International Journal of Economic Plants 2023, 10(2):132-135 *Full Research*

Doi: HTTPS://DOI.ORG/10.23910/2/2023.0516c

Effect of Dose and Time of Nitrogen Application on Growth and Yield of Sesamum (*Sesamum indicum* L.) Under Irrigated Conditions

E. Aruna* and K. Sunil Kumar

Agricultural Research Station, Utukur, Kadapa, ANGRAU, Andhra Pradesh (516 003), India

Corresponding Author

E. Aruna
e-mail: arunaettapu@gmail.com

Article History

Article ID: IJEP0516c
Received on 11th February, 2023
Received in revised form on 30th April, 2023
Accepted in final form on 19th May, 2023

Abstract

The experiment was conducted during *rabi* season from November to January months of 2020–21 in the farm of Agricultural Research Station, Utukur, Kadapa, Andhra Pradesh, India to study the growth and yield performance of sesame under different levels and times of nitrogen application. The treatments included four levels of nitrogen viz., 40, 60, 80 and 100 kg ha^{-1} and four application timings as 50:50 basal and 30 DAS, 25:75 basal and 30 DAS, 25:37.5:37.5 basal, 20 and 40 DAS and 0:50:50 basal, 20 and 40 DAS which were laid out in split plot design with levels of nitrogen in main plots and time of nitrogen application in sub plots in three replications. The test variety YLM-66 was mixed with sand in 1:3 proportion and sown at a spacing of 30×10 cm^2. Taller plants were recorded with application of 100 kg N ha^{-1} which was on par with 60 and 80 kg ha^{-1} and the number of branches per plant was not influenced significantly by nitrogen. The number of capsules plant^{-1}, number of seeds capsule^{-1} and seed yield was higher with application of 80 kg N ha^{-1} indicating this as an optimum of nitrogen fertilizer in contrast to the present recommended dose of 40 kg N ha^{-1}and regarding the time of application, and number of splits, application of 80 Kg N ha^{-1} in three splits in the ratio of 25-37.5-37.5 at basal, 20 and 40 days after sowing is recommended for getting higher seed yield in sesamum. Under irrigated conditions in YSR Kadapa district of Andhra Pradesh.

Keywords: Dose, growth, sesamum, time of nitrogen, yield

1. Introduction

Sesame (*Sesamum indicum* L.) called as queen of oil seeds is one of the most ancient oilseed crops in the tropics. It is an important source of high-quality oil and protein (Jhonson et al., 1979, Elleuch et al., 2007). The oil has excellent stability due to the presence of natural antioxidants such as sesamolin and sesamin (Bedigian et al.,1985). The proteins in sesame are rich in the essential sulphur-containing amino acids such as methionine and tryptophan (Ogundare et al., 2015). India ranked third in sesame production (866 mt) with the largest area (1947 mha) but the productivity is extremely low (413 kg ha^{-1}) compared to the world average (535 kg ha^{-1}). Inappropriate use of fertilizers is one of the major production constraints in sesame (Amin and Alireza, 2015, El-Sherif, 2016). Sesame is grown in an area of 5000 ha in YSR Kadapa district of Andhra Pradesh during *rabi* season with average productivity of 800 kg ha^{-1}. Among the different agronomic management components that influences the productivity of sesame, nutrient management plays a major role out of which widely applied nitrogen management is little bit difficult due to its losses by ammonia volatilization during nitrification, denitrification, downward leaching and runoff with poor efficiency of 30–40%. Nitrogen is considered as an essential element of bio-molecules such as amino acids, proteins, nucleic acids, phyto hormones and a number of enzymes and coenzymes. N strongly stimulates growth, expansion of the crop canopy and interception of solar radiation. Nitrogen is the most dynamic and important nutrient required for survival of all living things (Rosolem et al., 2017, Fageria and Baligar, 2005), Nitrogen contributes up to 50% of all nutrient inputs and hence called as determinant of farmers crop yield (Babajide and Oyeleke, 2014, Snehu et al., 2010). Significant positive correlation was observed between nitrogen application rate and yield in sesamum Varied responses of sesamum to nitrogen from 60 kg (Shilpi et al., 2012) to 180 kg ha^{-1} were observed at different places. Patel et al. (2014), Kushawala et al. (2022) reported the response up to 75 kg N ha^{-1} and Rao et al. (1994), Umar et al. (2012) studied the effects of N fertilizer rates (0, 40 and 80 kg ha^{-1}) on sesame yield, Yield components, seed composition, seed protein and oil and found that 80 kg N ha^{-1} as optimum for higher seed yield (0.79 t ha^{-1}) and oil content (45.9%). Damdar et al. (2015) observed increased sesame yield up to 90 kg N ha^{-1} and Vaghani et al. (2010) up to 100 kg ha^{-1}. Ramakrishnan et al. (1994) reported significant increase in sesame yield and

yield related components with increase in nitrogen levels up to 120 kg N ha^{-1}. Zeb and Jan (2021) reported response up to 180 kg N ha^{-1} in sesamum. Accordingly, methods have been recommended for improving the efficiency of fertilizer nitrogen viz., selection of plants with high nitrogen efficiency, adjusting the timing of fertilizer application and developing more efficient fertilizers. Out of this, time of fertilizer application with synchronization of crop nutrient demand is largely important as the maximum potential rate of N uptake is determined by plant growth stage and lower N uptake occurs during the seedling stage and pre-harvest periods, while the vegetative growth and flower initiation demand higher N supply. Auwalu et al. (1995) and Gebremariam (2015) reported significant influence of timing of nitrogen application on yield of sesame. Tadesse et al. (2013) also reported the significant effect of nitrogen application timing on qualitative and quantitative yield, agronomic characters and nitrogen use efficiency in corn. Hence the experiment was commenced to determine the optimum dose and best time of nitrogen application on sesame in YSR Kadapa district of Andhra Pradesh.

2. Materials and Methods

The experiment was conducted in the farm of Agricultural Research Station, Utukur, Kadapa, Andhra Pradesh, India which is situated at 14.45° N latitude and 78.81° E longitude during *rabi* season from November to January of 2020–2021 to study the performance of sesame under different levels and times of nitrogen application. The soil of the experimental site was red clayey in texture, low in available nitrogen (160 kg ha^{-1}), medium in available phosphorus (30 kg ha^{-1}) and rich in available potash (320 kg ha^{-1}). The treatments included four levels of nitrogen viz., 40, 60, 80 and 100 kg ha^{-1} and four application timings of nitrogen as 50:50 basal and 30 DAS, 25:75 basal and 30 DAS, 25:37.5:37.5 basal, 20 and 40 DAS and 0:50:50 basal, 20 and 40 DAS which were laid out in split plot design with levels of nitrogen in main plots and time of application in sub plots in three replications. The clean seed of popularly grown yelamanchili -66 was mixed with sand in 1:3 proportions and sown with a spacing of 30×10 cm^2 in the plots of size 3.6×4.0 m^2 on 20th November. Recommended dose of Phosphorus and potassium (25–25 kg ha^{-1}) was applied through single super phosphate and murate of potash respectively and nitrogen was applied as per the treatments. At present, the Recommended dose of nitrogen for sesame during *rabi* season was 40 kg ha^{-1}. Two hand weedings were carried out at 20 and 40 DAS. All other agronomic practices were followed as per the recommendations prescribed by the ANGRAU. The observations on growth and yield attributes were taken from randomly selected five plants and yield from net plot area and subjected to statistical analysis.

3. Results and Discussion

3.1. Effect of nitrogen

Successive increase in nitrogen from 40 to 100 kg ha^{-1} influenced the growth, yield parameters and yield in sesame under irrigated conditions during *rabi* season (Table 1). Taller plants were recorded with application of 100 kg N ha^{-1} which was on par with 60 and 80 kg N ha^{-1}. Though the number of branches plant^{-1} was more with 100 kg N ha^{-1} it was found non significant. Whereas , significantly higher number of capsules plant^{-1} were recorded with application of 100 kg N ha^{-1} which

Table 1: Growth and yield of sesame as influenced by dose and time of nitrogen application during rabi

Treatments	Plant height (cm)	No. of branches plant^{-1}	No. of capsules plant^{-1}	Capsule length (cm)	No. of seeds capsule^{-1}	Test weight (g)	Seed yield (kg ha^{-1})
Levels of Nitrogen (kg ha^{-1})							
40	105	3.81	50.53	2.2	53.18	0.322	1188
60	109	3.65	54.75	2.1	54.15	0.325	1248
80	111	3.86	66.66	2.1	55.35	0.325	1310
100	112	4.01	68.54	2.2	55.80	0.325	1372
SEm±	1.0	0.12	0.88	0	0.41	0.005	26.8
CD (*p*=0.05)	3.5	NS	3.0	NS	1.00	NS	93
Time of nitrogen application							
50-50 (basal, 30 DAS)	109	4.06	62.35	2.2	54.06	0.325	1268
25-75 (basal, 30 DAS)	107	3.83	60.42	2.2	53.25	0.320	1223
25-37.5-37.5 (basal,20, 40 DAS)	114	4.06	64.80	2.1	55.78	0.321	1374
0-50-50 (basal, 20, 40 DAS)	107	3.38	53.70	2.1	55.34	0.328	1255
SEm±	0.82	0.05	0.57	0	0.34	0.005	26.1
CD (*p*=0.05)	2.4	NS	1.7	NS	1.00	NS	76

was on par with 80 kg ha^{-1}. Significantly lower number of capsules were recorded with application of 40 kg N ha^{-1}. The number of seeds capsule^{-1} were significantly more with 100 kg N ha^{-1} compared to 40 and 60 kg N ha^{-1} but was on par with 80 kg N ha^{-1}. Test weight in sesame was not significantly influenced by the quantity of nitrogen. significantly higher seed yield of 1372 kg ha^{-1} was recorded with application of 100 kg N ha^{-1} which was on par with 80 kg N ha^{-1}. Ahmad et al. (2018) also reported an Optimum dose of 100 kg N ha^{-1} in sesame. Increases in N supply within limits are associated with increase in leaf area, carboxylases, and chlorophyll content which in turn determines the photosynthetic activities of leaf and ultimately dry matter production and allocation to the various organs of a plant (Maqsood et al., 2016, Babajide and Oyeleke, 2014) which ultimately decides the yield.

3.2. Effect of time of application of nitrogen

Application of nitrogen in 25-37.5-37.5 ratio at basal, 20 and 40 DAS recorded significantly taller plants, higher number of capsules plant^{-1} and number of seeds capsule^{-1}. But the number of branches plant^{-1}, capsule length and test weight of sesamum were not significantly influenced by the timing of nitrogen application (Table 1). Significantly higher seed yield of 1374 kg ha^{-1} was recorded with application of nitrogen in three splits in 25-37.5-37.5 ratio at basal, 20 and 40 DAS. Interaction of dose and application timing of nitrogen was found significant and application of at 100 kg ha^{-1} in 25-37.5-37.5 ratio at basal, 20 and 40 DAS recorded higher seed yield of 1469 kg ha^{-1} (Table 2).

Table 2: Interaction of dose and time of nitrogen on yield of sesame during *rabi*

Nitrogen/ time of application	50-50 (Basal, 30 DAS)	25-75 (Basal, 30 DAS)	25-37.5-37.5 (basal, 20, 40 DAS)	0-50-50 (Basal, 20 40 DAS)	Mean
40	1219	1098	1271	1165	1188
60	1196	1194	1401	1203	1248
80	1304	1228	1355	1356	1310
100	1356	1370	1469	1296	1372
Mean	1268	1222	1374	1255	

SEm± 53; CD (p=0.05) 162 (at same level of A); 52 161 (at same level of B)

4. Conclusion

The number of capsules plant^{-1},number of seeds capsule^{-1} and seed yield was higher with application of 80 kg N ha^{-1} indicating this as an optimum of nitrogen fertilizer and regarding the time of application, and number of splits, application of 80 Kg N ha^{-1} in three splits in the ratio of 25-37.5-37.5 at basal, 20 and 40 days After sowing is recommended for getting higher seed yield in sesamum under irrigated conditions in YSR Kadapa district of Andhra Pradesh.

5. Acknowledgement

The author is thankful to Acharya N.G. Ranga Agricultural University, Lam, Guntur for financial assistance for conducting the trial.

7. References

Ahmad, J., Ahmad, F., Iqbal, S., Shah, S.M.A., Ali, M., Abbas, M.W., Nawaz. H., Mehmood, Z., Ali, B., Ali, S., 2018. Growth and oil yield of sesame as influenced by sulphur and nitrogen. Journal of Agricultural Research 3(7), 000187.

Amin, K., Alireza, S., 2015. The effect of different levels and split application of nitrogen on yield and yield components of sesame plant in Hamidiyeh weather conditions. Indian Journal of Fundamental and Applied Life Sciences 5(2), 34–40.

Auwalu, B.M., Oseni, T.O., Okonkwo, C.A.C., Tenebe, V.A., Pal, U.A., 1995. Influence of some agronomic practices on the growth and yield of vegetable sesame (*Sesamum radiatum*, Schum.). Advances in Horticultural Science 9(1), 33–36.

Babajide, P.A., Oyeleke, O.A., 2014. Evaluation of sesame (*Sesamum indicum*) for optimum nitrogen requirement under usual farmers' practice of basal organic manuring in the Savanna ecoregion of Nigeria. Journal of Natural Sciences Research 4(17), 122–132.

Bedigian, D., Segler, D., Harlan, J.R., 1985. *Sesamin sesamolin* and the origin of sesame. Biochemical Systematics and Ecology 13(2), 133–139.

Damdar, R.R., Bhale, V.M., Deshmukh, K.M., 2015. Yield, growth and quality of summer sesame (*Sesamum indicum* L.) as influenced by irrigation and nitrogen levels. International Journal of Agricultural Sciences 11(2), 301–306.

Elleuch, M., Besbes, S., Roiseux, O., Blecker, C., Attian, H., 2007. Quality characteristics of sesame seeds and by-products. Food Chemistry 103(2), 641–650.

El-Sherif, A., 2016. Sesame (*Sesamum indicum* L.) yield and yield components influenced by nitrogen and foliar micronutrient applications in the Fayoum region, Egypt. Egypt Journal of Agronomy 38(3), 355–367.

Fageria, N.K., Baligar, V.C., 2005. Enhancing nitrogen use efficiency in crop plants. Advances in Agronomy 88, 97–185.

Gebremariam, G., 2015. Growth, yield and yield component of sesame (*Sesamum indicum* L.) as affected by timing of nitrogen application. Journal of Biology, Agriculture and Healthcare 5(5), 165–169.

Jhonson, L.A., Suleiman, T.M., Lusaris, E.W., 1979. Sesame protein: A review and prospectus. Journal of the American Oil Chemists Society 56(3), 463–468.

Kushawala, S., Singh, A.K., Singh, A., Singh, B.K., Minz, S.D., 2022. Effect of different levels of sulphur and nitrogen on growth, yield and quality of sesame (*Sesamum Indicum* L.) under Bael (*Aegle marmelos* L.) based agri-horti system. Ecology Environment and Conservation 28(3), 1404–1410.

Maqsood, M.A., Awan, U.K., Aziz, T., Arshad, H., Ashraf, N., Ali, M., 2016. Nitrogen management in calcareous soils:Problems and solutions. Pakistan Journal of Agricultural Sciences 53(1), 79–95.

Ogundare, S.K., Ayodele, F.G., Oloniruha, J.A., 2015. Effect of time of sowing and urea application rate on the growth and yield of two varieties of sesame (*Sesamum indicum*) in Ejiba Kogi state, Nigeria. Nigerian Journal of Agriculture, Food and Environment 11(4), 118–123.

Patel, H.K., Patel, R.M., Desai, C.K., Patel, H.B., 2014. Response of summer sesamum (*Sesamum indicum* L.) to different spacings and levels of nitrogen under north Gujarat condition. International Journal of Agricultural Sciences 10(1), 336–343.

Ramakrishnan, A., Sundaram, A., Apparao, K., 1994. Influence of fertilization on yield and components of sesame (S*esamum indicum*). Madras Agricultural Journal 81, 696–698.

Rao, V.P., Raikhelkar, S.V., Sondge, V.D., 1994. Effect of irrigation and fertilization on yield and its components in sesame (*Sesamum indicum* L.). Indian Journal of Agricultural Sciences 64(2), 93–100.

Rosolem, C.A., Ritz, K., Canterella, H., Galdos, M.V., Hawkesford, M., Whalley, R., Mooney, S.J., 2017. Enhanced plant rooting and crop system management for improved nitrogen use efficiency. Advances in Agronomy 146, 205–239.

Shilpi, S., Islam, M.N., Sutradhar, G.N.C., Husna, A., Akter, F., 2012. Effect of nitrogen and sulfur on the growth and yield of sesame. International Journal of Bio-resource and Stress Management 3(2), 177–182.

Snehu, H.E., Kwari, J.D., Sandabe, M.K., 2010. Effects of N, P and K fertilizers on yield content and uptake of NPK by sesame. International Journal of Agriculture & Biology 12(6), 845–850.

Tadesse, T., Assfa, H., Liben, M., Tadesse, Z., 2013. Effects of nitrogen split-application on productivity, nitrogen use efficiency and economic benefits of maize production in Ethiopia. International Journal of Agricultural Policy and Research 1(4), 109–115.

Umar, U.A., Mahmud, M., Abubakar, I.U., Babaji, B.U., Idris, U.D., 2012. Effect of nitrogen fertilizer level and intra row spacing on growth and yield of sesame (*Sesamum indicun* L.) varieties. International Journal of Agronomy and Plant Production 3(4), 139–144.

Vaghani, J.J., Polara, K.B., Chovatia, P.K., Thumar, B.V., Parmar, K.B., 2010. Effect of nitrogen, potassium and sulphur on yield, quality and yield attributes of *kharif* sesame (*Sesamum indicum* L.). Asian Journal of Soil Science 5(2), 318–321.

Zeb, A., Jan, A., 2021. Response of sesame (*Sesamum indicum* L.) to sowing methods, nitrogen and sulphur levels. Sarhad Journal of Agriculture 37(1), 278–289.