Journal of Agroforestry and Environment

Volume 16, Issue 2, 2023

Journal DOI: https://doi.org/10.55706/jae

Journal homepage: www.jagroforenviron.com

Effect of Planting Methods and Planting Density on Growth and Yield of Sesame in Non-saline Area of Patuakahali, Bangladesh

Nowrose Jahan Lipi[1] and Muhammad Maniruzzaman[2]

[1]Dept. of Agronomy, Patuakhali Science and Technology University
[2]Dept. of Agricultural Chemistry, Patuakhali Science and Technology University

*Correspondence: manir@pstu.ac.bd.

Received: 25/05/2023

Accepted: 26/08/2023

Available online: 29/08/2023

Abstract: The planting methods and planting density influence the growth and yield of crops. A field experiment was conducted with split-plot design using two planting methods (row and broadcast) and four planting densities (40, 50, 60, and 70 plants m^{-2}) to observe the effect on yield and yield attributing characters of sesame in the field laboratory of Agronomy Department in Patuakhali Science and Technology University. The yield and yield components were significantly affected by planting methods. The row planting method showed higher yield and yield components than the broadcasting method. The yield and yield components were also affected by planting density. The plant height, the number of branches $plant^{-1}$, the number of capsule $plant^{-1}$, and 1000 seed weight were reduced with the increase of planting density except for yield. The highest yield (1358.0 kg ha^{-1}) was obtained from 60 plants m^{-2} in the row planting method. Row planting method with 60 plants m^{-2} could be recommended for better yield of sesame.

Keywords: Growth; Planting density; Sesame; Yield

INTRODUCTION

Sesame (*Sesamum indicum* L.) is an important oil seed crop grown worldwide. It possesses the second position of mustard on the basis of cultivation and production in Bangladesh. Sesame can be grown in almost all the regions of Bangladesh. Sesame is grown on a small scale and usually, fewer inputs are provided for cultivation. In Bangladesh, the scarcity of edible oil has been a severe problem for many years (Khatun et al. 2016). To fulfill the demand every year Bangladesh Government has to spend a huge amount of money. As rice is the staple food crop in Bangladesh, the farmer in the southern tidal region follows the rice (transplant *aman*)-fallow- fallow cropping pattern. However, the area of oilseed crop cultivation can be increased by utilizing the fallow land. Cultivation of mustard is limited in this region due to some unavoidable environmental factors. Farmers are not encouraged to grow soybean in their fields as the processing of soybean is very difficult. So sesame might be the only oilseed crop that can be cultivated in this region for oil production to fulfill the oil demand.

The yield rate of sesame is generally lower than other crops because of genetic environmental issues (Ashri, 1998). The yield of sesame can be increased by adopting better management practices. Most of the farmers of Bangladesh use the broadcasting method for sesame cultivation because it needs less equipment and it is very easy for sowing seeds. The broadcasting method results in non-uniform plant spacing in the field. The uniform plant spacing is more adventitious than non-uniform plant spacing for environmental factors. Many researchers showed a significant yield reduction in non-uniform plant spacing for different crops such as sunflower (Wade, 1990), corn (Pommel and Bonhomme, 1998), and sorghum (Larson and Vanderlip, 1994). In the broadcasting method, modern types of equipment cannot be used for management practices. On the other hand, the row planting method is better than the broadcasting method (Caliskan et al. 2004). The row planting method has some advantages over the broadcasting method such as it provides efficient use of resources like light, nutrients, moisture etc., enhances light interception, and facilitates intercultural operations (Mihretie et al. 2021).

Plant density is another factor for better growth and yield of crops. Competition for efficient use of resources like light, moisture, and nutrients is increased in higher density of plants as a result, an adverse effect of higher plant population is observed on the yield of crops (Depenbrock et al. 2001). For the above reasons, the

experiment was conducted to observe the effect of planting density and planting spacing on the growth and yield of sesame in the non-saline tidal area of Bangladesh.

MATERIALS AND METHODS

Description of the experimental site

The study was carried out in the non-saline area of Bangladesh situated in the AEZ 13. It was conducted in the field laboratory of Patuakhali Science and Technology University, Dumki, Patuakhali which was at 22°20'90″N latitude and 90°20'29″ E longitude (Figure 1).

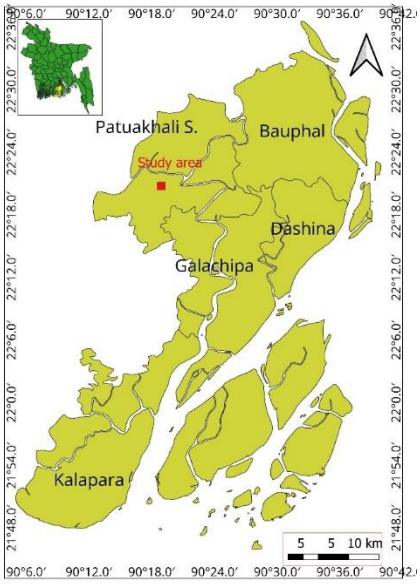

Figure 1. Location of the study area in the map

Experimental Design and Treatments

The experiment was conducted with two factors using a split-plot design with three replications. The planting methods were allotted in the main plot and the planting density was allotted in the subplot. There were two planting methods (row and broadcast) and four planting densities (40, 50, 60, and 70 plants m-2) used in the experiment.

Land preparation and seed sowing

The area of the subplot was 10m^2 (2.5m×4m). The plots were prepared by plowing followed by laddering. The weeds were removed and the seeds were sown on 15 August after finally land prepared well. The sesame cultivar "T6" was sown.

Fertilization and intercultural operation

The same amount of fertilizers such as urea (125 kg ha^{-1}), TSP (150 kg ha^{-1}), MOP (50 kg ha^{-1}) gypsum (110 kg ha^{-1}), and zinc sulfate (5 kg ha^{-1}) were applied according to the BARI fertilizer recommended guide in each plot. Half of the urea and all dose of other fertilizers were applied during the final land preparation. The rest of the urea was applied after 35 days of seed sowing. All the intercultural operations like thinning, gap filling, irrigation, weeding, insect and pest management, etc. were done according to BARI, Bangladesh. Three surface irrigations were applied during the growing period.

Sampling and harvesting

From each plot, ten plants were randomly selected and marked. After sixty days of seed sowing the plant height was recorded from the selected plants. Harvesting was done when crops were fully matured. The harvested sesame was properly tagged and dried in the sun.

Data collection

The following data were recorded: The plant height (cm), number of branches plant-1, number of capsule plant-1, 1000 seed weight (g), and seed yield (ton ha^{-1}).

Statistical analyses

The statistical analyses were done using the statistical package SPSS 16.0. The mean difference was compared by Duncan's Multiple Range Test and the analysis of variance was calculated.

RESULTS AND DISCUSSION

Plant growth

The plant height was considerably affected by planting methods and planting density individually (Table 1&2) but it was not significant (p=0.140) when planting methods and planting density were considered simultaneously. When the row planting method was used, taller plants were found (Table 1 and Figure 1).

Table1. Effect of planting methods on yield and yield attributing characters of sesame

Planting Method	Plant height (cm)	No. of branches plant^{-1}	No. of capsules plant^{-1}	1000 seed weight (gm)	Seed yield (kg ha^{-1})
Broadcasting Method	95.54	2.38	23.34	2.28	981.13
Row Method	100.90	2.40	27.58	2.67	1206.00
Level of significance	**	ns	**	**	**

ns= not significant, **= significant at p=0.01 provability level

DOI: https://doi.org/10.55706/jae1622

The number of branches plant^{-1} was also significantly affected by planting density but not significantly affected (p=0.675) though row planting gave more branches per plant (Table 1&2).

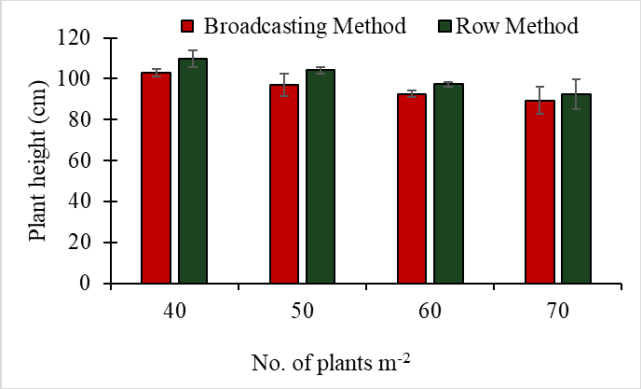

Figure 1. Effect of planting methods and planting density on plant height

When planting methods and planting density were considered simultaneously the number of branches was also significantly affected (Figure 2). As the row planting method ensured a more uniform distribution of plant population, it provided favorable environmental and nutritional conditions, allowed to do easy intercultural operations resulting in higher plant growth (Mihretie et al. 2021).

Table 2. Effect of planting density on yield and yield attributing characters of sesame

Planting density m-2	Plant height (cm)	No. of branches plant^{-1}	No. of capsule plant^{-1}	1000 seed weight (gm)	Seed yield (kg ha^{-1})
40	106.43	3.02	34.22	2.88	935.75
50	100.55	2.55	28.25	2.65	1205.00
60	94.95	2.10	23.85	2.32	1358.00
70	90.94	1.90	15.50	2.03	875.08
Level of significance	**	**	**	**	**

**= significant at p=0.01 provability level

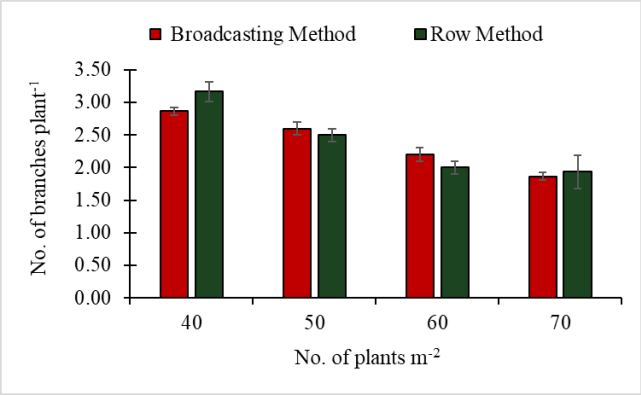

Figure 2. Effect of planting methods and planting density on the number of branches plant^{-1} of sesame

We found taller plants in the lower planting density plots. In our study, the sesame was grown in irrigated conditions with high temperature and light intensity. For this reason, the vigorous growth of plants was observed due to less inter-competition for light, water, and nutrients.

Number of capsule plant^{-1}

The number of capsule plant^{-1} was significantly influenced by planting methods and planting densities individually and simultaneously (Table 1&2, Figure 3). The row planting method showed higher capsule plant^{-1}. The highest number of capsule plant^{-1} (34.22) was found in the lowest planting density (40 plants m^{-2}) whereas the lowest capsule plant-1(15.50) was found in the highest planting density (70 plants m^{-2}). Plants grown in the row method with less planting density can enjoy light, moisture, nutrients, and other favorable environmental conditions which favored plant growth resulting increased number of capsule plant^{-1} (Kasperbauer, 1987). A similar result was found by Jadhav et al. (1992) and Majumder and Roy (1992).

DOI: https://doi.org/10.55706/jae1622

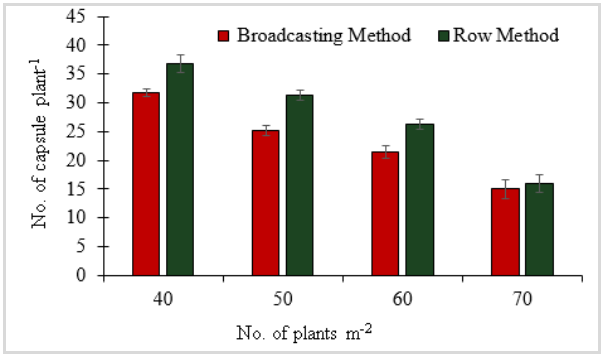

Figure 3. Effect of planting methods and planting density on the number of capsule plant^{-1} of sesame

1000 seed weight

A significant variation was observed in 1000 seed weight of sesame when different planting methods and planting densities were used (Table 1&2, Figure 4).

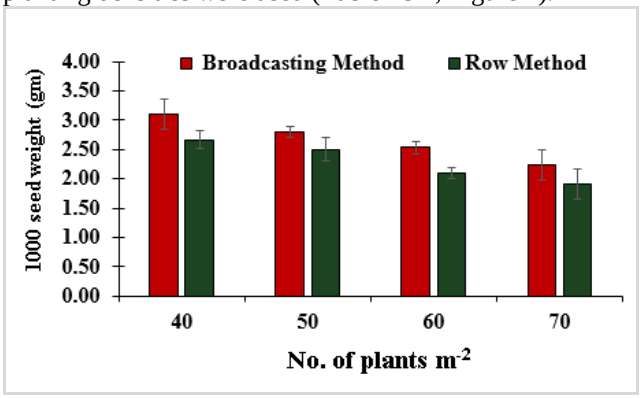

Figure 4. Effect of planting methods and planting density on 1000 seed weight of sesame

The row cultivation method showed a higher seed weight. One thousand-seed weight gradually reduced with the increasing planting density (Caliskan et al., 2004). In the case of 1000 seed weight, a similar result was found by Majumder and Roy (1992).

Yield of seed

The yield of sesame seed was significantly affected by the methods of planting and planting density (Table 1&2, Figure 5). A higher seed yield was obtained in the row planting method compared to the broadcasting planting method. Plants grown in the row planting method with less planting density got sufficient light, moisture, nutrients, and other favorable environmental conditions which favored plant growth resulting in higher yield (Kasperbauer, 1987). On the other hand, plants grown in the broadcasting method might be closer to competing for light, moisture, and nutrients resulting in less yield of sesame. Similar data was found by Caliskan et al. (2004) in sesame, Wade (1990) in sunflower, Pommel and Bonhomme (1998) in corn, and Larson and Vanderlip (1994) in sorghum.

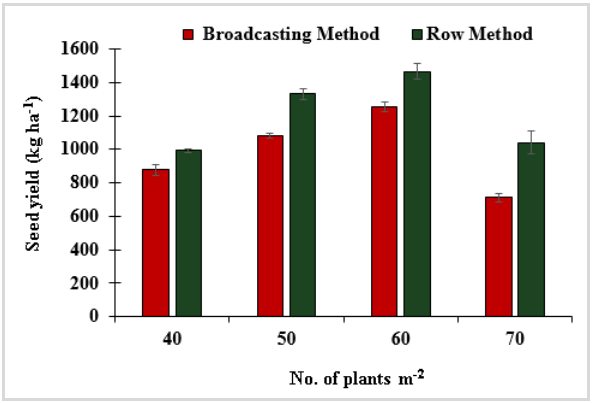

Figure 5. Effect of planting methods and planting density on yield of sesame

The highest yield (1358.00 kg ha^{-1}) was found in 60 plants m^{-2} planting density (Table 2). Up to a certain level, it was increased from the lowest planting density. Though the increasing plant density reduced the number of capsules and seed plant^{-1} up to a certain limit, the rate of increase in the number of plants per unit area was much greater than the reduction rate of yield components. When crossing the limit in highest plant density the yield might be reduced. For this reason, the highest yield was obtained in 60 plants m-2 than 70 plants m-2 planting density.

CONCLUSION

It may be concluded that the yield and yield components were significantly affected by planting methods and planting density. The row planting method showed higher yield and yield components than the broadcasting method. The plant height, the number of branches plant^{-1}, the number of capsule plant-1, and 1000 seed weight were reduced with the increase of planting density except for yield. The highest yield (1358.0 kg ha^{-1}) was obtained from 60 plants m^{-2} in the row planting method. Row planting method with 60 plants m-2 could be recommended for better yield of sesame.

Acknowledgments

The authors are grateful to Patuakhali Science and Technology University for the successful completion of this experiment through funding.

Conflict of Interest

There is no conflict of interest declared by the authors.

REFERENCES

Anderson, J.M. and Ingram, J.S.I. 1996. Tropical Soil Biology and Fertility a Handbook of Methods 2nd edi. CAB International. Wallingford, U.K. pp. 57-58.

Ashri, A. 1998. Sesame breeding. Plant Breed. Rev., 16: 179-228.

Caliskan, S., Arslan, M., Arioglu, H. and Isler, N. 2004. Effect of planting method and plant population on growth

and yield of sesame (Sesamum indicum L.) in a Mediterranean type of environment. Asian Journal of Plant Sciences, 3(5):610-613.

Diepenbrock, W., Long, M. and Feil, B., 2001. Yield and quality of sunflower as affected by row orientation, row spacing and plant density. Die Bodenkultur, 52 (1:).29-36.

Jadhav, A.S., Chavan, G.V. and Gungarde, S.R., 1992. Geometry of sesame (Sesamum indicum) cultivars under rain-fed conditions. Indian Journal of Agronomy, 37(4):857-858.

Kasperbauer, M.J. 1987. Far-red light reflection from green leaves and effects of phytochrome- mediated partitioning under field conditions. Plant Physiol. 85:350-354.

Khatun, M., Tanvir, M., Hossain, B., Monayem, M.M.A., Khandoker, S. and Rashid, M.A., 2016. Profitability of sunflower cultivation in some selected sites in Bangladesh. Bangladesh Journal of Agricultural Research. 41(4): 599-623.

Larson, E.L. and Vanderlip, R.L. 1994. Grain sorghum yield response to nonuniform stand reductions. Journal of Agronomy, 86: 475-477.

Majumdar, D., and Roy, S. 1992. Response of summer sesame to irrigation, row spacing and plant population. Indian Journal of Agronomy, 37: 758-762.

Mihretie, F., Tsunekawa, A., Bitew, Y., Chakelie, G., Dere, B., Getahun, W., Beshir, O., Tadesse, Z.,and Asfa M., 2021. Teff [Eragrostis tef (Zucc.)] Rainfed ield Response to Planting Method, Seeding Density, and Row Spacing. Agronomy Journal, 113 (1):111–122.

Pommel, B. and Bonhomme, R. 1998. Variations in the vegetative and reproductive systems in individual plants of a heterogeneous maize crop. European Journal of Agronomy, 8: 39-49.

Wade, L.J. 1990. Estimating loss in grain yield due to suboptimal plant density and non-uniformity in plant spacing. Australian Journal of Experimental Agriculture, 30(2): 251-255.

DOI: https://doi.org/10.55706/jae1622