turned into specified in randomized block design by keeping three spacing levels, *i.e.* S - (20 x 10 cm), S2 – (30x10cm) and S3 – (40x10cm) and Plant growth regulators *i.e.* Boric acid 3000ppm, Gibberellic acid 50ppm and Salicylic acid 40ppm which was replicated three times. Results revealed that application of spacing 40 x 10 cm + Gibberellic acid 50ppm was recorded significantly maximum plant height (81.62 cm), number of tillers per plant (6.16), Plant dry weight (15.1 g/plant) and Grain yield (4.23t/ha). However, net return (72,650 INR/ha) and B:C ratio (2.19) have been recorded with treatment of 40 x 10cm spacing + Gibberellic acid 50ppm. Therefore I concluded that spacing of 40 x 10cm + Gibberellic acid 50ppm was produced more grains and economic effective.

Keywords: *Finger millet,Spacing,Plant growth regulator,Yield.*

INTRODUCTION

Finger millet (Eleusine coracana L.) is cereal grass grown **frequently** for its grain. Finger millet is a robust, tufted, tillering annual grass, upto 170cm height. Its florescence is like panicle which contain 4-19 finger resembles like spikes (Quatrocchi, 2006).

Finger millet has the highest amount of calcium (344mg%) and potassium (408 mg%) about 80 - 85% of the finger millet is amylopectin and remain 15 to 20 % is amylose. Since ragi is gluten free, it is wonderful grain alternative for people who are gluten-sensitive. It is one of the important millets occupying highest area under cultivation amongst small millets. Among the small millets, finger millet ranked 4th globally based on its importance after sorghum, bajra and foxtail millet respectively (Gupta *et al.,* 2012) .

In India, it's far cultivated over a place of 1.20 million hectares with total production of approximately 1.99 million tonne and productiveness of 1656 kg consistent with hectare. Plant spacing performs an crucial position on growth, improvement and yield of millet crops. Optimum plant density guarantees flowers to develop well making higher usage of daylight and soil nutrients.

Closer spacing hampers intercultural operations and in a densely populated crop, the inter-plant competition for nutrients, air and light is higher, which usually results in mutual shading, lodging and reduces the harvest index (Narayan *et al.*, 2018).

Foliar spray of nutrients, vitamins and plant growth regulators are quickest manner to enhance up crop growth due to the fact the vitamins are to be had to plant life on the preliminary ranges and crucial ranges. Foliar application of nutrients, vitamins and growth regulators has been advised for growing the fertilizer use performance. It presents extra fast usage of vitamins and lets in the correction of found deficiencies in much less time than that might be required via way of means of soil treatments. Growth regulators can enhance the physiological performance together with photosynthetic cappotential and may decorate powerful partitioning of accumulates from supply and sink within side the subject crops (Solaimalai *et al.,* 2001). Salicylic acid is one such plant growth regulator, which participates within side the law of some of physiological activities taking area within side the plant (Ashraf et al., 2010). Hence, the prevailing research turned into completed with the foliar spray of vitamins and plant growth regulators at the growth and yield of finger millet.

Plant growth regulators like salicylic acid (SA) and gibberellic acid (GA3) are identified endogenous regulator of plant metabolism, which specifically involved in biotic and abiotic stress. GA3 work as a hormone in regulating plant growth. Which can stimulate the rapid stem and root growth and growth velocity of germination. Boric acid extensively inspired many increase factors as plant height, leaf number, leaf area, haulm fresh and dry weight Salicylic acid is ortho-hydroxybenzoic acid and it's far a secondary metabolite performing as analogous of increase regulating substances. Foliar software of salicylic acid exerted a great impact on plant increase metabolism while carried out at physiological concentration, and as a result acted as one of the plant growth regulating substances. SA will increase cell metabolic rate.

MATERIALS & METHODS

A field experiment was laid out during *Kharif* season of 2021 at Crop Research Farm, Department of Agronomy, SHUATS, Prayagraj (U.P) which is located at 25^0 39' 42"N latitude, 81^0 67'56" E longitude and 98m altitude above the mean sea level, during *Kharif* season 2021 on sandy loam soil, having nearly neutral in soil reaction (pH 7.1), organic carbon (0.112), available nitrogen (278.93kg/ha K), available phosphorus (10.8kg/ha) and available potassium (206.4 kg/ha). The weather of the region is semi- arid subtropical. Treatments comprised of T_1 – 20 x 10 cm + Boric acid 3000ppm, T_2 – 20 x 10 cm + Gibberellic acid 50ppm, T_3 – 20 x 10 cm + Salicylic acid 40ppm, T_4 – 30 x 10 cm + Boric acid 3000ppm, T_5 30 x 10 cm + Gibberellic acid 50ppm, T_6 – 30 x 10 cm + Salicylic acid 40ppm K, T_7 – 40 x 10 cm + Boric acid 3000ppm, T_8 – 40 x 10 cm + Gibberellic acid 50ppm, T_9 – 40 x 10 cm + Salicylic acid 40ppm and T_{10} – (Control). These had been replicated thrice in RBD (Randomized Block Design). The recommended dose of fertilizer is 60-30-30 kg/ha NPK. Recommended dose of fertilizer turned into implemented on the time of sowing in the form of urea, DAP and MOP.

Chemical analysis of soil

Composite soil samples are accumulated earlier than format of the test to decide the preliminary soil properties. The soil samples are accumulated from 0-15 cm intensity and have been dried below shade, powdered with timber pestle and mortar, surpassed via 2 mm sieve and have been analyzed for natural carbon via way of means of fast titration technique via way of means of Nelson (1975), Available nitrogen become predicted via way of means of alkaline permanganate technique via way of means of Subbiah and Asija (1956), to be had phophorus via way of means of Olsen's technique as mentioned via way of means of Jackson (1967), to be had potassium become decided via way of means of the use of the flame photometer everyday ammonium acetate answer and estimating via way of means of the use of flame photometer (ELICO Model) as mentioned via way of means of Jackson (1973).

Statistical analysis

The statistics recorded had been exceptional traits had been subjected to statistical evaluation through adopting Fishers the technique of evaluation of variance (ANOVA) as defined through

Gomez and Gomez (2010). Critical difference (CD) values had been calculated the 'F' test was found tremendous at 5% level.

RESULTS AND DISCUSSION

Growth attributes

Plant height(cm)

Observations concerning the plant height of finger millet are given in Table 1 and there has been a growing in crop age plant height turned into regularly accelerated with the development at some point of the experimentation. The evaluation on plant height turned into considerably better in all of the exceptional growth periods with the degrees of spacing and plant growth regulators. At harvest, most plant height (81.62cm) turned into recorded with software of spacing 40x10cm + Gibberellic acid 50ppm which turned into considerably advanced over all different remedies and statistically at par with treatment of spacing 20 x 10 cm + Gibberellic acid 50ppm (80.70cm) . All the levels of plant growth, plant height turned into discovered to be accelerated in plant density.The spacing 40 cm apart rows resulted in taller plant height as compared to other rows spacing this may be due to the competition between plants for light within dense plant population. Also, high plant density could reduce light intensivity within plant canopy and encourage IAA synthesis and increase stem elongation. The similar findings were reported by E.A.Ali (2011)

Number of tillers per plant

Observations regarding the tillers of finger millet are given in Table1 and there was Tillering progressively increased with plant advance during plant growth. At harvest, recorded with treatment of application of spacing 40 x 10 cm + Gibberellic acid 50ppm (6.16) which were significantly superior **to** all other treatments except **application** treatment of spacing 20x10 cm + Gibberellic acid 50ppm (5.93) which were statistically at par with treatment of application of spacing 40 x 10 cm + Gibberellic acid 50ppm. A wider crop geometry had yielded a greater number of tillers/plants at all growth stages compared to others. The two wider spatial arrangements of 30 x 10 cm and 40 x 10 cm appeared to encourage tiller formation. From the results it shows that there was significance difference in the number of tillers between spacing 20 x 10 cm and 30 x 10 cm of above 0.5. Also there was a significance difference in mean number of tillers between 20 x 10 cm and 40 x 10 cm of about 0.3 but ,there was no significant difference

in the mean number of tillers between 30 x 10 cm and 40 x 10 cm indicating the tiller formation is encouraged by a wider spacing. The similar findings was reported by Andrew Korir et al.,(2018)

Plant dry weight (g/plant)

Observations concerning the plant dry weight are given in table 1 and there was plant dry weight had consecutively magnified from 20 DAS to at harvest. At harvest , higher plant dry weight (15.01 g) recorded with treatment of application of spacing 40 x 10 cm + gibberellic acid 50ppm that were considerably superior over all alternative treatments except with treatment of application of spacing 20 x 10 cm + gibberellic acid 50ppm (14.13g), which were statistically at par with treatment of application of spacing 40 x 10 cm + gibberellic acid 50ppm. magnified plant population due to nearer putting and double seedling/hill magnified the amount of tillers and eventually plant dry matter production. Improvement of leaves may need increased the chemical process potency of corakan and have elicited to provide plant dry matter production. This was an accordance with the sooner findings of Rajesh (2011).

Yield

Grain yield (t/ha)

Treatment with application of spacing 40 x10 cm + gibberellic acid 50ppm was recorded most Grain yield (4.23 t/ha) that was considerably superior over all alternative treatments except with the treatment of application of spacing 20 x 10 cm + salicylic acid 40ppm (3.97 t/ha) which were statistically at par with the treatment with spacing 40 x10 cm + gibberellic acid 50ppm. 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 30 cm spacing 15 kg/ha (2214.4 kg/ha).Similar findings were reported by Nigus and Birhanu (2018).

Stover yield (t/ha)

Treatment with application of spacing 40 x 10 cm + Gibberellic acid 50ppm was recorded maximum stover yield (5.01 t/ha) which was significantly superior over all other treatments except with the treatments 30 x 10 cm + Gibberellic acid 50ppm(4.84 t/ha) and 20 x 10cm + Salicylic acid 40ppm (4.78 t/ha) are statistically at par with the treatment with spacing 40 x 10 cm + Gibberellic acid 50ppm. More plant population owing to closer spacing at 40 x 10 cm might

have contributed to highest plant dry matter production and variety of leaves that ultimately increased the straw yield. Similar findings have conjointly been reportable earlier by (Rajesh,2011) and Kalaraju *et al.*(2011)

Harvest index (%)

Treatment with application of spacing 40 x 10 cm + Gibberellic acid 50ppm which was recorded maximum Harvest index (45.77%) which was significantly superior over all other treatments expect with the treatments 20 x 10 cm + Gibberellic acid 50ppm (42.42%), 20 x 10cm + Salicylic acid 40ppm (45.37%), 30 x 10cm + Gibberellic acid 50ppm (43.13), 40 x 10cm + Salicylic acid 40ppm (44.96) are statistically at par with the treatment with spacing 30 x 10 cm + Gibberellic acid 50ppm. This was principally because of increase of grain yield with optimum straw yield that successively resulted in higher harvest index. These results were in confirmity with findings of Kumar et al. (2019).

Economics

Maximum net returns (72650.00 INR/ha) and benefit cost ratio (2.19) was obtained with application of spacing 40x10 cm + gibberellic acid 50ppm that was considerably superior over remainder of the treatments.

CONCLUSION

On the basis of one season experimentation application of spacing 40 x10 cm + gibberellic acid 50ppm was found more productive (2.19 t/ha) likewise as economics (72650.00 INR/ha).

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Table 1 Effect of spacing and biofertilizer on growth attributes, yield and economics of Finger millet

Treatments	Growth attributes			Yield			Economics	
	Plant height (cm)	Tillers per plant	Dry weight (g/plant)	Grain yield (t/ha)	Stover yield (t/ha)	Harvest index (%)	Net return (INR/ha)	B:C ratio
20 x10 cm + Boric acid 3000ppm	77.87	5.33	12.12	2.77	4.70	37.08	35620	1.05
20 x 10 cm + Gibberellic acid 50ppm	80.70	5.93	14.13	3.39	4.60	42.42	51250	1.52
20 x 10cm + Salicylic acid 40ppm	75.04	4.90	10.63	3.97	4.78	45.37	65590	1.94
30 x 10cm + Boric acid 3000ppm	79.32	5.33	12.61	3.14	3.90	39.63	45110	1.35
30 x 10cm + Gibberellic acid 50ppm	79.73	5.36	10.40	3.49	4.84	43.13	53990	1.62
30 x 10cm + Salicylic acid 40ppm	76.04	5.16	11.48	3.04	4.63	39.63	42580	1.27
40 x 10 cm + Boric acid 3000ppm	76.90	5.06	10.86	3.04	3.76	44.70	42770	1.28
40 x 10cm + Gibberellic acid 50ppm	81.62	6.16	15.01	4.23	5.01	45.77	72650	2.19
40 x 10cm + Salicylic acid 40ppm	73.85	4.50	9.67	3.35	4.10	44.96	50490	1.51
22.5 x 10 cm + 60:30:30 kg/ha NPK	72.02	5.20	9.12	2.21	3.63	37.84	23170	0.70
SEm (±)	0.323	0.227	0.344	0.20	0.090	1.25		
CD (0.05%)	0.962	0.671	1.022	0.58	0.268	3.70		