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# EFFECT OF SPACING AND TERMINAL CLIPPING SCHEDULE ON GROWTH AND YIELD OF SUMMER SESAMUM (*SESAMUM INDICUM* L.)

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**ABSTRACT**

An experiment was conducted during summer season of the year 2015 at College Agronomy Farm, Anand Agriculture University, Anand to investigate the effect of spacing and terminal clipping schedule on growth and yield of summer sesamum. The experiment comprising of three spacing *viz.*, $S_1$: 30 cm, $S_2$: 45 cm, $S_3$: 60 cm and four terminal clipping *viz.*, $C_1$: No clipping, $C_2$: Terminal clipping at 20 DAS, $C_3$: Terminal clipping at 30 DAS and $C_4$: Terminal clipping at 40 DAS. Significantly higher number of branches (5.12 and 4.95) and capsules/plant (66.75 and 62.44) was recorded under $S_2$ treatment (45 cm spacing) but it was at par with treatment $S_3$ (60 cm spacing) treatment, respectively. Similarly, significantly higher seed yield was recorded under $S_2$ treatment (1132 kg/ha) but was at par with $S_1$ (30 cm spacing) treatment (1079 kg/ha). In terminal clipping, significantly higher number of branches (5.63) and capsules/plant (73.08) was recorded under treatment $C_3$ (terminal clipping at 30 DAS) but was at par with treatment $C_4$ (terminal clipping at 40 DAS). Significantly the highest seed and stalk yield (1229 and 2605 kg/ha) was registered under treatment $C_3$ (terminal clipping at 30 DAS), respectively.

## INTRODUCTION

Sesamum (*Sesamum indicum* L.) is one of the oldest spice and oilseed crops domesticated well over 3000 years ago, also grown as cash crop in foreign countries. The production of oilseed crops in our country including sesamum is not enough to meet the domestic demand of the large population mainly due to its cultivation during rainy season on marginal lands. Sesamum yield is the manifestation of various physiological processes occurring in plants and they are usually modified by management practices *viz.*, plant geometry, fertilization, terminal clipping *etc.* are important aspect for determining the yield. Monpara and Vaghasia (2016) found that row spacing of 30 cm x 10 cm recorded significantly the highest seed yield of sesamum. Modification of physiology of the plants in terms of terminal clipping was found beneficial for increasing the yield of sesamum because the shoot tip rising from the shoot apical meristem inhibits the growth of the lateral bud by repressing auxin. When the shoot is cut off through terminal clipping, the lateral bud begins to lengthen which is mediated by a release of cytokines. Once the apical dominance has been lifted from the plant, elongation and lateral growth is promoted and the lateral buds grow into new branches. Kamble *et al.* (2015) observed significantly higher plant height, branches plant$^{-1}$, number of capsules plant$^{-1}$, number seeds capsule$^{-1}$ as well as seed yield were recorded in clipping at 35 DAS than no clipping treatment. Similar line of results was also noticed by Singh *et al.* (2013). In general, limited data are available on these aspects and in Gujarat, so far no any work on terminal clipping on sesamum is carried out as individual factor or in conjunction with other factor. Hence, it is essential to evaluate the agronomic practices for sesamum, considering the above point. The present experiment was planned to study the effect of physiological interventions and spacing on yield of summer sesamum (*Sesamum indicum* L.) under middle Gujarat conditions at Anand Agricultural University, Anand.

## MATERIALS AND METHODS

A field experiment was conducted during summer season of the year 2015 at College Agronomy Farm, Anand Agriculture University, Anand. The soil of the experiment field was loamy sand (Goradu) having 8.40 pH, 0.45 organic carbon, 219.52 kg/ha, available N, 44.80 kg/ha, available $P_2O_5$ and 257.60 kg/ha available $K_2O$. Average annual rainfall of 864.5 mm, which is realized entirely from the south-west monsoon currents. The maximum temperature ranged between 27.8 to 42.5 °C and minimum temperature ranged between 12.7 to 28.0 °C during the crop season. The experiment was consisted of 12 treatment combinations with two factors studied under factorial randomized block design with four replications. The factor one with three levels ($S_1$: 30 cm, $S_2$: 45 cm and $S_3$: 60 cm) and second factor with four levels ($C_1$: No clipping, $C_2$: Terminal clipping at 20 DAS), $C_3$: Terminal clipping at 30 DAS) and $C_4$: Terminal clipping at 40 DAS). Sowing of sesamum var. GT-3 was done on 21$^{st}$ February, 2015 as per the spacing treatment. Entire quantity of nitrogen (50 kg/ha) and phosphorous (25 kg/ha) in the form of urea and single super phosphate, respectively were applied at the time of sowing as per recommendation. Thinning operations should be carried out at 15 DAS to maintain proper plant population. In general, different weather parameters were favourable for plant growth during experimental period. The other package of practices was adopted to raise the crop as per the recommendations. In order to represent the plot five plants from each plot selected and labelled and all biometric observations was taken from selected plants. Data on various observations during the experiment period was statistically analysed as per the standard procedure developed by Cochran and Cox (1957).

## RESULTS AND DISCUSSION

### Effect of spacing

Data presented in Table 1 indicated that plant population recorded at harvest showed linearly decreasing trends wherein, treatment $S_1$ recorded significantly the highest (289) while treatment $S_3$ recorded significantly the lowest (115) plant population net/plot. The higher plant population under narrow row spacing was also observed by Tahir *et al.* (2012). The data on periodical plant height indicated different spacing treatment significantly influence plant height at 60 DAS and at harvest but at 30 DAS it was non-significant. Spacing treatment differed significantly from each other and treatment $S_1$ and $S_3$ recorded significantly the highest (89.73 cm) and the lowest (77.71 cm) plant height, respectively at harvest. Sarma (1994) observed that in narrow spacing, plants compete more for available resources especially for light and resulted in more height than widely spaced plants in sesamum. Similarly, Murade *et al.* (2014) also observed higher plant height under 30 x 10 cm spacing treatment in urdbean and kumari *et al.*(2015) also observed that optimum spacing (30 x 10 cm) recorded higher plant height in flax.

Results indicated that number of branches/plant was significantly affected by different spacing treatment at 60 DAS as well as at harvest but at 30 DAS it was unaffected. At 60 DAS, significantly the highest and the lowest number of branches/plant (5.12 and 4.22) were recorded under treatment $S_2$ and $S_1$, respectively. This may be due to under wider spacing congenial micro environment prevailed from its early growth stage which might have helped to put forth enhanced rate of growth and development of plant (Sivagamy and Rammohan, 2013). These results are in accordance with those reported by Murade *et al.* (2014) in urdbean. Significantly higher number of capsules/plant (66.75) was recorded under treatment $S_2$ while the lowest (47.50) number of capsules/plant was recorded under treatment $S_1$. Hemalatha *et al.* (1999) also found similar line of results which indicated that competition free environment enabling the crop for the use of growth limiting resources efficiently which contributed to improved crop performance. Further, a liner response was observed in average number of days to 50% flowering due to different row spacing wherein, treatment $S_3$ recorded more days to reach at 50 % flowering. While treatment $S_1$ recorded significantly the lowest days to attained 50% flowering. Test weight of sesamum

**Table 1: Growth, yield attributes and yields of sesamum as influenced by spacing and terminal clipping treatments**

| Treatment | Plant population /net plot | Plant height (cm) | | | Number of branches plant/plant | | | Day to 50 % flowe ring | No. of capsules / plant | Test weight (g.) | Seed yield (kg/ha) | Stalk yield (kg/ha) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | At harvest | at 30 DAS | at 60 DAS | At harvest | At 30 DAS | At 60 DAS | At harvest | | | | | |
| $S_1$: 30 cm | 289 | 16.15 | 72.88 | 89.73 | 2.41 | 2.85 | 4.22 | 41.13 | 47.5 | 3.77 | 1079 | 2299 |
| $S_2$: 45 cm | 173 | 15.59 | 68.72 | 82.71 | 2.45 | 4.02 | 5.12 | 43.25 | 66.75 | 3.81 | 1132 | 2367 |
| $S_3$: 60 cm | 115 | 16.28 | 66.73 | 77.71 | 2.46 | 3.68 | 4.95 | 44.94 | 62.44 | 3.78 | 813 | 1747 |
| S.Em. + | 3.1 | 0.26 | 1.28 | 1.49 | 0.05 | 0.08 | 0.09 | 0.3 | 1.65 | 0.03 | 30 | 49 |
| C. D. at 5% | 8.9 | NS | 3.69 | 4.31 | NS | 0.25 | 0.27 | 0.86 | 4.77 | NS | 86 | 140 |
| $C_1$: No clipping | 191 | 16.73 | 74.02 | 90.63 | 2.43 | 2.61 | 3.5 | 43.25 | 43.33 | 3.77 | 757 | 1823 |
| $C_2$: Clipping at 20 DAS | 195 | 14.51 | 68.35 | 80.47 | 2.46 | 3.3 | 4.52 | 43 | 53.92 | 3.79 | 979 | 1917 |
| $C_3$: Clipping at 30 DAS | 196 | 16.03 | 63.22 | 76.4 | 2.46 | 4.74 | 5.63 | 42.92 | 73.08 | 3.82 | 1229 | 2605 |
| $C_4$: Clipping at 40 DAS | 187 | 16.76 | 72.19 | 86 | 2.4 | 3.43 | 5.38 | 43.25 | 65.25 | 3.78 | 1065 | 2206 |
| S.Em. + | 3.6 | 0.3 | 1.48 | 1.73 | 0.06 | 0.1 | 0.11 | 0.34 | 1.91 | 0.04 | 35 | 56 |
| C. D. at 5 % | NS | 0.88 | 4.26 | 4.97 | NS | 0.29 | 0.32 | NS | 5.51 | NS | 99 | 162 |
| S x C | 6.2 | NS | NS | Sig. | NS | Sig. | Sig. | NS | Sig. | NS | Sig. | Sig. |
| C.V (%) | 6.5 | 6.7 | 7.4 | 7.2 | 8.3 | 9.9 | 8 | 2.8 | 11.2 | 3.2 | 11.9 | 9.2 |

**Table 2: Number of branches/plant at 60 DAS and at harvest as influenced by interaction effect of different spacing and terminal clipping treatments**

| Number of branches/plant | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Treatments | $C_1$ | | $C_2$ | | $C_3$ | | $C_4$ | |
| | At 60 DAS | At harvest | At 60 DAS | At harvest | At 60 DAS | At harvest | At 60 DAS | At harvest |
| $S_1$ | 2.75 | 3.4 | 2.8 | 4.3 | 3.8 | 4.7 | 2.55 | 4.5 |
| $S_2$ | 2.85 | 3.55 | 3.6 | 4.85 | 5.75 | 6.13 | 3.9 | 5.9 |
| $S_3$ | 2.7 | 3.57 | 3.5 | 4.4 | 4.67 | 6.07 | 3.85 | 5.75 |
| | At 60 DAS | | | | At harvest | | | |
| S. Em. ± | 0.17 | | | | 0.19 | | | |
| C. D. at 5 % | 0.5 | | | | 0.55 | | | |
| C. V. % | 9.9 | | | | 8 | | | |

**Table 3: Number of capsules/plant as influenced by interaction effect of different spacing and terminal clipping treatments**

| Number of capsules/plant<br>Treatments | $C_1$ | $C_2$ | $C_3$ | $C_4$ |
|---|---|---|---|---|
| $S_1$ | 38.5 | 42.5 | 62.5 | 46.5 |
| $S_2$ | 47.57 | 60.5 | 82.5 | 76.25 |
| $S_3$ | 43.75 | 58.75 | 74.25 | 73 |
| S. Em. ± | 3.31 | | | |
| C. D. at 5 % | 9.54 | | | |
| C. V. % | 11.2 | | | |

was found to be non-significant due to spacing treatment.

Treatment $S_2$ and $S_1$ remain at par with each other but recorded significantly higher seed (1132 and 1072 kg/ha) and stalk (2372 and 2299 kg/ha) yields as compared to treatment $S_3$, respectively. It was ascribed that under medium spacing proper arrangements of plant might have helped in better absorption of moisture and nutrients as well as efficient photosynthesis which ultimately lead to increased vegetative growth of the plant which resulted in better manifestations of higher value for all the yield contributing traits. In conformity with the results of the present study Roy *et al.* (2009) reported that sparsely populated fields with wider spacing could lead to uneconomic utilization of space, profuse growth of weeds and pests and reduction of yield per unit area of sesamum.

**Effect of terminal clipping**

Plant population net/plot recorded at harvest was found to be non significant due to different terminal clipping treatments which indicated that the plant population was homogenous for different treatment under study and the results achieved due to only treatment effect (Table 1). Periodical plant height was significantly affected due to different clipping treatments in which treatment $C_1$ recorded significantly maximum plant height (16.73 cm) at 30 DAS which was remain at par with treatment $C_4$ (16.76 cm) and $C_3$ (16.03 cm), while significantly the lowest (14.51 cm) plant height was measured under treatment $C_2$. At harvest, trend remained more or less same with slight change in order of the treatments. Maximum plant height under no clipping treatment might be due to continuous supply of auxin to apical meristematic tissue while minimum plant height under terminal clipping treatment due to removal of apical growth or top most shoots from plant which arrests the vertical growth of plant. These finding are similar with Kamble *et al.* (2015).

Data on number of branches/plant indicated that treatment $C_3$ recorded significantly the highest number of branches/plant (4.74 and 5.63) at 60 DAS and at harvest while the lowest (2.61 and 3.50) was noticed under treatment $C_1$ (Table 1). Similarly, Kamble *et al.*, 2015 on sesamum indicated that the higher number of branches/plant under terminal clipping at 35 DAS might be due to clipping during log phase where plant gains speed at logarithmic levels whereas, clipping at 25 and 45 DAS is less might be due to clipping during log phase and slow growth phase, respectively. Days to 50 % flowering was found non-significant due to terminal clipping treatments. Similarly, significantly the highest number of capsules/plant (73.08) was recorded under treatment $C_3$ while the lowest number of capsules/plant (43.33) was observed under treatment $C_1$. The higher number of capsules/plant under terminal clipping treatment might be due to dispersion of carbohydrates or food material toward the auxiliary vegetative buds below clipped portion which in turn might have helped in production of more number branches/plant thereby more number of capsules/plant. These results are in close agreements with the finding of Kamble *et al.* (2015). Weight of 1000 seed was found non-significant due to terminal clipping treatments.

The data further indicated that the highest (1229 and 2605 kg/ha) and the lowest (757 and 1823 kg/ha) seed and stalk yields were recorded under treatment $C_3$ and $C_1$, respectively. The higher yield under terminal clipping treatment might be due in plants, the development of auxillary buds are inhibited normally by Indole Acetic Acid (IAA) produced in the apical meristem. If the source of auxin is removed by excising the apical meristem, the lateral branching gets accelerated, which resulted in increased number of capsules/plant thereby increased seed yield. The results are in line with the finding of Bharathi *et al.* (2012).

**Interaction effect**

Data presented in Table 3 indicated that number of branches at 60 DAS and at harvest and capsules/plant were significantly influenced due to combine effect of spacing and terminal clipping treatments. Treatment combination $S_2C_3$ recorded significantly the highest number of branches/plant (5.75) while treatment combination $S_1C_4$ recorded significantly lower (2.55) number of branches at 60 days after sowing. More or less similar line of results was also noticed at harvest. Early clipping recorded less number of branches/plant which might be due to availability of limited growing point on topped main stem. While clipping at the middle of crop growth stage increased number of branches this may be attributed to nipping effect of apical buds which resulted in production of more secondary branches and cessation of vertical growth on account of effective translocation of growth regulator particularly auxins being diverted to the primary and tertiary shoot buds which in normal condition reported by Thakur and Lakpale (2014) in soybean. Similarly, number of capsules/plant was also observed significantly the highest (82.50) under treatment combination $S_2C_3$ whereas; treatment combination $S_1C_1$ recorded lower (38.50) number of capsules/plant (Table 3). This may be due to increased in number of branches/plant hence, number of capsules/plant positively depend upon number of branches/plant. Moreover, nipping clearly indicates that energy which was previously used by plant to become taller was diverted towards capsules formation (Sarkar and Pal, 2005).

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