Effect of spacing and plant growth regulators on yield and economic of Zaid sesame (Sesamum indicum L.)

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Abstract

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 (30 cm x 10 cm and 45 cm x 10 cm) and different levels of NAA (10 ppm & 20 ppm), GA3 (10 ppm & 20 ppm), IAA (10 ppm & 20 ppm) and salicylic acid (10 ppm & 20 ppm) as foliar spray. Study revealed that Spacing 45 cm x 10 cm + GA3 10 ppm foliar spray at 30 and 45 DAS was recorded significantly higher Seed yield (8.27 q/ha), Stover yield (27.84 q/ha) as compared to all the treatment combinations. The economic analysis clearly indicates that higher B:C ratio (2.10) recorded with treatment of spacing 45 cm x 10 cm + GA3 10 ppm foliar spray at 30 and 45 DAS as compared to all treatment combinations.

Keywords: Spacing, NAA, GA3, IAA, salicylic acid

Introduction

Sesame (Sesamum indicum L.) Adomend 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) [2]. 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) [11].

GA3 accelerated stem elongation and bud development (Kabar et al. 1990) [4]. Gibberellins (GA3) constitute a group of tetracyclic diterpenoids, involved in plant growth and development. Gibberellic acid (GA3) 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) [9, 10]. 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) [8].

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, the total dry matter of crops. It is also known that auxin suppresses axillary bud outgrowth (Shimuzu-Sato et al. 2009) [6].
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 Tuna et al. 2007) [3]. 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) [3], 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° 24’ 42” N latitude, 81° 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. T1: Control Spacing 30 cm x 10 cm + Water spray at 30 & 45 DAS, T2: Spacing 30 cm x 10 cm + NAA 20 ppm Foliar spray at 30 DAS, T3: Spacing 45 cm x 10 cm + NAA 10 ppm Foliar spray at 30 and 45 DAS, T4: Spacing 30 cm x 10 cm + GA3 20 ppm Foliar spray at 30 DAS, T5: Spacing 45 cm x 10 cm + GA3 10 ppm Foliar spray at 30 and 45 DAS, T6: Spacing 30 cm x 10 cm + IAA 20 ppm Foliar spray at 30 DAS, T7: Spacing 45 cm x 10 cm + IAA 10 ppm Foliar spray at 30 and 45 DAS, T8: Spacing 30 cm x 10 cm + Salicylic acid 20 ppm Foliar spray at 30 DAS, T9: Spacing 45 cm x 10 cm + 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

Seed yield (q/ha), Stover Yield (q/ha), Harvest Index (%) Data pertaining to Seed yield (q/ha), Stover yield (q/ha), Harvest Index (%) is presented in Table 1. The treatment with Spacing 45 cm x 10 cm + GA3 10 ppm Foliar spray at 30 and 45 DAS were recorded maximum seed yield (8.27 q/ha) and stover yield (27.84 q/ha) which which was significantly superior over all the treatments. However, in case of seed yield and stover yield treatment with spacing 45 cm x 10 cm + GA3 10 ppm Foliar spray at 30 and 45 DAS, were statistically on par with treatment of spacing 45 cm x 10 cm + GA3 10 ppm Foliar spray at 30 and 45 DAS. Harvest index (%) shows non-significant result among different treatments but it found maximum (23.53%) in spacing 45 cm x 10 cm + Salicylic acid 10 ppm Foliar spray at 30 and 45 DAS. It might due to better utilization of available resources viz. mineral, nutrients, water, sunlight and the optimum plant population. Shinde et al. (2011) also reported that GA3 treated plots showed highest yield compared to control.

Economics

Economics of crop production is dependent on market price of inputs and quantity of output produced and price in the market (Aparna et al., 2020) [1]. As result found seed and stover yield varies from treatment to treatment. The maximum gross return and net return was observed in high yield producing treatment, i.e., Spacing 45 cm x 10 cm + GA3 10 ppm Foliar spray at 30 and 45 DAS. The maximum gross return (l9837.7/ha), net return (l9987.7/ha) and B:C ratio (2.10) were found under treatment of spacing 45 cm x 10 cm + GA3 10 ppm Foliar spray at 30 and 45 DAS.

Table 1: Effect of Spacing and Plant growth regulators on Seed yield, Stover yield and Harvest index of Zaid Sesame.

| Treatments | Seed yield (q/ha) | Stover yield (q/ha) | Harvest index (%) |
|------------|------------------|--------------------|-------------------|
| 1 Control- Spacing 30cmx10cm + Foliar Spray with Water at 30 and 45 DAS | 4.50 | 24.36 | 20.36 |
| 2 Spacing 30cmx10cm + NAA 20 ppm Foliar spray at 30 DAS | 5.24 | 23.62 | 18.59 |
| 3 Spacing 45cmx10cm + NAA 10 ppm Foliar spray at 30 and 45 DAS | 7.17 | 26.32 | 21.56 |
| 4 Spacing 30cmx10cm + GA3 20 ppm Foliar spray at 30 DAS | 5.14 | 25.64 | 20.82 |
| 5 Spacing 45cmx10cm + GA3 10 ppm Foliar spray at 30 and 45 DAS | 8.27 | 27.84 | 19.89 |
| 6 Spacing 30cmx10cm + IAA 20 ppm Foliar spray at 30 DAS | 5.27 | 24.24 | 21.92 |
| 7 Spacing 45cmx10cm + IAA 10 ppm Foliar spray at 30 and 45 DAS | 7.24 | 26.09 | 21.31 |
| 8 Spacing 30cmx10cm + Salicylic acid 20 ppm Foliar spray at 30 DAS | 5.61 | 24.63 | 22.53 |
| 9 Spacing 45cmx10cm + Salicylic acid 10 ppm Foliar spray at 30 and 45 DAS | 4.48 | 24.28 | 23.53 |
| S.Em(±) | 0.7703 | 0.8067 | 0.9195 |
| CD (p=0.05) | 2.3094 | 2.4184 | - |

Table 2: Effect of Spacing and Plant growth regulators on Total Cost of Cultivation, Gross Return, Net Return and B:C of Zaid Sesame

| Treatments | Total cost of cultivation | Gross return | Net return | B: C ratio |
|------------|--------------------------|--------------|------------|-----------|
| 1 Control- Spacing 30cmx10cm + Foliar Spray with Water at 30 and 45 DAS | 28980 | 5835.4 | 29355.4 | 1.01 |
| 2 Spacing 30cmx10cm + NAA 20 ppm Foliar spray at 30 DAS | 29120 | 62915.9 | 33795.9 | 1.16 |
| 3 Spacing 45cmx10cm + NAA 10 ppm Foliar spray at 30 and 45 DAS | 28970 | 80116.8 | 51146.8 | 1.77 |
| 4 Spacing 30cmx10cm + GA3 20 ppm Foliar spray at 30 DAS | 29080 | 64191.9 | 35111.9 | 1.21 |
| 5 Spacing 45cmx10cm + GA3 10 ppm Foliar spray at 30 and 45 DAS | 28950 | 89837.7 | 60887.7 | 2.10 |
| 6 Spacing 30cmx10cm + IAA 20 ppm Foliar spray at 30 DAS | 29160 | 63793.7 | 34633.7 | 1.19 |
| 7 Spacing 45cmx10cm + IAA 10 ppm Foliar spray at 30 and 45 DAS | 28990 | 80389.5 | 51399.5 | 1.77 |
| 8 Spacing 30cmx10cm + Salicylic acid 20 ppm Foliar spray at 30 DAS | 29180 | 66680.4 | 37500.4 | 1.29 |
| 9 Spacing 45cmx10cm + Salicylic acid 10 ppm Foliar spray at 30 and 45 DAS | 29000 | 57883.7 | 28883.7 | 1.00 |
Conclusion

It can be inferred from the above experiment that Spacing 45cm x 10cm + GA3 10 ppm foliar spray at 30 and 45 DAS was recorded higher yield and found to be economically beneficial for the farmers.

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