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Effect of Spacing and Plant Growth Regulators on Growth and Yield of *Zaid* Sesame (*Sesamum indicum* L.)

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A B S T R A C T

The field experiment was conducted during *Zaid* season, 2020 at Crop Research Farm (CRF), Department of Agronomy, SHUATS, Prayagraj (UP) On sandy loam soil to investigate the Effect of Spacing and Plant Growth Regulators on Yield and Economic of *Zaid* Sesame (*Sesamum indicum* L.). The experiment was laid out in Randomized Block Design with nine treatments replicated thrice with the different spacing (30cm x 10cm and 45cm x 10cm) and different levels of NAA (10 ppm & 20 ppm), GA_3 (10 ppm & 20 ppm), IAA (10 ppm & 20 ppm) and salicylic acid (10 ppm & 20 ppm) as foliar spray. Study revealed that Spacing 45cm x 10cm + GA_3 10 ppm foliar spray at 30 and 45 DAS was recorded significantly higher Plant Height (88.29 cm), No of Branches (4.21), Plant Dry Weight (21.81 g) as compared to all the treatment combinations. The yield attributes are higher Capsule/plant (43.96), Seeds/Capsule (54.52) and Seed yield (8.27 q/ha), Stover yield (27.84 q/ha) recorded with treatment of spacing 45cm x 10cm + GA_3 10 ppm foliar spray at 30 and 45 DAS as compared to all treatment combinations.

Introduction

Sesame (*Sesamum indicum* L.) Adomed as "Queen of oil seed crop". It is commonly known as Til, Gingeli, Sim and it is the oldest important oil seed crop in the tropics. It has been believed as sesame probably originated in Africa. It belonging to the order Tubiflorae, family Pedaliaceae an important oil seed crop being cultivated in the tropics as well as in the temperate zone of the world and cultivated for its high-quality oil (Chung *et al.,* 2003). Sesame is one of the oldest oilseed crop cultivated in India. It is called as by virtue of its excellent quality. Sesame is very drought-tolerant crop of semiarid regions. It is superior to other oilseed crop due to adaptability to varied agro-climatic condition and high degree of drought tolerance.

Among the cultural practices, row spacing is one of the important components, manipulation of which could lead for optimizing yield. Population density has profound influence on grain yield. The plant density can be adjusted by the use of either different seed rates or different row spacing. Optimum planting density enables the sesame

plant to grow properly both in its aerial and underground parts by utilizing maximum radiant energy, space and water which ultimately leads to boost crop production (Shinde *et al,* 2011).

GA_3 accelerated stem elongation and bud development (Kabar *et al.,* 1990). Gibberellins (GA_3) constitute a group of tetracyclic diterpenoids, involved in plant growth and development. Gibberellic acid (GA_3) a well-known phytohormone, has numerous physiological effects on plants including seed germination, growth, stem elongation, leaf expansion, photosynthesis, flowering and cell expansion (Taiz and Zeiger, 2010; Yuan and Xu, 2001). Naphthalene acetic acid is the growth promoting substance, which may play a significant role to change growth characters and yield of sesame. Foliar application of growth regulator-NAA produces more fertile grain. NAA has a positive effect on growth and higher dry matter production. Foliar spray of NAA (15 ppm) at 15, 30 and 45 days after sowing increased fruit set and productivity (Siddik *et al.,* 2016).

IAA has been found to increase the plant height, number of leaves per plant, pod size with consequent enhancement of yield. It also increases the flowering, fruit set, and the total dry matter of crops. It is also known that auxin suppresses axillary bud outgrowth (Shimuzu-Sato *et al.,* 2009).

Salicylic acid (SA) belongs to a group of phenolic compounds, which is widely in plants and is now known as a hormone-like substance (Levent *et al.,* 2007). SA acts as a potential non-enzymatic antioxidant as well as a plant growth regulator, which play an important role in regulation of plant physiological stages, including photosynthesis, growth, nitrate metabolism, heat production (Joseph *et al*., 2010), flowering, the effect on the germination of seeds, maturity and response to stress.

Materials and Methods

An experiment was carried out to study the "Effect of Spacing and Plant Growth Regulators on Yield and Economic of*Zaid* Sesame (*Sesamum indicum* L.) during *Zaid* season of 2020 at Crop Research Farm (CRF), Department of Agronomy, SHUATS, Naini Agricultural Institute, Prayagraj (U.P), which is located at 25^o 24' 42" N latitude, 81^o 50' 56" E longitude and 98 m altitude above the mean sea level.The soil of the experimental plot was sandy loam in texture, nearly neutral in soil reaction (pH 7.4), low in organic carbon (0.28%), medium in available N (225 Kg/ha), high in available P (19.60 Kg/ha) and available K (92.00 Kg/ha). The experiment was laid out in Randomized Block Design with consisted of nine treatments replicated thrice viz.T_1: Control Spacing 30cm x 10cm + Water spray at 30 & 45 DAS, T_2 Spacing 30cm × 10cm + NAA 20 ppm Foliar spray at 30 DAS, T_3: Spacing 45cm × 10cm + NAA 10 ppm Foliar spray at 30 and 45 DAS, T_4:Spacing 30cm × 10cm + $GA_3$20 ppm Foliar spray at 30 DAS, T_5: Spacing 45cm × 10cm + $GA_3$10 ppm Foliar spray at 30 and 45 DAS, T_6: Spacing 30cm × 10cm + IAA 20 ppm Foliar spray at 30 DAS, T_7: Spacing 45cm × 10cm + IAA 10 ppm Foliar spray at 30 and 45 DAS, T_8: Spacing 30cm × 10cm + Salicylic acid 20 ppm Foliar spray at 30 DAS, T_9: Spacing 45cm × 10cm + Salicylic acid 10 ppm Foliar spray at 30 and 45 DAS. Foliar application of these plant growth regulators was made at 30 and 45 days after sowing. The growth parameters were recorded at periodical intervals of 20, 40, 60, 80 from randomly selected five plants in each plot were collected. Statically analysis was done and mean compared at 5% probability level for significant results.

Results and Discussion

Effect of spacing and plant growth regulators on growth parameters

The growth parameters like plant height, No of branches and dry weight of plant were significantly affected by the application Spacing and GA_3. Table 1.

Growth parameters

Plant height

The results revealed that Spacing of 45cm×10cm + $GA_3$10 ppm foliar spray at 30 and 45 DAS recorded maximum plant height (88.29 cm). The increased plant height in row spacing of 45cm x 10cm probably tended the plants to be taller for getting the light in closed spacing (Shekh *et al.,* 2014). Sethy *et al.,* (2016) revealed that application of GA_3 recorded significantly higher plant height.

Branches/plant

At 80 DAS, maximum Number of branches (4.21) was recorded with application of Spacing 45cm×10cm + GA3 10 ppm Foliar spray at 30 and 45 DAS and minimum Number of branches (3.50) was recorded with Treatment 1.Application of GA_3 was found most effective in increasing number of branches. Kothule *et al.,* (2003)

Dry weight (g)

At 80 DAS, significantly highest plant dry weight (21.81) was observed with application of Spacing 45cm×10cm + GA3 10 ppm Foliar spray at 30 and 45 DAS which was superior over the treatments. Rahman *et al.,* (2004) revealed that the foliar spray of GA3 had the most regulatory effect to enhance dry weight.

Table.1 Effect of Spacing and Plant Growth Regulators on growth parameters of*Zaid* Sesame (80 DAS)

S. No.	Treatments	Plant height (cm)	No. of branches /plant	Dry weight (g/plant)
1	Control- Spacing 30cm×10cm + Foliar Spray with Water at 30 and 45 DAS	85.30	3.50	**18.15**
2	Spacing 30cm×10cm + NAA 20 ppm Foliar spray at 30 DAS	84.23	4.06	**19.02**
3	Spacing 45cm×10cm + NAA 10 ppm Foliar spray at 30 and 45 DAS	85.41	3.61	**20.38**
4	Spacing 30cm×10cm + GA3 20 ppm Foliar spray at 30 DAS	84.07	3.38	**18.42**
5	Spacing 45cm×10cm + GA3 10 ppm Foliar spray at 30 and 45 DAS	88.29	4.21	**21.81**
6	Spacing 30cm×10cm + IAA 20 ppm Foliar spray at 30 DAS	84.68	3.72	**18.26**
7	Spacing 45cm×10cm + IAA 10 ppm Foliar spray at 30 and 45 DAS	85.37	3.51	**20.44**
8	Spacing 30cm×10cm + Salicylic acid 20 ppm Foliar spray at 30 DAS	84.46	3.85	**19.20**
9	Spacing 45cm×10cm + Salicylic acid 10 ppm Foliar spray at 30 and 45 DAS	84.50	4.02	**18.60**
	SEm(±)	1.1972	0.3036	**0.4966**
	CD (p=0.05)	**3.5893**	**-**	**1.4888**

Table.2 Effect of spacing and plant growth regulators on yield attributes and yield of *Zaid* sesame (80 DAS)

	Treatments	Capsules/plant	Seed yield (q/ha)	Straw yield (q/ha)
1	Control- Spacing 30cm×10cm + Foliar Spray with Water at 30 and 45 DAS	38.69	9.81	**19.06**
2	Spacing 30cm×10cm + NAA 20 ppm Foliar spray at 30 DAS	35.53	10.74	**18.12**
3	Spacing 45cm×10cm + NAA 10 ppm Foliar spray at 30 and 45 DAS	40.83	12.67	**20.82**
4	Spacing 30cm×10cm + GA3 20 ppm Foliar spray at 30 DAS	39.51	9.97	**20.14**
5	Spacing 45cm×10cm + GA3 10 ppm Foliar spray at 30 and 45 DAS	43.96	13.77	**22.34**
6	Spacing 30cm×10cm + IAA 20 ppm Foliar spray at 30 DAS	39.06	10.77	**18.74**
7	Spacing 45cm×10cm + IAA 10 ppm Foliar spray at 30 and 45 DAS	41.33	12.74	**20.59**
8	Spacing 30cm×10cm + Salicylic acid 20 ppm Foliar spray at 30 DAS	39.28	11.11	**19.13**
9	Spacing 45cm×10cm + Salicylic acid 10 ppm Foliar spray at 30 and 45 DAS	39.13	9.86	**18.78**
	SEm(±)	1.5824	0.7972	**0.8607**
	CD (p=0.05)	**4.7441**	**2.3901**	**2.4184**

Application of growth regulators significantly increased the total dry matter accumulation irrespective of varieties due to increasing cell division and other physiological activities, due to the increase of leaf area more photosynthesis are produced and the total dry matter of the plant was increased (Gungarde *et al.,* 1992; Patel, 2012).

Effect of spacing and plant growth regulators on yield attributes and yield

Effect of Spacing and Plant growth regulators on yield attributes and yield of *Zaid* Sesame are presented in Table 2.

Yield attributes and Yield

Yield attributes and yield were significantly affected by45cm×10cm + GA3 10 ppm Foliar spray at 30 and 45 DAS resulted in significant increase in number of Capsules per plant (43.96), maximum number of seeds per capsule (54.52), maximum seed yield (8.27 q/ha) and stover yield is (27.84 q/ha). Maximum results was found in Spacing 45cm x 10cm + GA3 10 ppm at 30 and 45 DAS may be due to its play an important role in improving the plant growth and yield of sesame. Shinde *et al.,* (2011) observed that the highest values for growth and yield attributes of sesame were obtained under 45 cm spacing (11.53q ha^{-1}). Sarkar *et al.,* (2002) recorded that GA_3 had a regulatory effect to increase the number of flowers, number of pods, percentage of fruit set, number of seed $plant^{-1}$, seed yield $plant^{-1}$, 1000-seeds weight and seed yield and stover yield.

In conclusion it can be inferred from the present investigation that Spacing 45cm x 10cm along with application of $GA_3$10 ppm at 30 and 45 DAS recommended for receiving higher growth and yield of Sesame.

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