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Response of silicon supplementation on yield of black sesame (*Sesamum indicum* L.)

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Abstract

A present investigation was carried out during the *Rabi Season* of 2024 at Himalayan University farm, Jollang, Itanagar, to determine the response of Seed Priming on growth of black Sesame (*Sesamum indicum* L.) The experiment was outlined in a Randomized Block Design (RBD) with 9 (nine) treatments and 3 (three) replication. The treatment includes, T1- Control (No treatment), T2-100% RDF, T3- 100% FYM, T4- FYM+ RDF+ Silicon diatomaceous earth @2 g/m, T5- FYM+RDF+ Silicon diatomaceous earth @4g/m², T6- FYM+RDF+ Silicon diatomaceous earth @6g/m², T7- FYM+RDF+ Silicon diatomaceous earth @8g/m², T8-FYM+RDF+ Silicon diatomaceous earth @10 g/m².The study recorded significance difference among treatments in terms of Number of Capsule, Seed yield and Harvest index at 30, 60 and 90 DAS.

Keywords: Farm Yard Manure (FYM), Recommended dose of fertilizer (RDF), Diatomaceous earth

Introduction

Sesame (*Sesamum indicum* L.) is one of the oldest oilseed crops known to humanity, cultivated for thousands of years for its high-quality edible seeds and oil. Belonging to the family Pedaliaceae, sesame is a self-pollinated, annual plant that thrives in tropical and subtropical climates. It is widely grown across Asia, Africa, and parts of South America and is particularly valued for its adaptability to drought-prone and marginal soils, making it a vital crop for smallholder and resource-poor farmers.

Sesame seeds are highly nutritious, containing 40-60% oil, 20-25% protein, and significant levels of minerals and antioxidants such as Sesamin, sesamol, and sesamol, which contribute to their long shelf life and numerous health benefits. The oil is considered premium due to its stability and rich flavour, making it a staple in many culinary traditions and a valuable raw material in cosmetics and pharmaceuticals.

Despite its potential, sesame cultivation faces challenges such as low yield, non-synchronous maturity, susceptibility to waterlogging, and limited mechanization due to capsule shattering. However, with increasing global demand for healthy vegetable oils and organic products, sesame continues to gain importance in sustainable agriculture. Advances in breeding, agronomy, and crop protection offer new opportunities to enhance productivity, resilience, and profitability in sesame farming.

Sesame (*Sesamum indicum* L.) is one of the earliest human production and consumption oil crops in the family of Pedaliaceae Zech-Matterne V *et al.*, (2015)^[9], rape, soybean, and peanuts, known as China's four major oil crops. First discovered in ancient sites in Pakistan, sesame is a long-established cultivated crop Bedigian, D *et al.*, (2010)^[3]. It is distributed in countries such as India, China, and Malaysia. Chinese people have used sesame seeds for more than 5000 years Zech-Matterne V *et al.*, (2015)^[9] and Majdalwih, AF *et al.*, (2017)^[4]. Globally, India, Sudan, Myanmar, China, and Tanzania are the major producers of sesame. In recent years, the production of sesame seeds in African countries has increased, and Tanzania has replaced India as the leading producer of sesame seeds. According to the Food and Agriculture Organization of the United Nations, the global production of sesame in 2017 was 5.899 million tons, of which 806,000 tons were produced in Tanzania and 733,000 tons in China Xu, G *et al.*, (2018)^[7].

Sesame is widely grown and popular because of its highly aromatic odor and mellow flavor. In

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people’s lives, sesame seeds are often used to make a variety of foods, such as sesame oil, sesame paste, or to decorate other foods. The scientific nutritional value status of sesame seeds was established on a legal level in 2002 when they were included in the list of medicinal and food ingredients published by the former Chinese Ministry of Health. Among the reviews on sesame, only one detailed review on the phytochemistry and ethno- pharmacology of sesame has been published in recent years Mili, A.; Das *et al.*, (2021) ^[6]. Other reviews are either about a certain chemical composition in the sesame seeds Andargie, M *et al.*, (2021) ^[1], on some of the pharmacological effects of sesame Wu, M.-S *et al.*, (2019) ^[8], or the technical aspects of its production Myint, D *et al.*,(2020) ^[5]. This review will focus on not only the phytochemical and pharmacological properties of sesame but also the economic-phytological and nutritional value of sesame.

Materials and Methods

The experiment entitled influence of silicon supplementation and FYM on productivity and quantity of Black sesame (*Sesamum indicum* L.) 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 analyse the different Sesame varieties and to assess their performance in Kharif season. The procedure followed and the materials and methods used for the study are given below;

Location and Experimental site

The trial was laid out at the agriculture field of Himalayan University, Jollang, during Kharif season of 2024-2025. Jollang is medium size village located in Itanagar Circle of Papumpare district, Arunachal Pradesh. The village is under tropical climatic zone with an average rainfall of 3500-4000 mm at an average meter from mean sea level.

Soil types of the experimental plot

The experiment was conducted in a medium land with irrigation facility. The soil was sandy loam and loamy sandy in texture. The bulk soil samples (0-15 cm depth) were collected from the field before the commencement of the experiment (2024) and tested for important soil properties using the standard procedures.

Climatic conditions

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 15 °C and 28 °C, respectively. The average relative humidity 87%.

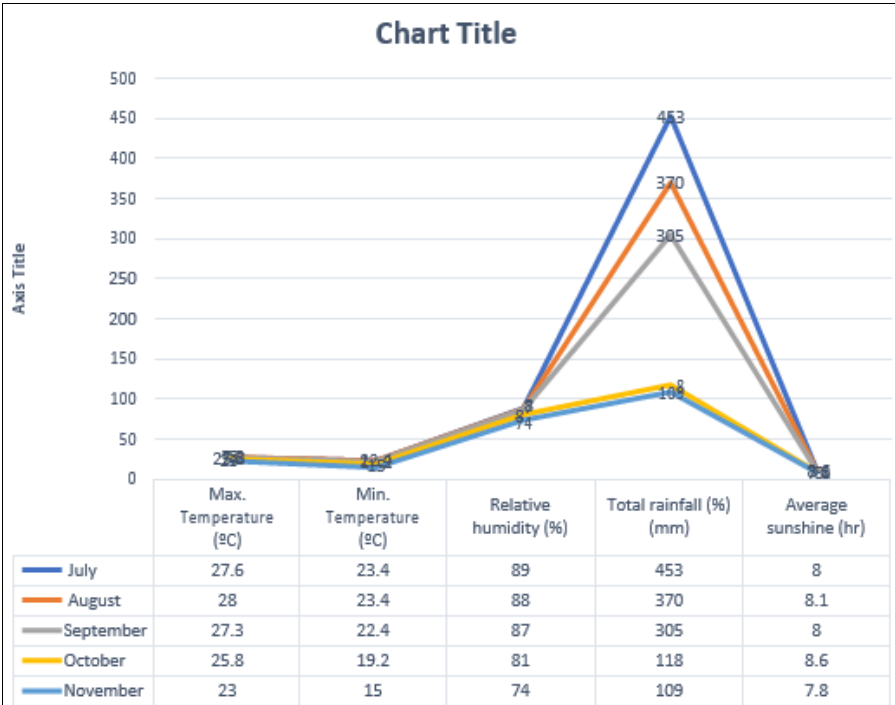


Fig 1: Meteorological data of weather parameters and total rainfall during the cropping season (Kharif 2024-2025)

Crop Yield Attributes

1. Number of Capsule

The number of Capsule plant recorded at harvest is presented in Table and graphically depicted in the data shows that there was significant effect of different treatments on the number of Capsule per plant.

2. Seed yield

The yield of capsule per plot was taken after the harvesting of

individual plot and yield per plot was recorded and then finding was expressed in g/ha.

3. Harvest index

The Harvest index (%) recorded at harvest, is presented in table no.3. The data shows that there was a significant effect of different treatments on the harvest index%.

It was calculated by diving economic yield by total biological yield (Donald, 1962) the following formula was used:

$$\text{Harvest Index (HI)} = \frac{\text{Economic Yield}}{\text{Biological Yield}} \times 100$$

Results and Discussion

The yield and development attributes of black Sesame were recorded under a Randomized Block Design (RBD) with three replications. Observations were taken for various traits such as Number of Capsule, Seed yield, and Harvest index. The data were statistically analyzed to compute the general mean, standard error (SEd), and critical difference (CD) for each trait.

1. Number of Capsule

Number of Capsule of Black Sesame recorded was statistically analyzed After Harvest and presented. The greatest number of Capsule was observed in treatment T8, which included RDF, FYM and silicon diatomaceous earth @10 g/m², resulting in an average Capsule of 76.06667. The less No. of capsule were 52.23333, were recorded in the control treatment (T1), which did not receive any additional inputs.

Research on sesame seeds has predominantly focused on physiological indices such as seed count, capsule quantity, plant growth, and the oil and organic acid content of sesame seeds.

The maturation of sesame capsules is closely linked to the process of lignification, which is essential for the structural integrity of the plant. The preparation of the sesame capsule samples, the analysis of capsule extracts and the quantification and identification of metabolites were performed at Novogene Co., LTD. (Shanghai, China). For metabolites analysis, each sample was repeated six times. The QC quality control samples were prepared to balance the state of chromatography mass spectrometry system and monitoring and maintain the stability of the system during the experiment. Added the supernatant to the LC-MS/MS system (Waltham, MA, USA).

Table 1: Effect of Silicon diatomaceous earth on Number of Capsule of Black Sesame.

Treatments	No. of Capsules per plant
T1-Control	52.23333
T2 - 100% RDF	58.3
T3 - 100%FYM	60.03333
T4- RDF+FYM+ diatomaceous earth 2g/m ²	69.1
T5 - RDF+FYM+ diatomaceous earth 4g/m ²	74.9
T6 - RDF+FYM+ diatomaceous earth 6g/m ²	71.06667
T7 - RDF+FYM+ diatomaceous earth 8g/m ²	68.16667
T8 - RDF+FYM+ diatomaceous earth 10 g/m ²	76.06667
F test	S
SEd(±)	0.306186
CD	0.64908

2. Seed Yield

Seed Yield of Black Sesame recorded was statistically analyzed After Harvest and presented. The greatest number of Capsule was observed in treatment T8, which included recommended dose of fertilizers along with Silicon diatomaceous earth @10 g/m², resulting in an average Capsule of 18.91333 kg. Treatment T1 consisting of produced a seed Yield 10.12333 kg, were recorded in the control treatment (T1), which did not receive any additional inputs.

The increased seed yield was due to pinching of plants which may be attributed to the proportionate increase in yield contributing characters i.e., more number of productive branches and more number of flowers per plant.

Table 2: Effect of Silicon diatomaceous earth on Seed yield of Black Sesame

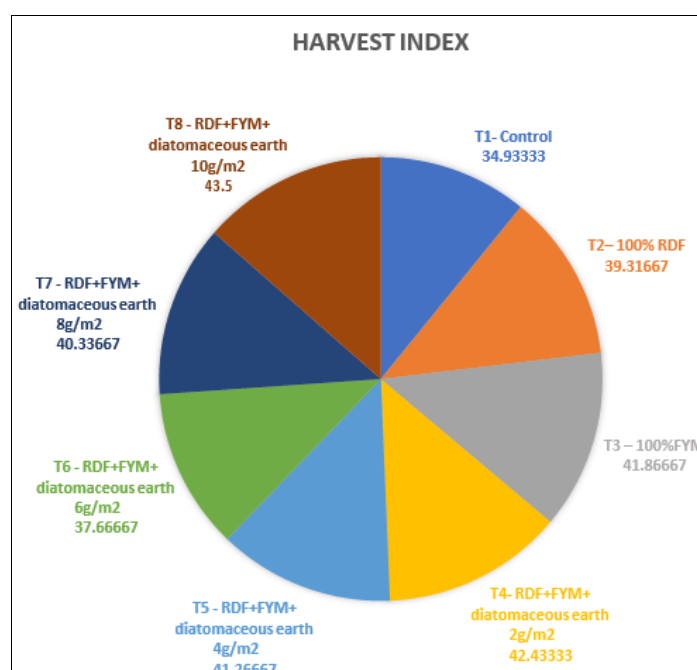
Treatments	Seed yield
T1- control	10.12333
T2- 100% RDF	17.32
T3 - 100%FYM	11.38667
T4- RDF+FYM+ diatomaceous earth 2g/m ²	13.44
T5 - RDF+FYM+ diatomaceous earth 4g/m ²	15.69
T6 - RDF+FYM+ diatomaceous earth 6g/m ²	12.61333
T7 - RDF+FYM+ diatomaceous earth 8g/m ²	14.64333
T8 - RDF+FYM+ diatomaceous earth 10 g/m ²	18.91333
F test	S
SEd(±)	42.86571
CD	90.87124

3. Harvest Index

Harvest Index of Black Sesame recorded was statistically analyzed After Harvest and presented. The greatest number of Harvest Index was observed in treatment T8, which included recommended dose of fertilizers along with Silicon diatomaceous earth @10 g/m², resulting in an Average harvest index of 43.5 kg. The less Harvest Index 34.93333 kg, were recorded in the control treatment (T1), which did not receive any additional inputs.

Table 3: Effect of Silicon diatomaceous earth on Harvest Index of Black Sesame

Treatments	Harvest index
T1- Control	34.93333
T2- 100% RDF	39.31667
T3 - 100%FYM	41.86667
T4- RDF+FYM+ diatomaceous earth 2g/m ²	42.43333
T5 - RDF+FYM+ diatomaceous earth 4g/m ²	41.26667
T6 - RDF+FYM+ diatomaceous earth 6g/m ²	37.66667
T7 - RDF+FYM+ diatomaceous earth 8g/m ²	40.33667
T8 - RDF+FYM+ diatomaceous earth 10 g/m ²	43.5
F test	S
SEd(±)	3.738892
CD	2.764199



Graph 1: Graph presentation of harvest index

Conclusion

Based on comprehensive study, it concluded that the utilizing of Silicon diatomaceous earth on black sesame shows the most favourable outcomes across Yield Attributes *i.e.* Number of Capsules 76.06667 and Seed Yield 18.91333 and Harvest Index 43.5 kg and moreover, it is seen that under T8 (silicon diatomaceous earth 10 g/m²). The approach the use of silicon diatomaceous earth not only boosts productivity but also improves soil health, supporting sustainable agriculture in soils. T8 demonstrated superior performance, showcasing optimal growth parameters proved to be the most effective treatment among all the mentioned treatments.

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