R. Suvitha *et al*, International Journal of Advances in Agricultural Science and Technology,
Vol.5 Issue.7, July- 2018, pg. 1-9 ISSN: 2348-1358
Impact Factor: 6.057
NAAS Rating: 3.77

# Effect of Plant Geometry and Nutrient Management Practices on Yield and Nutrient uptake of Rainfed Sesame (*Sesamum indicum* L.) under Vertisol Condition

**R. Suvitha[1*], M. Joseph[2], M. Hemalatha[3], G. Bharathi[4]**
[1*,4]PG Scholar
[2]Assistant Professor, Department of Agronomy, AC & RI, Killikulam
[3]Associate Professor, Department of Agronomy, AC & RI, Killikulam
Department of Agronomy, Agricultural College and Research Institute, Killikulam, Thoothukudi District, Tamil Nadu
*Corresponding Author: suvitha59528@gmail.com; 9092238490

***Abstract:*** ***Field experiment was conducted at black soil farm, Agricultural research station, Kovilpatti. The sesamum variety SVPR 1 was sown during rabi season (October – January) to find out suitable plant geometry, levels of fertilizers and foliar spray of mepiquat chloride at 30 DAS, $MnSO_4$ and DAP at flower initiation and capsule formation stage for maximize the yield. The experiment was laid out in randomized block design and three replications. The trial consists of twelve treatments in combination of plant spacing, nutrient levels and foliar nutrition. The results revealed that, rainfed sesame sown with closer plant spacing of 30 × 20 cm coupled with 125 per cent RDF followed by foliar spray of 125 ppm mepiquat chloride at 30 DAS + 0.5 % $MnSO_4$ & 2 % DAP at FIS & CF significantly improved the components viz., economic yield and nutrient uptake. This contributed in producing significantly higher uptake of nutrients (34.0, 5.90 & 26.0 kg NPK $ha^{-1}$), seed (706 kg $ha^{-1}$) and stalk yield (1799 kg $ha^{-1}$) over recommended practice of 30 × 30 cm spacing + 100 % RDF alone.***

***Keywords:*** ***Plant spacing - Nutrition - Nutrient uptake - Rainfed sesame***

## Introduction

Sesamum (*Sesamum indicum* L.) is an ancient oil yielding crop and popularly known as “Queen of Oilseeds”. India ranks first in acreage and production and largest exporter of sesame in the world especially white seeded type which are in great demand. The two important reasons for low yield in our country found to be low fertility status of soil and non-application or devoid of proper nutrient management in crop production practices (Teshhome, 2016). It is widely preferred for its qualities of drought tolerance and oil content in the seeds. Increase in the production of sesame can be achieved by increasing the area, evolving new

 

ISSN: 2348-1358
Impact Factor: 6.057
NAAS Rating: 3.77

technologies which can help to increase the seed and oil yield by approaching the modern crop production technologies particularly include the spacing and nutrient management which increase the number of branches and number of capsules per plant and enhances the production of sesame crop by uptake of nutrients. Hence this study was initiated with the objectives of determining the effect of different plant geometry, fertilizers levels, foliar spray of growth retardant and nutrients on the performance of sesame yield and uptake of nutrients under rainfed conditions.

**Materials and Methods**

The experiment was conducted at the black soil farm of Agricultural Research Station, Kovilpatti during *rabi* season 2017 (November 2017 to January 2018). The soil was clay loam with low in organic carbon (3.4 g), available nitrogen (176 kg $ha^{-1}$), phosphorus (10 kg $ha^{-1}$), high in potassium (365 kg $ha^{-1}$) and available manganese is 2.22 ppm. The mean annual rainfall is 703 mm and the maximum and minimum temperature ranges from 34.9˚C and 22.8˚C, respectively. During the cropping period, the crop received 267.4 mm of rainfall in 11 rainy days and the maximum and minimum temperature ranges from 34.4˚C and 17.6˚C, respectively.

The experiment was laid out in randomized block design with three replication and twelve treatments. The treatment consists of two plant geometry, two different dose of fertilizer and foliar spray of 125 ppm MC at 30 DAS, + 0.5 % $MnSO_4$ + 2 % DAP at flower initiation stage and capsule formation stage. The sesame variety SVPR 1 was chosen for the study. All agronomic operation *viz.*, weed control, hoeing, thinning, plant protection measure and harvesting as well as postharvest operation were made uniformly under all treatments.

 

 ISSN: 2348-1358
Impact Factor: 6.057
NAAS Rating: 3.77

Various observation *viz.*, drymatter production, seed yield, analysis of nutrient uptake was recorded using the formula as below.

$$\text{Nutrient uptake (kg ha}^{-1}) = \frac{\text{Percentage of nutrient content} \times \text{Total DMP (kg ha}^{-1})}{100}$$

**Result and Discussion:**

**Yield of rainfed sesame**

The maximum seed yield (706 kg ha$^{-1}$) recorded in 30 × 20 cm spacing with basal application of 125 % RDF + foliar spraying of 125 ppm Mepiquat Chloride at 30 DAS + 0.5 % $MnSO_4$ & 2 % DAP at flower initiation and capsule formation stage (Table 1). It was 33.14 per cent higher grain yield than the recommended practices of sesame comprising 30 × 30 cm spacing +100% RDF as basal without foliar spray (Fig 1). The higher yield under closer plant geometry might be due to that the greater number of sesame per unit area in narrow distance between hills compensate that reduction in yield attributes of individual plants such as number of capsules plant$^{-1}$,number of seeds capsule$^{-1}$ and test weight. Similar results evidenced by Bakhshandeh (2006), Caliskan *et al*. (2004). Application of N and P fertilizers to sesame increases the drymatter and seed yield which is in the findings of Shehu *et al*., (2010), Schilling and Cattan(1991). Foliar application of 2 % DAP enhanced the seed yield of crop than soil application alone. Application of DAP as foliar spray at FIS and CF along with RDF recorded higher yield than without DAP as foliar spray. This findings is also in accordance with Mahajan *et al*. (2015) and Bhowmick. 2006 .Foliar application of micro nutrients increase the seed yield in rainfed sesame due to irrespective of NPK levels. It might be due to improvement in growth and enhancement in the photosynthetic, metabolic activities

 

 ISSN: 2348-1358
Impact Factor: 6.057
NAAS Rating: 3.77

and translocation of drymatter from source to sink. Similar results were found in Dixit & Elamathi (2007).

Stalk yield of rainfed sesame was also significantly influenced by plant spacing, nutrient levels and foliar spray. Stalk yield is directly proportional to plant population and drymatter accumulation in sesame SVPR 1. Hence, the plant spacing of 30 × 20 cm with application of fertilizer level of 125 per cent $ha^{-1}$ + foliar spraying of 125 ppm Mepiquat Chloride at 30 DAS+0.5 % $MnSO_4$ & 2 % DAP at flower initiation and capsule formation stage recorded more growth and DMP resulted in higher stalk yield (1799 kg $ha^{-1}$) of rainfed sesame which recorded 28.34 % higher stalk yield than the recommended practices. The increased stalk yield might be due to profound increase in plant height, number of branches $plant^{-1}$ with increasing N application results in higher stalk yield. Similar findings support to the results of Shrivastava and Tripathi (1992) and Vaghani (2010).

**Nutrient uptake of rainfed sesame**

Nutrient uptake is a product of nutrient concentration and drymatter accumulation. Optimum plant population, higher NPK levels with foliar spray of nutrients enhanced the uptake of N, P and K. Better nutrient uptake improved the vegetative growth as indicated by higher drymatter accumulation, resulting in greater DMP under maximum plant population with high dose of fertilizers and foliar nutrition than minimum plant population with RDF and either with or without foliar nutrition.

Rainfed sesame sown at 30 × 20 cm spacing with basal application of 125 % RDF +foliar spraying of 125 ppm Mepiquat Chloride at 30 DAS + 0.5 % $MnSO_4$ & 2 % DAP at flower initiation and capsule formation stage enhanced the higher NPK uptake (34.0, 5.90 & 26.0 kg NPK $ha^{-1}$) than the 100 per cent NPK alone (Table 2). The nutrient removal by

 

ISSN: 2348-1358
Impact Factor: 6.057
NAAS Rating: 3.77

sesame crop under 100 per cent NPK with foliar nutrition was proved similar uptake pattern as in case of 125 per cent NPK alone under both the plant spacing (Fig 2). Nutrient uptake by rainfed sesame also had a pronounced effect due to foliar nutrition. The reason for higher nutrient removal by the sesame might be due to the accessibility of nutrients is higher under application of higher dose of NPK along with two rounds of foliar nutrients containing major and micro nutrients providing a balanced nutrient supply. On the other hand, nutrient availability was the limiting factor under other treatments without foliar nutrition resulted in lower uptake of NPK by sesame crop. Earlier Singaravel *et al.* (2002) had also reported that application of higher RDF along with foliar nutrition exhibited higher uptake of NPK in crop over other treatments. Similar trends also observed in plant Mn uptake duo to different plant spacing, levels of NPK and foliar nutrition treatments in rainfed sesame.

**Conclusion:**

It was concluded that sowing of moderately branched SVPR 1 sesame at 30 × 20 cm spacing with application of 125 % RDF as basal + foliar spray 125 ppm Mepiquat Chloride at 30 DAS+0.5 % MnSO4 & 2 % DAP at flower initiation and capsule formation stage is the viable package for uptake of nutrients and getting higher yield under rainfed condition.

# References:

[1]. Bakhshandeh, A. (2010). Determination of Optimum Row-Spacing and Plant Density for Uni-branched Sesame in Khuzestan Province. *Journal of Agricultural Science and Technology*, 8, 25-33.
[2]. Bhowmick, M. (2006). Foliar nutrition and basal fertilization in chickpea under rainfed condition. *Environment and Ecology*, 24(4), 1028.
[3]. Caliskan, S., Arslan, M., Arioglu, H., & 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 J. Plant Sci*, 3(5), 610-613.

 

ISSN: 2348-1358
Impact Factor: 6.057
NAAS Rating: 3.77

[4]. Dixit, P. M., & Elamathi, S. (2007). Effect of foliar application of DAP, micronutrients and NAA on growth and yield of green gram (*Vigna radiata* L.). *Legume Res*, 30(4), 305-307.
[5]. Mahajan, A., Bhagat, R., & Gupta, R. (2008). Integrated nutrient management in sustainable rice-wheat cropping system for food security in India. *SAARC Journal of Agriculture*, 6(2), 29-32.
[6]. Schilling, R., & Cattan, P. (1991). Sesame cultivation in tropical Africa. *Oleagineux*, 46(3), 125-128.
[7]. Shehu, H., Kwari, J., & Sandabe, M. (2010). Effects of N, P and K fertilizers on yield, content and uptake of N, P and K by sesame (*Sesamum indicum)*. *International Journal of Agriculture and Biology*, 12(6), 845-850.
[8]. Shrivastava, G., & Tripathi, R. (1992). Effect of irrigation, mulch and nitrogen levels on growth and yield of summer sesame (*Sesamum indicum*), *Indian J. Agron.*, 37, pp. 602-604.
[9]. Singaravel, R., Imayavaramban, V., Thanunathan, K., & Shanmughapriya, V. (2002). Effect of micronutrients on yield and nutrient uptake of sesame (*Sesamum indicum* L.) in a vertisol soil. *Sesame and safflower Newsletter* (17), 46-48.
[10]. Teshome, T. (2016). Effects of Nitrogen, phosphorous (inorganic fertilizers) and Farm Yard Manure on growth, yield, yield components and oil contents of Sesame ( *Sesamum indicum* L.) at Assosa district, Beneshangul Gumuze Region, Ethiopia. *Nature and Science*, 14(12), 19-28.
[11]. Vaghani, J. (2010). Nitrogen, potassium and sulphur requirement for targeted yield of *kharif* sesame. Ph.D. Thesis, JAU., Junagdh.

**Table 1. Effect of planting geometry, soil and foliar nutrition on Seed and Stalk yield (kg ha$^{-1}$) of rainfed sesame**

| Treatments | | | Seed yield (kg ha$^{-1}$) | Stalk yield (kg ha$^{-1}$) |
|---|---|---|---|---|
| $T_1$ | 30 × 30 cm spacing | 100 % RDF alone | 472 | 1289 |
| $T_2$ | | 100 % RDF + FS 125 ppm MC at 30 DAS + 0.5 % $MnSO_4$ at FIS & CF | 498 | 1355 |
| $T_3$ | | 100 % RDF + FS 125 ppm MC at 30 DAS + 0.5 % $MnSO_4$ + 2 % DAP at FIS & CF | 547 | 1444 |
| $T_4$ | | 125 % RDF alone | 524 | 1415 |
| $T_5$ | | 125 % RDF + FS 125 ppm MC at 30 DAS + 0.5 % $MnSO_4$ at FIS & CF | 558 | 1462 |

 

ISSN: 2348-1358
Impact Factor: 6.057
NAAS Rating: 3.77

| | | | | |
|---|---|---|---|---|
| $T_6$ | | 125 % RDF + FS 125 ppm MC at 30 DAS + 0.5 % $MnSO_4$ + 2 % DAP at FIS & CF | 598 | 1549 |
| $T_7$ | 30 × 20 cm spacing | 100 % RDF alone | 535 | 1434 |
| $T_8$ | | 100 % RDF + FS 125 ppm MC at 30 DAS + 0.5% $MnSO_4$ at FIS & CF | 585 | 1539 |
| $T_9$ | | 100 % RDF + FS 125 ppm MC at 30 DAS + 0.5 % $MnSO_4$+ 2 % DAP at FIS & CF | 620 | 1618 |
| $T_{10}$ | | 125 % RDF alone | 605 | 1609 |
| $T_{11}$ | | 125 % RDF + FS 125 ppm MC at 30 DAS + 0.5% $MnSO_4$ at FIS & CF | 651 | 1691 |
| $T_{12}$ | | 125 % RDF + FS 125 ppm MC at 30 DAS + 0.5 % $MnSO_4$+ 2 % DAP at FIS & CF | 706 | 1799 |
| SEd | | | 19.28 | 49.66 |
| CD (p = 0.05) | | | 40.05 | 103.00 |

**Table 2. Effect of planting geometry, soil and foliar nutrition on plant N, P and K uptake (kg $ha^{-1}$)of rainfed sesame**

| Treatments | | | Nutrient uptake (kg $ha^{-1}$) | | | Micro nutrient uptake |
|---|---|---|---|---|---|---|
| | | | N | P | K | Mn (g $ha^{-1}$) |
| $T_1$ | 30 × 30 cm spacing | 100 % RDF alone | 20.4 | 4.08 | 18.3 | 160.3 |
| $T_2$ | | 100% RDF + FS 125 ppm MC at 30 DAS + 0.5% $MnSO_4$ at FIS & CF | 23.0 | 4.29 | 19.2 | 238.4 |
| $T_3$ | | 100 % RDF+FS 125 ppm MC at 30 DAS + 0.5 % $MnSO_4$+ 2 % DAP at FIS & CF | 26.1 | 4.55 | 20.2 | 253.2 |
| $T_4$ | | 125 % RDF alone | 24.3 | 4.42 | 19.6 | 168.5 |

 

ISSN: 2348-1358
Impact Factor: 6.057
NAAS Rating: 3.77

| | | | | | | |
|---|---|---|---|---|---|---|
| $T_5$ | | 125 % RDF + FS 125 ppm MC at 30 DAS + 0.5% $MnSO_4$ at FIS & CF | 27.0 | 4.82 | 21.7 | 289.3 |
| $T_6$ | | 125% RDF+ FS 125 ppm MC at 30 DAS + 0.5 % $MnSO_4$+ 2 % DAP at FIS & CF | 28.4 | 5.14 | 22.1 | 310.7 |
| $T_7$ | 30 × 20 cm spacing | 100% RDF alone | 25.4 | 4.46 | 20.1 | 165.4 |
| $T_8$ | | 100% RDF + FS 125 ppm MC at 30 DAS + 0.5% $MnSO_4$ at FIS & CF | 27.6 | 5.00 | 21.9 | 265.5 |
| $T_9$ | | 100% RDF+ FS 125 ppm MC at 30 DAS + 0.5 % $MnSO_4$+ 2 % DAP at FIS & CF | 30.0 | 5.25 | 23.2 | 329.9 |
| $T_{10}$ | | 125% RDF alone | 28.8 | 5.19 | 22.9 | 170.3 |
| $T_{11}$ | | 125% RDF + FS 125 ppm MC at 30 DAS + 0.5% $MnSO_4$ at FIS & CF | 31.4 | 5.27 | 24.3 | 352.2 |
| $T_{12}$ | | 125% RDF+ FS 125 ppm MC at 30 DAS + 0.5 % $MnSO_4$+ 2 % DAP at FIS & CF | 34.0 | 5.90 | 26.0 | 360.5 |
| SEd | | | 0.81 | 0.04 | 0.60 | 7.6 |
| CD (p = 0.05) | | | 1.72 | 0.10 | 1.40 | 16.0 |

 

ISSN: 2348-1358
Impact Factor: 6.057
NAAS Rating: 3.77

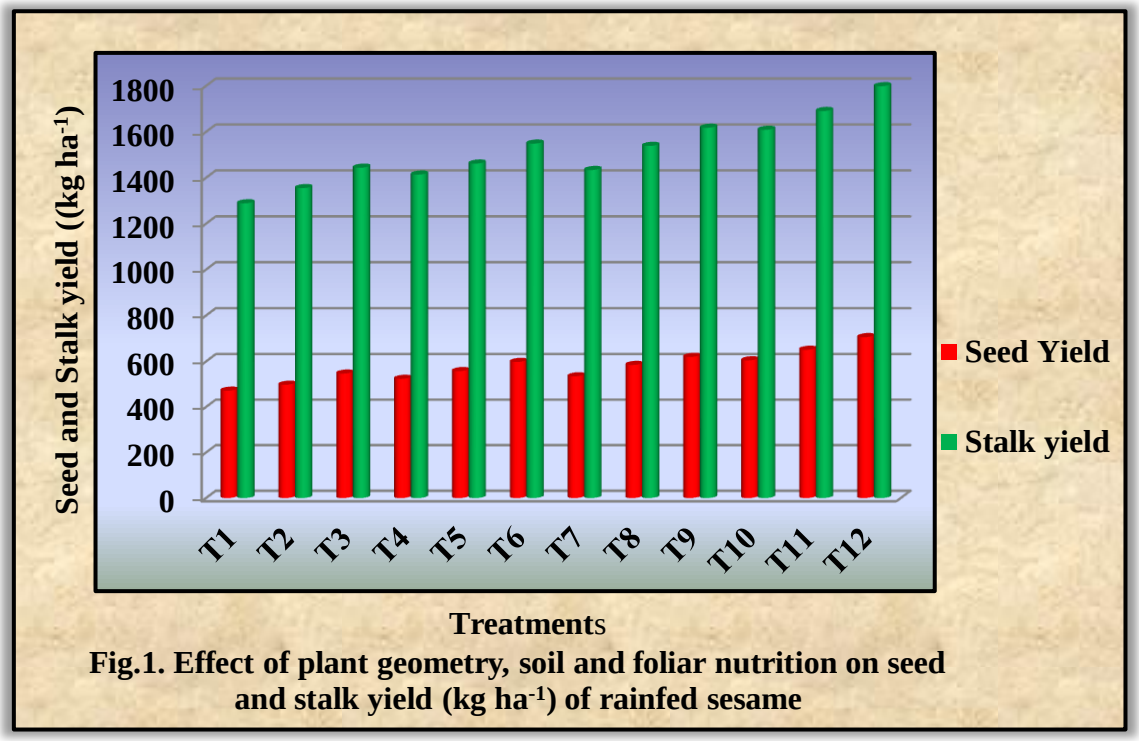


**Fig.1. Effect of plant geometry, soil and foliar nutrition on seed and stalk yield (kg ha$^{-1}$) of rainfed sesame**

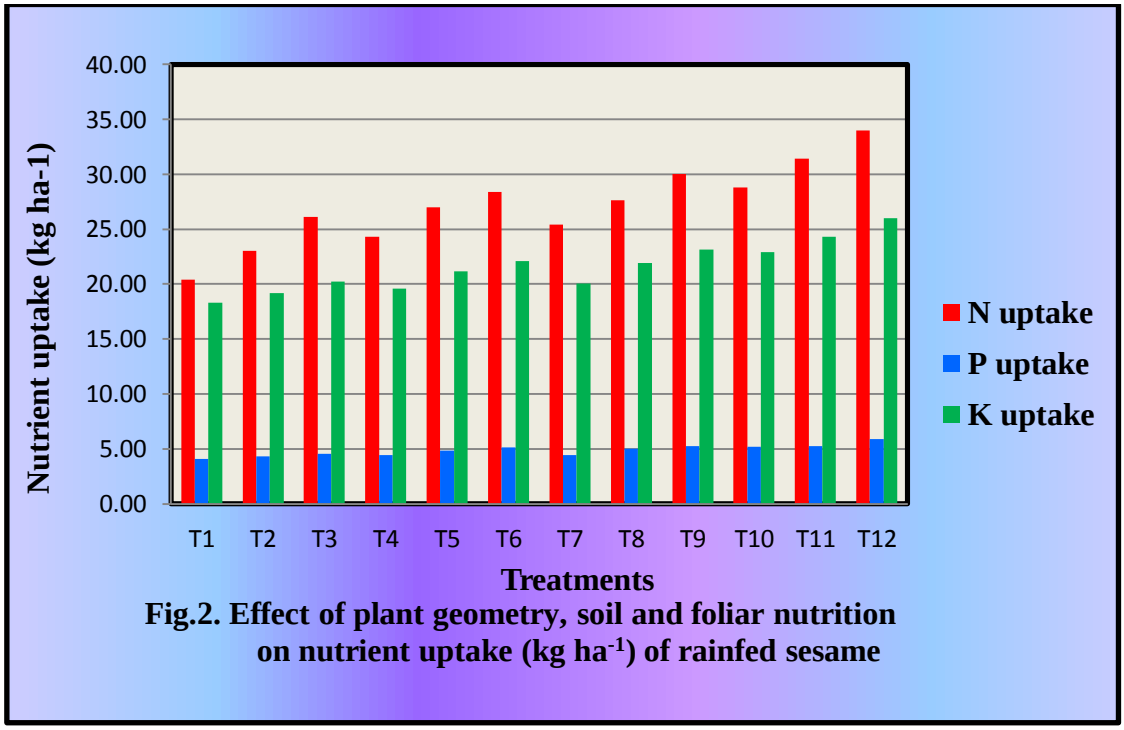


**Fig.2. Effect of plant geometry, soil and foliar nutrition on nutrient uptake (kg ha$^{-1}$) of rainfed sesame**

 