**Effect of Foliar Application of Different Organic Liquid Formulation on Growth of Black Sesame (*Sesamum indicum* L.)**

**Abstract**

A present investigation was carried out during the *Kharif Season* of 2024 at Himalayan University farm, Jollang, Itanagar, to determine the response of Jeevamrut fertilizer on growth of black sesame (*Sesamum indicum* L.) The experiment was outlined in a Randomized Block Design (RBD) with nine treatments and three replication. The treatment included combination jeevamrut and Panchgavy. The study recorded significance difference among treatments in terms of plant height, leaf length, and number of leaf, dry weight and fresh weight of plant at 30, 60 and 90 DAS. The result revealed that the treatment T4 (Foliar Spray Jeevamrut @ 2.5% + Foliar Spray Panchgavya @ 5% ) was found to be best treatment for obtaining maximum plant height, leaf length, number of leaf , dry weight and fresh weight , this indicating the combined effect of jeevamrut fertilizer on black sesame .

Keywords: Jeevamrut, Panchagavya, Black Sesame, Randomized block design (RBD).

1. **Introduction**

Sesame (*Sesamum indicum* L.) is an annual flowering plant that belongs to the family Pedaliaceae and one of the earliest crops cultivated in the ancient times world( Augstburger *et al.,* 2000).The second era in sesame research (2000–2013) was characterized first, by the employment of classical breeding methods including induced mutation and screening of genotype for desirable characters (Wongyai et *al*., 2001).Sesame seeds are rich in essential components; including oil (comprising 44–58% of the seed), protein (18–25%), carbohydrates (11–13.5%), and ash content (approximately 5%) (Kang, 2003) the use of natural diet and herbs has become very popular in recent decades due to tendency for the consumption of toxin-free food with minimal adverse effect (Kelly et *al*., 2005). Lignans play an important role in protecting the sesame plant against pests in the form of powerful antioxidants and insecticides (Jeng & Hou, 2005).

It has been an important oil seed crop for centuries and is often referred to as the "Queen of Oilseeds" (Nayar, 1984). Sesame is cultivated extensively in various regions worldwide, mostly in tropical and subtropical areas particularly in Asia and Africa (Wen-Huey, 2007).Furthermore, sesame is often grown in harsh environments and exposed to various biotic and abiotic stresses that heavily impair its productivity (Witcombe et *al*., 2007). The availability of molecular markers has paved the way for several genetic diversity studies in sesame. Knowledge on the genetic diversity and population structure of germplasm collections is an important foundation for crop improvement and a key component of effective conservation and breeding strategies (Thomson et *al*., 2007).Studies on unsaturated fatty acids by various researchers suggest that Indian sesame germplasm has high genetic variability with respect to fatty acid composition (Uzun *et al.,* 2008).

Despite of being such an important sesame growing state, the average productivity of sesame in Rajasthan is very low in comparison to global as well as national. Cultivation of crop on marginal and sub-marginal lands of poor fertility under rain fed condition, low rainfall, poor agronomic practices and inadequate or even no use of fertilizers are the major factors responsible for low productivity. Sulphur is important for the health and structure of soil, helping to maintain its pH and fertility (Jamal et *al*., 2010).

Sesame oil is antibacterial, antiviral, antifungal and antioxidant. The antioxidants make the oil very resistant to oxidative rancidity and are known for its stability and quality. The high levels of unsaturated (UFA) and polyunsaturated fatty acids (PUFAs) also increase the quality of the oil for human consumption (Nupur et *al*., 2010).The oil possesses high stability to oxidation due to the presence of antioxidants such as sesamol, sesamolin and sesamin) and tocopherols (Sabah, 2008).Sesame helps to prevent a number of diseases such as hypertension, hypercholesterolemia, cancer, and aging (Kanu et *al*., 2010).Sesame is primarily grown for its oil-bearing seed. Beside the high oil content, sesame seeds contain almost 18% proteins and among the fatty acid compositions, oleic acid (39.6%) and linoleic acid (46%) are the two main components with the ideal ratio of almost 1:1 (Anilakumar et *al*., 2010). Matka Khad is prepared by mixing of cow urine with cow dung, jaggery and water in a certain proportion. Matka khad is used in agricultural crops as an organic product to supply growth stimulators and various nutrients which result in higher growth and yield. Matka khad includes a higher count of azotobacter, actinomycetes and phosphate solubilizers as per its microbial analysis (Chadha et *al*., 2012).

The introgression of useful genes from wild species into cultivars via conventional breeding has not been so far successful in sesame mainly due to post-fertilization barriers (Tiwari et *al*., 2011).Timely harvesting ensures optimum quality and consumer acceptance. The harvesting of the sesame must be done at its physiological maturity, for delayed harvesting may result in shattering of seeds. The physiological maturity is ascertained when the following changes are observed: the lower most capsule turned brown and began to pop open, the stem turned yellow, the leaves started falling-off, blossoming has finished and leaves turned yellow. Uniform maturity is an important genotypic feature that not only minimizes harvesting cost but also the yield losses. Sesame is generally harvested by hand, dried in field and threshed and cleaned manually (Ranganatha *et al.,* 2011).Germplasm collection, characterization and conservation, huge genetic materials of cultivated sesame along with wild related species are currently preserved in several around the world mainly in Asia (Zhang Y. et *al*., 2012)

The application of organic nutrients or growth regulators to seeds or roots is one alternative. These substances may support plant growth or provide disease control via a number of ways, such as the provision of organic nutrients or the creation of plant hormones. The panchgavya is a potent stimulator of plant development that raises the biological effectiveness of crops. In order to protect plants from diseases and to improve the nutritional value of fruits and vegetables, it is used to stimulate soil and soil microorganisms. Role of foliar application or seed soaking of panchgavya in production of many plantation crops had been well documented in India. Other findings reported that liquid manure (25% herbal based kunapajala) may be an eco-friendly technique that can be used to improve seed quality and biochemical activities of wheat seeds (Devi et *al*., 2023).

The foliar application of several liquid manures improved N, P and S content in the seed and stalk as well as their overall uptake in sesame. According to the data in the Table 1 matka khad and control treatments were not as effective at enhancing the N, P and S contents of sesame seeds and stalks as panchgavya when applied topically. However, effect of vermiwash was statistically equal to panchgavya in terms of nitrogen and sulphur content in seed and stalk and phosphorus content in seed. Four nitrogen atoms are bonded in each chlorophyll structure, which is a component of the nitrogen content in leaves (Devi et *al*., 2024).

1. **MATERIALS AND MEHTODS**

The experiment was carried out at agriculture field, Jollang, college of agriculture, Himalayan University, during the period of Kharif season. On 6th July 2024. The experimental farm is situated at 27.074684, N latitude and 93.652878 E longitude with an average elevation of 320 meters. It was undertaken with the objective to analyze the different Sesame verities and to assess their performance in Kharif season.

The Treatment Include, T1- Control, T2- Foliar Spray Panchgavya @ 2.5%, T3- Foliar Spray Panchgavya @ 5% , T4- Foliar Spray Jeevamrut @ 2.5% T5- Foliar Spray Jeevamrut @ 5%, T6- Foliar Spray Vermiwash @ 2.5% , T7- Foliar Spray Vermiwash @ 5% , T8 - Foliar Spray Liquid Bio-Fertilizer @ 2.5% , T9 - Foliar Spray Liquid Bio-Fertilizer @ 5%. The experiment was carried out in Random Block Design (RBD) in the year 2024-2025

**2.1 Weather and Climate**

The climate condition of Itanagar is humid subtropical climate with distinct season. the rainy season usually starts from May and it extends up to September and from October onwards. The meteorological data of weather parameter. temperature, rainfall, relative humidity and sunshine hours recorded during the period of experimentation from July to November during the year 2024-2025 were obtained from meteorological observatory, for the period of the experimentation have been presented in the table. The mean minimum and maximum temperature recorded during the cropping season was 22.3 °C and 27.6 "C, respectively. The average relative humidity

**Figure 1. Meterological data of weather parameters and total rainfall during the cropping season (*Kharif* 2024-2025)**

**2.2 Crop growth parameters**

**Plant height**

Plant height was taken in cm from the growth level to the tip of the plant from randomly selected 3 three plants in each individual plot and these plants were tagged for subsequent observation. A total of 3 (three) observation 30DAS, 60DAS and 90 DAS were recorded from the same plants in each plot and the average height of plant in each treatment was worked out for each observation.

**Number of leaves per plant**

The total number of leaves per plant was recorded 30DAS, 60DAS and 90 DAS and average number of each leaf per plant was calculated.

**Leaves length**

Leaves length was taken in cm from the growth level to the of the plant from randomly selected 3 three plants in each individual plot and these plants were tagged for subsequent observation. A total of 3 (three) observation 30DAS, 60DAS and 90 DAS were recorded from the same plants in each plot and the average height of plant in each treatment was worked out for each observation.

**Dry Weight**

The dry weight of a plant is the weight of the plant after all its water content has been removed. This is typically done by drying the plant material at temperatures higher than ambient temperature until all moisture is evaporated.

1. **RESULTS AND DISCUSSIONS**

The growth and development parameters of black Sesame were recorded under a Randomized Block Design (RBD) with three replications. Observations were taken for various traits such as plant height (cm), leaf length, Number of leaf and fresh weight and dry weight. The data were statistically analyzed to compute the general mean, standard error (SEd), and critical difference (CD) for each trait.

**3.1 Plant height**

Plant height of black aromatic rice recorded at 30, 60, and 90 DAS was statistically analyzed and presented. At 30 days after sowing (DAS), the greatest plant height was observed in treatment T4, which included recommended dose of fertilizers along with Foliar Spray Jeevamrut @ 2.5% and Foliar Spray Panchgavya @ 5%, resulting in an average height of 20.4 cm. Treatment T3 consisting of produced a height of 20.4 cm, with no significant difference compared to T3 The shortest plants, measuring 12.26 cm, were recorded in the control treatment (T1), which did not receive any additional inputs. At 60 DAS, the greatest plant height was observed to be statistically significant in treatment T4 along with Foliar Spray Jeevamrut @ 2.5% and Spray Panchgavya @ 5, resulting in average height of 49.5cm. And T3 consisting of Foliar Spray Panchgavya @ 2.5% giving an average height of 44.63 cm. The shortest plants, measuring 31.2cm, were recorded in the control treatment (T1), which did not receive any additional inputs. At 90 DAT, the greatest plant height was observed in treatment T4, which included Foliar Spray Jeevamrut @ 2.5% along Foliar Spray Panchgavya @ 5% with resulting in an average height of 79.5 cm. Treatment T3 consisting of Foliar Spray Panchgavya @ 5%, produced a plant height of 79.1 cm, with no significant difference compared to T4 The shortest plants, measuring 60.1 cm, were recorded in the control treatment (T1), which did not receive any additional inputs.

Plant height of sesame measured at harvest was not differed significantly due to different time of application of jeevamrut. The data on plant height of sesame recorded at harvest as influenced by Plant height and number of branches per plant of sesame due to application of jeevamrut was found significant was attributed to micronutrients, growth hormones and higher microbial population in phyllosphere which might have resulted in higher uptake of as soil nutrients which by the end significantly increased the plant growth and overall development (Palekar, 2006).

**Tab1e 1. Effect of Foliar application of different organic liquid formulation on plant height of Black Sesame**

|  |  |  |  |
| --- | --- | --- | --- |
| **Treatment** | **Plant height (cm)** | | |
| **30 DAS** | **60 DAS** | **90 DAS** |
| T-1 Control | 12.6 | 31.2 | 60.1 |
| T-2 Foliar Spray Panchgavya @ 2.5% | 19.6 | 44.1 | 77.8 |
| T-3 Foliar Spray Panchgavya @ 5% | 20.4 | 44.6 | 79.1 |
| T-4 Foliar Spray Jeevamrut @ 2.5% | 20.4 | 49.5 | 79.5 |
| T-5 Foliar Spray Jeevamrut @ 5% | 17.3 | 40.6 | 76.9 |
| T-6 Foliar Spray Vermiwash @ 2.5% | 15.3 | 34.5 | 66.6 |
| T-7 Foliar SprayVermiwash @ 5% | 15.4 | 36.7 | 73.7 |
| 7-8 Foliar Spray Liquid BioFertilizer @ 2.5% | 13.8 | 34.7 | 62.1 |
| T-9 Foliar Spray Liquid BioFertilizer @ 5% | 16.9 | 37.9 | 74.1 |
| **F test** | NS | NS | S |
| **S.Ed±** | 2.122114 | 2.746589 | 4.993729 |
| **CD** | 4.498681 | 5.822508 | 10.58623 |

**3.2 Leave length**

Leaf length of black Sesame recorded at 30, 60, and 90 DAT was statistically analyzed and presented.6At 30 days after transplanting the greatest leave length was observed in treatment T4, which included Foliar Spray Jeevamrut @ 2.5% along with Foliar Spray Panchgavya @ 5%, resulting in an average length of 5.9 cm. Treatment consisting of Foliar Spray Jeevamrut @ 2.5% produced a leave length of 5.4 cm, with no significant difference compared to T3 The shortest plants, measuring 4.6 cm, were recorded in the control treatment (T1) which did not receive any additional inputs. At 60 DAS, the greatest leave length was observed to be statistically significant in treatment T4 which included Foliar Spray Jeevamrut @ 2.5% and resulting in average length of 8.4 cm. and T3 consisting Foliar Spray Panchgavya @ 5%, and, giving an average length of 8.1 cm. The shortest leave, measuring 6.6 cm, were recorded in the control treatment (T1), which did not receive any additional inputs.At 90 DAS the greater leaf length observed in treatment T4 (Foliar Spray Jeevamrut @ 2.5%+ Foliar Spray Panchgavya @ 5%,) compared to the shortest leaf length in treatment T1 (Control) can likely be attributed to the positive effects of jeevamrut and Panchagavya on black sesame .Fym uptake by releasing nutrients in a controlled manner, ensuring a steady supply of rhizobium to the plants. Its particles allow for more efficient absorption through the roots, leading to better nutrient utilization.

It produces a 1–2 in (2.5–5cm) long white, bell shaped inflorescence growing from the leaf axils (where the leaf stalk joins the stem). The blooms do not open all at once, but gradually, from the base of the stem upwards to the top of the plant. The flowers are both male and female and will self-pollinate. The seed is produced in a 1–1.5 in (2.5–3.8 cm) long, divided seed capsule that opens when the seeds are mature. There are 8 rows of seed within each seed capsule, and seed may be yellow, white, brown, or black (Morris, 2002).

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**Table.2.Effect of Foliar application of different organic liquid formulation on leave length of Black Sesame**

|  |  |  |  |
| --- | --- | --- | --- |
| **Treatments** | **Leaf length (cm)** | | |
| **30 DAS** | **60 DAS** | **90 DAS** |
| **T1 - Control** | 4.6 | 6.6 | 11.6 |
| **T2 –** Foliar Spray Panchgavya @ 2.5% | 5.3 | 8.0 | 13.8 |
| **T3 –** Foliar Spray Panchgavya @ 5% | 5.4 | 8.1 | 13.8 |
| **T4 –** Foliar Spray Jeevamrut @ 2.5% | 5.9 | 8.4 | 13.9 |
| **T5 -** Foliar Spray Jeevamrut @ 5% | 5.1 | 8 | 13.8 |
| **T6 –** Foliar Spray Vermiwash @ 2.5% | 4.4 | 7.3 | 12.8 |
| **T7 –** Foliar SprayVermiwash @ 5% | 4.4 | 7.4 | 12.8 |
| **T8 –** Foliar Spray Liquid BioFertilizer @ 2.5% | 4.3 | 7.2 | 12.8 |
| **T9-** Foliar Spray Liquid BioFertilizer @ 5% | 51 | 7.6 | 13.7 |
| **F test** | S | S | S |
| **S.Ed±** | 0.555434 | 0.247447 | 0.555434 |
| **CD (P=0.05)** | 1.177468 | 0.530722 | 1.177468 |

**3.3 Number of leaves**

The number of Leave, recorded at 30, 60, and 90 days after sowing (DAS), was statistically analyzed and the results were displayed.At 30 DAS, treatment T4, which received 100% of the recommended of organic fertilizers along with Foliar Spray Jeevamrut @ 2.5% + recorded the highest, number of Number of leave and this difference, was statistically significant. This was followed by treatment T4, which received (9.6) and Foliar Spray Jeevamrut @ 2.5% + Foliar Spray Panchgavya @ 5 %,) with and this difference was statistically significant. This was followed by treatment T3, which received the lowest number of leaves (6.3), was observed in the control treatment (T1), which did not receive any additional nutrient inputs. At 60 DAS, the greatest Number of leave was observed to be statistically significant in treatment T4 along with Foliar Spray Jeevamrut @ 2.5% and Spray Panchgavya @ 5, resulting in average No.of Leaves of 17.6. And T3 consisting of Foliar Spray Panchgavya @ 2.5% giving an average Number of 17.6. The shortest plants, measuring 12.3, were recorded in the control treatment (T1), which did not receive any additional inputs. At 90 DAS, treatment T4, which received 100% of the recommended of organic fertilizers along with Foliar Spray Jeevamrut @ 2.5%) and Foliar Spray Panchgavya @ 5% recorded the highest number of Number of leaves (28.6), and this difference was statistically significant. This was followed by treatment T3, The lowest number of leaves (20.3) was observed in the control treatment (T1), which did not receive any additional nutrient inputs. The probable reason for maximum inflorescence plant might be the increase of supply of Fym and plants, which accelerated the activity of enzyme involved in photosynthesis.

Table.3. Effect of Foliar application of different organic liquid formulation on number of leaves of Black Sesame

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Treatments** | **Number of leave** | | | |
| **30 DAS** | **60 DAS** | **90 DAS** | |
| **T1 – Control** | 6.3 | 12.3 | | 20.3 |
| **T2 –** Foliar Spray Panchgavya @ 2.5% | 9.6 | 15.6 | | 25.6 |
| **T3 –** Foliar Spray Panchgavya @ 5% | 9.6 | 17.6 | | 28.3 |
| **T4 –** Foliar Spray Jeevamrut @ 2.5% | 9.6 | 17.6 | | 28.6 |
| **T5 -** Foliar Spray Jeevamrut @ 5% | 8.6 | 15.6 | | 23.3 |
| **T6 –** Foliar Spray Vermiwash @ 2.5% | 7.6 | 13.6 | | 21.3 |
| **T7-** Foliar SprayVermiwash @ 5% | 8.3 | 13.6 | | 21.3 |
| **T8 –** Foliar Spray Liquid BioFertilizer @ 2.5% | 7.3 | 16.6 | | 18.3 |
| **T9 -** Foliar Spray Liquid BioFertilizer @ 5% | 8.6 | 14.6 | | 22.6 |
| **F test** | S | S | | S |
| **S.Ed±** | 0.228218 | 0.306186 | | 0.677003 |
| **CD (P=0.05)** | 0.4838 | 0.649086 | | 1.435183 |

**3.4 Dry Weight**

Dry weight of black Sesame recorded at 30, 60, and 90 DAS was statistically analyzed and presented.At 30 DAS, treatment T4, which received 100% of the recommended Organic fertilizers along with Foliar Spray Jeevamrut @ 2.5% andFoliar Spray Panchgavya @ 5%, recorded the highest Dry Weight (5.4 g), and this difference was statistically significant. This was followed by treatment T3, which received 5 % and Foliar Spray Panchgavya @ 5% with an average dry weight count of (5 g). The lowest dry weight (3.1g) was observed in the control treatment (T1), which did not receive any additional nutrient inputs. At 60 DAS, treatment T4, which received 100% of the recommended of organic fertilizers along with Foliar Spray Jeevamrut @ 2.5% and Spray Panchgavya @ 5% recorded the highest dry weight (8.8 g ), and this difference was statistically significant. This was followed by treatment T3. The lowest dry weight (6.2 g) was observed in the control treatment (T1), which did not receive any additional nutrient inputs. At 90 DAS, treatment T4, which received 100% of the recommended of Organic fertilizers along with Foliar Spray Jeevamrut @ 2.5% and Foliar Spray Panchgavya @ 5%, recorded the highest dry weight (24.9 g) , and this difference was statistically significant. This was followed by treatment T3 , which received 100% Foliar Spray Panchgavya @ 5% and The lowest dry weight (6.5 g ) was observed in the control treatment (T1), which did not receive any additional nutrient inputs. The probable reason for highest dry weight might be the combination of foliar application of Spray Jeevamrut @ 2.5% and Foliar Spray Panchgavya @ 5%.

**Table.4.Effect of Foliar application of different organic liquid formulation on dry weight of Black Sesame**

|  |  |  |  |
| --- | --- | --- | --- |
| **Treatment** | **Dry weight (g )** | | |
| **30 DAS** | **60 DAS** | **90 DAS** |
| T-1 Control | 3.1 | 6.2 | 6.5 |
| T-2 Foliar Spray Panchgavya @ 2.5% | 4.6 | 8.1 | 22.8 |
| T-3 Foliar Spray Panchgavya @ 5% | 5 | 8.4 | 23.9 |
| T-4 Foliar Spray Jeevamrut @ 2.5% | 5.4 | 8.8 | 24.9 |
| T-5 Foliar Spray Jeevamrut @ 5% | 4.4 | 7.6 | 21.8 |
| T-6 Foliar Spray Vermiwash @ 2.5% | 3.8 | 6.8 | 19.8 |
| T-7 Foliar SprayVermiwash @ 5% | 4.4 | 7.0 | 20.8 |
| 7-8 Foliar Spray Liquid BioFertilizer @ 2.5% | 3.5 | 6.6 | 18.6 |
| T-9 Foliar Spray Liquid BioFertilizer @ 5% | 3.2 | 6.3 | 17.6 |
| **F test** | S | S | S |
| **S.Ed±** | 0.13189 | 0.14142 | 0.10069 |
| **CD (P=0.05)** | 0.2796 | 0.2998 | 0.21346 |

**Fig 2 .Effect of Foliar application of different organic liquid formulation on dry weight of Black Sesame**

**CONCLUSION**

Based on comprehensive study, it concluded that the utilizing of jeevamrut on black sesame shows the most favorable outcomes across growth parameters *i.e.* highest plant height ( 79.5cm), highest leaf length (13.9 cm), and highest dry weight ( 24.9 ) at 90 DAS and moreover, it is seen that under T4 ( Foliar Spray Jeevamrut @ 2.5% ). The approach the use Jeevamrut of only boosts productivity but also improves soil health, supporting sustainable agriculture in soils. T4 demonstrated superior performance, showcasing optimal growth parameters proved to be the most effective treatment among all the mentioned treatments.

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