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# Effect of Vermicompost and moisture conservation practices on growth parameters, yield attributes and yield of sesame

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## Abstract
A field experiment was conducted during *kharif* season of 2016 at S.K.N. College of Agriculture, Jobner to study the "Effect of vermicompost and moisture conservation practices on growth parameters, yield attributes and yield of sesame. The experiment comprising of four levels of vermicompost (Control, 1.5, 3.0 and 4.5 t/ha) and four moisture conservation practices (control, dust mulch, straw mulch and plastic mulch), thereby making 16 treatment combinations was laid out in factorial randomized block design and replicated thrice. The increasing levels of vermicompost up to @ 3.0 t/ha significantly increased the plant height at harvest, dry matter accumulation/plant at 30, 60 DAS and at harvest, number of branches/plant at 60 DAS at harvest, chlorophyll content at 40 DAS, crop growth rate and relative growth rate as compared to preceding levels but remained at par with vermicompost @ 4.5 t/ha. Significantly higher number of capsules/plant (30.3), seeds/capsule (45.2), test weight (2.67g) and seed (834 kg/ha) and straw yields (2073 kg/ha) of sesame were observed with application of vermicompost @ 3.0 t/ha but remained at par with vermicompost @ 4.5 t/ha. The significantly higher plant height, number of branches per plant and dry matter accumulation per metre row length were recorded with application of straw mulch. Applications of straw mulch also recorded significantly higher number of capsules per plant over control and dust mulch whereas; number of seeds per capsule was significantly higher with straw mulch. In respect of the effect of straw, plastic and dust mulch application being at par among each other gave significantly higher seeds per capsule of sesame.

**Keywords:** Moisture conservation practices, Mulch, Sesame and Vermicompost

## Introduction
India is one of the four major players in the global oilseeds/vegetable oils scenario, being one of the important oilseed grower, producer, importer, and exporter (De and Sinha, 2011) [4]. Sesame is the key edible oilseed crop in India and cultivated on 15.98 lakh hectares with production of 8.20 lakh tonnes (Anonymous, 2014-15a) [2]. This crop is having high quality of oil and meal and also sows wide adaptability for varied agro-climatic conditions. Due to soil and climatic adversities in rainfed ecosystems, the crop suffers from several biotic and abiotic stresses, particularly moisture stress and multi-nutrients deficiency, resulting in poor and unpredictable crop yields. Vermicompost is a prime source of macro and micro nutrients in chelated form and fulfills the balanced nutrient requirement of crops for longer period. Besides this, it also helps in maintaining soil fertility and precious eco-friendly environment of the soil. Organic mulch has been found to increase the nutrient content of soil following decomposition and mineralization, hence, can increase the vegetative growth of plants, which ultimately results in high yield (Singh *et al*., 2007; Ahamefule and Peter, 2014) [8, 1] attributable to the reduction in soil temperature and improved moisture holding capacity of the soil (Lal, 1974) [5]. Looking to the above facts, an experiment entitled "Effect of vermicompost and moisture conservation practices on growth parameters, yield attributes and yield of sesame'' was under taken.

## Metarials and methods
A field experiment was conducted at experimental farm of Department of Agronomy, S.K.N. College of Agriculture, Jobner (Rajasthan) during *Kharif* season of 2016. The field had an even topography and good drainage system. Soil of the experimental site was loamy sand in texture, poor in organic carbon content, available N as well as S and medium in available P and K. Soil was slightly alkaline in reaction with pH 8.2. The total rainfall received during crop growing period (*Kharif,* 2016) was 353 mm.

The experiment was conducted in fixed layout of factorial RBD, replicated thrice. The field experiment comprised of four levels of vermicompost viz. 0, 1.5, 3 and 4.5 tonne/ha and four levels of moisture conservation practices viz. control, dust mulch, straw mulch and plastic mulch. Sesame variety 'RT-346' was sown manually in rows spaced 30 cm apart at a depth of 3 cm following the seed rate of 4kg seed/ha. The seed was treated with bavistin @ 2 g/kg to protect it from the seed and soil borne diseases. Vermicompost (composition N-1.8-2.5, P-1.0 and K-1.5) was applied as per treatment at the time of sowing and was thoroughly incorporated in soil with the help of spade. Dust mulching was done twice at 20 and 55 DAS manually by hoeing with the help of *khassi*. Strip of 30 cm wide and 4 metre long black plastic was placed in between the rows 20 DAS in the ear marked plots and their corners were put under bund of the bed. Similarly, straw mulch of mustard @ 5 t/ha was applied at 20 DAS. One weeding cum hoeing was done manually at 25 DAS to facilitate aeration and removal of weeds. One irrigation was given at capsule development stage. Dusting of methyl parathion 2% @ 25 kg/ha was done to protect the crop from damage of sucking insects. Growth parameters, yield attributes and other biometrics observations were undertaken periodically as per requirements for validation of findings. The chlorophyll content of sesame was estimated by the method advocated by Arnon (1949) [3]. The leaf sample was ground in 80% acetone, centrifuged for 10 minutes at 2000 rpm and made final volume to 10 ml. The resultant absorbance of clear supernatant was measured by spectronic 20 at 652 nm and presented in terms of mg/g fresh weight of leaves.

$$\text{Total chlorophyll (mg/g)} = \frac{A_{(652)} \text{ X } 29 \text{ X Total volume (ml)}}{\alpha \text{X } 1000 \text{ X Weight of sample (gm)}}$$

Where, α is the path length = 1 cm

To assess the relationship, correlation and regression coefficients between seed yield of sesame and the independent variables i.e. yield attributes were computed using the method given by Snedecor and Cochran (1968). The regression equations were also fitted and tested for significance. The experimental data recorded for growth yield attributes and yield were statistically analysed by Fisher's 'Analysis of Variance' technique (Fisher, 1950).

## Result and discussion

### Effect of vermicompost

Application of vermicompost was found to cause significant improvement in growth attributes. Application of vermicompost @ 4 t/ha recorded the tallest plant height, higher dry matter accumulation at 30, 60 DAS and at harvest, higher number of branches 60 DAS and harvest, crop growth rate at 30-60 DAS and 60 DAS to at harvest, relative growth rate at 30-60 DAS and 60 DAS to at harvest, total chlorophyll content at 40 DAS, remained at par with @4.5 t/ha. It is established fact that vermicompost improve the physical and biological properties of soil including supply of almost all that essential plant nutrients for the growth and development of the plant. Thus balanced nutrition under favourable environment might have helped in production of new tissues and development and ultimately increased the plant height, dry matter accumulation and chlorophyll content. The improvement brought about in the growth parameters namely plant height, branches/plant and dry matter accumulation concomitant with CGR under @3.0 t vermicompost/ha led to improved sources and sink relationship with greater translocation of photosynthates towards reproductive organs and increased capsules/plant, seeds/capsuls and test weight (table 2), remained at par with @ 4t vermicompost/ha. The beneficial effect of vermicompost on these parameters might be due to it is contribution in supplying additional plant nutrient and increasing solubility of native soil nutrients. The another reason could be efficient and greater partitioning of metabolites and adequate transformation of nutrients to developing plant structures. As a result, almost all yield attributes of crop resulted in significant improvement due to vermicompost application. Application of vermicompost @ 3.0 t/ha enhanced the seed yield and straw yield (table 2) significantly over control and @1.5 t/ha but remained at par with @4.5 t/ha. The significant increase in seed yield under the influence of vermicompost was largely a function of improved growth and consequently increase in different yield attributes. Humic acid present in vermicompost enhance the availability of both native and added micronutrients in soil and thus plant growth, yield attributes and ultimatly yield increased.

### Effect of moisture conservation practices

Plant height, dry matter accumulation/metre row length, number branches and chlorophyll content of leaves (Table1) showed a significant improvement to sesame crop due to mulching treatments. Further, the straw mulch caused a significant increase in these growth components over dust mulch, plastic mulch and control. It is obvious that mulching leads to better plant growth by changing the micro-climate by conserving more moisture through reducing evaporation, altering soil temperature, controlling weeds and thus, economizing the use of irrigation water. Moreover, adequate presence of moisture to plants results in full cell turgidity and eventually higher meristematic activity, leading to more foliage development, greater photosynthetic rate and consequently better plant growth. The greater effectiveness of straw mulch in increasing the growth components is due to the fact that straw mulch attributed to adding nutrients through decomposition of stover and by suppressing weed growth, hence, depletion of nutrient and moisture is checked, thereby, making more moisture and nutrients available to crop plants. Similar findings were also obtained by Saren *et al.* (2008) [6] in niger.

The notable improvement in number of capsules/plant and number of seeds/capsule was obtained due to mulching practices. The significantly higher values of yield attributes were registered under straw mulch followed by plastic mulch and dust mulch (Table 2). Thus, the improvement in yield attributes of sesame under mulching practices could be ascribed to better availability of moisture and moderation of soil temperature which led to greater uptake of nutrients and reduced number of days taken to meet the required heat units for proper growth and development of plants and ultimately the yield attributes. Plastic mulch also proved superior to dust and no mulch (control) for yield attributes of sesame crop. Increase in yield attributes under plastic mulch is due to the fact that it leads to better moisture availability by reducing the water loss through evaporation process and by suppressing weed growth by depriving the germinating weeds.

Seed yield, stover yield and biological yield increased significantly due to mulching practices over no mulch (Table 2). The significant increase in seed yield under the influence of mulching was largely a function of improved growth and consequent increase in different yield attributes as mentioned above. The beneficial effect of organic mulch on seed yield might be due to favourable soil moisture regime and its better utilization in production of large number of seeds possibly by reducing floral abortion, maintenance of a steady flux of assimilates during grain filling, reducing the rate of leaf senescence and maintenance of photosynthetic activity of surviving leaves and enhanced remobilization of pre anthesis assimilates to seed during seed filling. Extended period of moisture availability and lower weed incidence due to organic mulch resulted in a higher dry matter accumulation and thereby, higher stover and biological yield. Similar findings were reported by Sekhon *et al*. (2005) [7] in soybean.

### Correlation and regression studies

The results of correlation coefficients indicated that seed yield was significantly and positively correlated with number of capsules/plant (r = 0.950), number of seeds/capsule (r = 0.970) and test weight (r = 0.978). Linear relationship appeared to exist between seed yield and independent variables. The regression equations (Table 4.3) showed that every unit increase in number of capsules/plant, number of seeds/capsule and test weight increased the seed yield by 25.74, 18.29, 316.7 kg/ha, respectively.

On the basis of one year experimentation, it may be concluded that application of vermicompost @ 3.0 t/ha along with use of straw mulch proved to be the superior treatment in dependently with regard to seed yield and net returns of sesame.

**Table 1:** Effect of vermicompost and moisture conservation practices on growth parameters of sesame.

| Teatment | Plant stand $m^{-1}$ row length 20 DAS | | Plant height at harvest (cm) | Branches per plant at harvest | Chlorophyll content (mg/g) | Dry matter accumulation (g/m row length) | | | CGR ($g/m^2$/day) | | RGR (mg/g/day) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 20 DAS | At harvest | | | | 30 DAS | 60 DAS | At harvest | 30 - 60 DAS harvest | 60-DAS – at harvest | 30 - 60 DAS | 60 DAS - at harvest |
| Vermicompost (t/ha) | | | | | | | | | | | | |
| Control | 9.60 | 8.70 | 92.4 | 2.70 | 3.52 | 12.2 | 83.4 | 99.2 | 2.37 | 0.53 | 64.09 | 5.74 |
| 1.5 | 9.70 | 8.95 | 101.0 | 3.10 | 3.69 | 13.9 | 93.7 | 116.3 | 2.66 | 0.75 | 63.62 | 7.16 |
| 3.0 | 9.80 | 9.30 | 105.4 | 3.27 | 3.82 | 14.9 | 102.3 | 126.9 | 2.91 | 0.82 | 64.23 | 7.14 |
| 4.5 | 9.90 | 9.50 | 108.5 | 3.29 | 3.94 | 15.5 | 107.1 | 130.2 | 3.05 | 0.77 | 64.45 | 6.47 |
| SEm± | 0.26 | 0.24 | 2.7 | 0.08 | 0.11 | 0.4 | 2.8 | 3.4 | 0.08 | 0.02 | 1.78 | 0.18 |
| Cd (P = 0.05) | NS | NS | 7.8 | 0.24 | 0.31 | 1.8 | 8.0 | 9.8 | 0.23 | 0.06 | NS | 0.53 |
| Moisture conservation practices | | | | | | | | | | | | |
| Control | 9.35 | 8.76 | 93.6 | 2.80 | 3.52 | 12.5 | 86.8 | 102.5 | 2.48 | 0.52 | 64.58 | 5.51 |
| Dust mulch | 9.55 | 8.96 | 101.1 | 3.06 | 3.72 | 13.9 | 93.7 | 116.5 | 2.66 | 0.76 | 63.59 | 7.23 |
| Straw mulch | 10.15 | 9.46 | 110.1 | 3.31 | 3.97 | 15.6 | 105.6 | 130.7 | 3.00 | 0.84 | 63.73 | 7.07 |
| Plastic mulch | 9.95 | 9.26 | 102.5 | 3.19 | 3.77 | 14.5 | 100.4 | 122.9 | 2.86 | 0.75 | 64.49 | 6.71 |
| SEm± | 0.26 | 0.24 | 2.7 | 0.08 | 0.11 | 0.4 | 2.8 | 3.4 | 0.08 | 0.02 | 1.78 | 0.18 |
| Cd (P = 0.05) | NS | NS | 7.8 | 0.24 | 0.31 | 1.8 | 8.0 | 9.8 | 0.23 | 0.06 | NS | 0.53 |

**Table 2:** Effect of vermicompost and moisture conservation practices on yield attributes and yields of sesame

| Treatment | Capsules/ plant | Seeds/ capsule | Test weight (g) | Seed yield (kg/ha) | Stalk yield (kg/ha) | Harvest Index (%) |
|---|---|---|---|---|---|---|
| Vermicompost (t/ha) | | | | | | |
| Control | 21.9 | 38.4 | 2.15 | 557 | 1514 | 26.9 |
| 1.5 | 27.2 | 42.8 | 2.47 | 712 | 1784 | 28.5 |
| 3.0 | 30.3 | 45.2 | 2.67 | 834 | 2073 | 28.7 |
| 4.5 | 31.8 | 46.4 | 2.73 | 912 | 2264 | 28.7 |
| SEm± | 0.75 | 1.6 | 0.07 | 28 | 66 | 0.7 |
| Cd (P = 0.05) | 2.2 | 3.3 | 0.19 | 81 | 192 | NS |
| Moisture conservation practices | | | | | | |
| Control | 25.6 | 38.4 | 2.27 | 655 | 1697 | 27.8 |
| Dust mulch | 29.0 | 43.1 | 2.54 | 760 | 1916 | 28.3 |
| Straw mulch | 33.5 | 46.4 | 2.58 | 810 | 2022 | 28.5 |
| Plastic mulch | 23.1 | 45.0 | 2.63 | 790 | 2000 | 28.2 |
| SEm± | 0.75 | 1.2 | 0.07 | 28 | 66 | 0.7 |
| Cd (P = 0.05) | 2.2 | 3.3 | 0.19 | 81 | 192 | NS |

**Table 3:** Correlation coefficient and linear regression equations showing relationship between independent variables (yield attributes and dependent variable (seed yield)

| Dependent variable (y) | Independent variables (x) | Correlation coefficient (r) | Regression equations (y=a+bx) |
|---|---|---|---|
| Seed yield | | | |
| | Capsules/plant | 0.950** | $Y= 32.061+25.74X_1$ |
| | Seeds/capsule | 0.970** | $Y= -30.899+18.29X_2$ |
| | Test weight | 0.978** | $Y= -33.489+316.77X_3$ |

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