**"Influence of Spacing and Sowing Practices on Soybean Growth Attributes in the Malwa Region of Madhya Pradesh"**

**Article type:** *Original Research Article*

 **ABSTRACT**
The present investigation was conducted at the Research Farm, Mandsaur University, Mandsaur (Madhya Pradesh), India, during the *Kharif* season (June–December 2024). The experiment aimed to evaluate the impact of different sowing methods and spacing treatments on the growth and yield of soybean. The study was carried out using a Split Plot Design with three replications and eight treatment combinations, resulting in 24 experimental plots. The gross plot size was 14.40 m², and the net plot size was 11.70 m². Soybean was sown with a seed rate of 80 kg/ha-1 and recommended fertilizer doses of 20:40:20 NPK per hectare.

The plant population at 30 DAS and at harvest was significantly influenced by sowing methods (flat bed and raised bed) and spacing treatments (broadcasting, 30×30 cm, 45×30 cm, 60×30 cm). Raised bed sowing (B2) consistently resulted in higher plant populations compared to flat bed sowing (B1), with the raised bed + broadcasting (B2S1) treatment showing the highest plant population at both stages. Soybean plants on raised beds (B2) had higher fresh (114.78 g) and dry (16.79 g) weights compared to flat beds (B1). The highest fresh and dry weight was observed in the raised bed + broadcasting treatment (B2S1), while the lowest was in raised bed + 60×30 cm spacing (B2S4).The number of pods at 90 DAS was higher in raised bed sowing (B2), with the raised bed + 60×30 cm spacing (B2S4) yielding the highest pod count (21.13 pods). The 30×30 cm spacing (S2) also resulted in more pods compared to broadcasting. Raised bed sowing (B2) resulted in earlier flowering (39.91 days) compared to flat bed sowing (40.00 days). The 30×30 cm spacing (S2) led to the earliest flowering, while broadcasting (S1) resulted in the early flowering.

***Keywords:*** Attributes, Growth, Influence, Malwa, Spacing, Sowing and Soybean.

**INTRODUCTION**

Soybean (Glycine max L.) is an essential legume belonging to the Leguminosae family, Papilionaceae subfamily, and Glycine genus. It has been cultivated in China since 3000 B.C. Over recent years, soybean production, processing, and trade have expanded significantly, greatly benefiting rural economies and improving farmers' socio-economic status. Soybean is a diploid, self-pollinating C3 plant with a chromosome number of 2n=40. It is an annual crop with a tap root system and a dicotyledonous structure. Soybeans grow well in various parts of India, adapting to tropical and subtropical climates with temperatures ranging from 25 to 30°C, annual rainfall of 700 to 1000 mm, and loamy soils with a pH of 6.0 to 7.5. The availability of these favorable conditions across much of India contributes to its widespread cultivation.

Soybean is a key oilseed crop, commonly used as a pulse, oilseed, vegetarian meat substitute, and in products such as soy milk. Often called the "Wonder crop" or "Golden Bean" of the 21st century, soybean is rich in protein (40–42%) and oil (20%) and contains 30% carbohydrates, 5% minerals, 4–5% crude fibers, 0.5% lecithins, and 4% saponin. It is a great source of essential vitamins and amino acids like lysine, glycine, and tryptophan. Additionally, its high content of isoflavones contributes to the prevention of heart disease and cancer [1]. Due to its wide range of uses, soybean is considered a wonder crop.

Soybean serves multiple purposes, particularly in producing edible oil and soy-based products such as soy milk, tofu (soya paneer), soy yogurt, soy ice cream, and soy butter. Soy flour, fortified food products, and biscuits are also popular for their nutritional benefits and affordability. Furthermore, soybeans are utilized in cosmetics for medicinal purposes, as the isoflavones found in soybeans can lower the risk of cardiovascular diseases and diabetes due to their low starch content.

Originating in China and introduced to India in 1882, soybean is now grown in numerous countries worldwide. During the 2019-2020 period, Brazil had the largest area under soybean cultivation (36.90 million hectares), followed by the USA (30.96 million hectares), Argentina (17.00 million hectares), and India (11.34 million hectares). In terms of production, Brazil was the leading producer in 2021-2022 with 144 million tonnes, while India ranked fifth, producing 11.20 million tonnes with a productivity of 1126 kg per hectare. Soybean cultivation in India is mainly concentrated in Madhya Pradesh, Uttar Pradesh, Rajasthan, and Maharashtra. In Maharashtra, during 2021-2022, 46.01 lakh hectares were dedicated to soybean cultivation, yielding 36.29 lakh tonnes with a productivity of 1054 kg per hectare. Vidarbha in Maharashtra is the top producer of soybeans, benefiting from average rainfall of 800 to 1000 mm and fertile black cotton soils, which are ideal for soybean cultivation. In 2019-2020, Vidarbha produced 48.25 lakh tonnes of soybeans across 41.24 lakh hectares, with a productivity of 853 kg per hectare.

Soybean is a versatile oilseed crop, rich in protein (40–42%), oil (20%), carbohydrates (30%), and essential vitamins. It's commonly used in products like soy milk, tofu, and soy flour, and is valued for its health benefits, including heart disease and cancer prevention due to high isoflavones. Known as the "Wonder crop" or "Golden Bean" of the 21st century, it is also used in cosmetics and medicinal products to reduce the risk of cardiovascular diseases and diabetes. Originating in China and introduced to India in 1882, soybean is grown worldwide. Brazil leads in cultivation, followed by the USA, Argentina, and India. In India, soybean is mainly grown in Madhya Pradesh, Uttar Pradesh, Rajasthan, and Maharashtra, with Vidarbha region being a top producer. Sowing methods like ridge and furrow and Broad Bed Furrow (BBF) are used to conserve moisture and improve yield. These methods are effective in increasing crop growth, especially in areas with variable rainfall.

Spacing between plants is crucial for optimizing growth and yield, as it influences nutrient uptake, aeration, and light availability. Proper spacing can reduce the need for additional inputs like seeds, fertilizers, and pesticides, making cultivation more cost-effective.

**MATERIAL AND METHODS**

The present investigation titled “Effect of Various Agronomic Manipulations In Spacing and Sowing Methods On Growth And Yield Attributes of Soybean (*Glycine Max* L.) In Malwa Region (M.P)”. The present experiment was conducted at Research Farm, under Mandsaur University, Mandsaur (Madhya Pradesh). Mandsaur (Madhya Pradesh) which is situated at latitude 240C 4’36.61’’N, longitude 7504’9.46’’ E and at an altitude of 442.16 meters above the mean sea level. The experiment involved two main plot treatments: B1 for flat bed sowing and B2 for raised bed sowing. There were four sub-plot treatments based on spacing: S1 for broadcasting, S2 for 30×30 cm spacing, S3 for 45×30 cm spacing, and S4 for 60×30 cm spacing. The treatment combinations were as follows: T1: Flat bed + Broadcasting (B1S1),T2: Flat bed + 30×30 cm spacing (B1S2),T3: Flat bed + 45×30 cm spacing (B1S3),T4: Flat bed + 60×30 cm spacing (B1S4),T5: Raised bed + Broadcasting (B2S1),T6: Raised bed + 30×30 cm spacing (B2S2), T7: Raised bed + 45×30 cm spacing (B2S3) andT8: Raised bed + 60×30 cm spacing (B2S4). The experiment was laid out using a split plot design with three replications. There were eight treatments in total, and the experiment was conducted in 24 plots. The gross plot size was 3.60 × 3.90 meters, which equals 14.40 m², while the net plot size was 3.0 × 3.90 meters, totaling 11.70 m². The gross plot area was calculated to be 424.70 m². For the soybean crop, the recommended fertilizer doses were 20 kg N, 40 kg P, and 20 kg K per hectare. The seed rate used for the experiment was 80 kg per hectare.

**RESULT AND DISCUSSION**

**4.1: Plant population**

Data pertaining to plant population at 30 Days After Sowing (DAS) and at harvest, as presented in the (Table-1), indicate the main effects of different sowing methods (flat bed and raised bed) and spacing treatments (broadcasting and various row spacings) on the plant population in Soybean (*Glycine max*). These factors significantly affected the plant population at both 30 DAS and harvest, with distinct trends observed throughout the growing stages.

**Main Effect of Sowing Methods:**

In general, the raised bed method (B2) showed a consistently higher plant population both at 30 DAS and at harvest compared to the flat bed method (B1). Soybean sown under raised beds (B2) had a plant population of 25 plants per square meter at 30 DAS, which reduced to 19.33 plants per square meter at harvest. In contrast, Soybean sown under flat beds (B1) had 19 plants per square meter at 30 DAS, with at harvest further decrease to 13 plants per square meter at harvest. The increased plant population observed with the raised bed method indicates its potential to support better overall plant establishment and survival rates. Previous studies are well justified with the present findings as made by(Mehta and Bharat, 2017; Asewar *et al.,* 2017 and Keisham *et al.,* 2021).

**Main Effect of Spacing:**

Among the different sowing method × spacing combinations, significant variations in plant populations were observed. For example, under the raised bed method (B2), the combination with broadcasting (S1) resulted in the highest plant population at 30 DAS (32.33 plants per square meter), and this remained relatively high at harvest with 29 plants per square meter. In contrast, the combination of flat bed method (B1) and 60×30 cm spacing (S4) resulted in the lowest plant population at both stages (13.33 plants per square meter at 30 DAS, decreasing to 13 plants per square meter at harvest). From the present experiment the explanation may be due to the wider spacing leading to fewer plants per unit area, coupled with the less favorable conditions of the flat bed method. It suggests that the plant spacing may not be ideal for maximizing plant establishment in the flat bed method, particularly at a larger distance between plants. The present study is incorporated with the findings of Ghormade *et al.,* (2011); Ghasemi *et al.,* (2017) and Rathnayaka *et al.,* (2018) in Soybean.

**Interaction Effects of Sowing Method and Spacing:**

The interaction between the sowing method and spacing treatments also revealed significant results. The highest plant population at both 30 DAS and harvest was observed under the raised bed + broadcasting (B2S1) treatment, with 32.33 plants per square meter at 30 DAS, decreasing slightly to 29 at harvest. Similarly, the flat bed + 45×30 cm spacing (B1S3) combination resulted in a good plant population, with 20.66 plants per square meter at 30 DAS, which slightly increased to 19.33 plants per square meter at harvest. On the other hand, the flat bed + 60×30 cm spacing (B1S4) combination resulted in the smallest plant population at both stages, with only 13.33 plants per square meter at 30 DAS and 13 plants per square meter at harvest. This highlights the importance of selecting appropriate sowing methods and spacing combinations to maximize plant population and ensure optimal crop performance. Similar observations were reported by the findings of Ghasemi *et al.,* (2017), El-Sayed *et al.,* (2020); and Zyada *et al.,* (2021) in Soybean.

**4.2: Fresh and Dry weight (g) of Soybean at 30 DAS**

The fresh and dry weight of soybean at 30 DAS varied significantly across sowing methods and subplot treatments as presented in (Table- 2).

**Main Effect of Sowing Methods:**

#### Soybean plants grown on raised beds (B2) had a higher fresh weight (114.78 g) and dry weight (16.79 g) compared to those grown on flat beds (B1), which had a fresh weight of 89.89 g and a dry weight of 14.82 g. These factors may improve nutrient and water uptake, allowing for greater biomass accumulation both in terms of fresh and dry weight. In contrast, flat bed sowing, while still effective, may not provide the same level of optimal conditions for early growth, leading to lower fresh and dry weights in plants grown on flat beds. Our results substantiate the findings of past studies conducted by Qureshi *et al.,* (2018) and Joseph *et al.,* (2019) in Soybean.

**Main Effect of Spacing:**

Among the subplot treatments, the plants grown with 30×30 cm spacing (S2) had the highest fresh weight of 114.85 g and the highest dry weight of 16.99 g followed by 60×30 cm spacing (S4) showed a fresh weight of 105.15 g and a dry weight of 16.00 g and broadcasting (S1) resulted in a fresh weight of 100.54 g and a dry weight of 15.76 g. The 45×30 cm spacing (S3) had the lowest fresh weight at 88.81 g and dry weight at 14.46 g. The evidence we present echoes the results reported by (Asewar *et al.,* 2017 and Singh *et al.,* 2018).

**Interaction Effects of Sowing Method and Spacing:**

The combination of B2S1 (Raised bed + Broadcasting) produced the highest fresh weight (138.02 g) and dry weight (18.51 g) followed by B2S2 (Raised bed + 30×30 cm spacing) resulted in a fresh weight of 125.33 g and a dry weight of 18.25 g and B2S3 (Raised bed + 45×30 cm spacing) resulted in a fresh weight of 123.36 g and a dry weight of 18.13g. The treatment T8 B2S4 (Raised bed + 60×30 cm spacing) resulted in the lowest fresh weight (72.27 g) and dry weight (13.50 g). The results obtained here are in contrast with the conclusions of (Adhikari and Ramana 2019 and Gulser, 2019).

**4.3:** **Number of Pods at 90 days after sowing (DAS)**

Data pertaining to the number of pods at 90 Days After Sowing (DAS), as presented in the (Table-3), indicate the main effects of different sowing methods (flat bed and raised bed) and spacing treatments (broadcasting and various row spacing) on the number of pods in Soybean. These factors significantly affected the number of pods at 90 DAS, with distinct trends observed throughout the growing stages. The current study aligns with previous reports by(Dhakad *et al.,* 2017 and Singh *et al.,*2021).

**Main Effect of Sowing Methods:**

In general, the raised bed method (B2) resulted in a higher number 17.76; of pods at 90 DAS compared to the flat bed method (B1) had 17.21 pods at 90 DAS.

**Main Effect of Spacing:**

Among the different spacing treatments, significant variations in the number of pods were observed. The 30×30 cm spacing (S2) treatment led to the highest number of pods at 90 DAS, with a measurement of 18.63, followed by the 30×30 cm spacing, followed by (S3) treatment, which resulted in 18.50 pods. In contrast, the broadcasting treatment (S1) resulted in the lowest number of pods at 90 DAS, with 17.06 pods. In contrast, the broadcasting treatment (S1) resulted in the lowest number of pods at 90 DAS. In line with the current experiment, the findings suggest as per (Ghasemi *et al.,* 2017 and Rathnayaka *et al.,* 2018) in Soybean.

**Interaction Effects of Sowing Method and Spacing:**

The interaction between the sowing method and spacing treatments revealed significant differences in the number of pods. The highest number of pods was observed under the treatment T8 (B2S4) raised bed + 60×30 cm spacing combination, with 21.13 pods, followed by treatment T5 (B2S1) raised bed + broadcasting with 19.00 pods, and treatment T2 B1S2 (Flat bed +30×30 cm spacing) (B1S2) with 18.86 pods. However, the minimum number of pods was recorded under the treatment B2S2 (Raised bed + 30×30 cm spacing) with 12.66 pods at 90 DAS. The results obtained here are in contrast with the conclusions of (Adhikari and Ramana 2019 and Gulser, 2019).

**4.4:** **Days to 50% flowering**

Data pertaining to the number of pods at 90 Days after Sowing (DAS), as presented in the (Table -4), indicate the main effects of different sowing methods (flat bed and raised bed) and spacing treatments (broadcasting and various row spacing) on days to 50% flowering in Soybean. These factors significantly affected the days to 50% flowering, with distinct trends observed throughout the growing stages. This suggests that the raised bed method may provide a more favorable environment for plant growth and development, leading to earlier flowering. The findings presented here contradict the results reported by (Eseigbe *et al.,*2024; Essilfie *et al.,*2024; Seo *et al.,*2024) in Soybean.

**Main Effect of Sowing Methods:**

In general, the raised bed method (B2) resulted in minimum days taken for flowering (39.91) days compared to the flat bed method (B1) which observed (39.91) at 90 days. This . The findings presented here contradict the results reported by (Eseigbe *et al.,*2024; Essilfie *et al.,*2024; Seo *et al.,*2024) in Soybean .

**Main Effect of Spacing:**

Among the different spacing treatments, significant variations were observed for days to 50% flowering. The 30×30 cm spacing (S2) treatment led to the minimum days to 50% flowering at 90 DAS, with 39.16 days, followed by treatment (S3) 45×30 cm spacing, which observed (40.00) days. In contrast, the treatment (S1) broadcasting treatment resulted maximum (40.66) days. This suggests that closer spacing may optimize flowering time, possibly by enhancing plant interaction or reducing competition for resources like nutrients and sunlight. Some previously studies also in line with our study as per (Gu *et al.,*2024 and Chavan *et al.,*2025) in Soybean.

**Interaction Effects of Sowing Method and Spacing:**

The interaction between the sowing method and spacing treatments revealed significant differences in the days to 50% flowering. The minimum days was observed under the treatment T8 (B2S4) Raised bed + 60×30 cm spacing combination, with (39.00) days, followed by treatment T4 (B1S4) Flat bed +60×30 cm spacing with (39.13) days, and treatment T6 (B2S2) Raised bed + 30×30 cm spacing with (39.33) days. However, the maximum days to 50% flowering was recorded under the treatment T3 (B2S2 ) flat bed +45×30 cm spacing with (40.66) days. The treatment T8 with Raised bed + 60×30 cm spacing (B2S4) resulted in the earliest maturity with followed by the treatment T3 with **Flat bed + 45×30 cm spacing** (B1S3) resulted in the earliest maturity with and the treatment T4 Flat bed +60×30 cm spacing (B1S4) reported respectively, indicating an intermediate maturity period. In contrast, treatment T5 with **raised bed + broadcasting** (B2S1) resulted in a longer maturity period. This shows that the spacing method, when paired with a suitable sowing method, plays a significant role in determining the maturity timeline. Similar findings were also noticed by (Pereyra *et al.,*2024; Dos Santos *et al.,*2024) in Soybean.

**CONCLUSION**

The raised bed method (B2) consistently resulted in a higher plant population compared to the flat bed method (B1). The best combination for plant population was raised bed + broadcasting (B2S1), while flat bed with wider spacing (60×30 cm) showed the lowest. Soybeans grown on raised beds (B2) had higher fresh and dry weights than those on flat beds (B1). The raised bed + broadcasting (B2S1) combination produced the highest biomass, while raised bed + 60×30 cm spacing (B2S4) had the lowest.Raised beds (B2) led to more pods compared to flat beds (B1). The highest pod count was found in the raised bed + 60×30 cm spacing (B2S4), while broadcasting (S1) had the lowest.The raised bed method (B2) resulted in earlier flowering. Raised bed + 60×30 cm spacing (B2S4) flowered the earliest, while broadcasting (S1) took the longest.

**COMPETING INTRESTS**

The authors declare that there are no competing interests regarding the publication of this research. The study was conducted without any financial or personal relationships that could have influenced the results or interpretation of the findings.

**Authors’s contributions**

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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**Table 1 Plant Population at 30 DAS (1 meter square in plot )**

|  |  |  |
| --- | --- | --- |
|  | **Main Plot** |  |
| **S. No.** | **Treatments** | **Sowing method** | Plant Population at 30 DAS (1 meter square in plot ) | At harvest |
| 1 | B1 | Flat bed | 19.00 | 13.00 |
| 2 | B2 | Raised bed | 25.00 | 19.33 |
|  | **Sub plot treatments** |  |  |
| 1 | S1 | Broadcasting | 25.50 | 22.50 |
| 2 | S2 | 30×30cm | 23.16 | 20.00 |
| 3 | S3 | 45×30cm | 21.83 | 17.16 |
| 4 | S4 | 60×30cm | 17.50 | 16.16 |
|  |  |  |
| **S.No.** | **Treatments** | **Treatment combination** | Plant Population at 30 DAS (1 meter square in plot ) | At harvest |
| 1. | T1 | B1S1 (Flat bed+Broadcasting) | 18.66 | 16.00 |
| 2. | T2 | B1S2 (Flat bed +30×30 cm spacing) | 23.33 | 18.00 |
| 3. | T3 | B1S3 (Flat bed +45×30 cm spacing) | 20.66 | 19.33 |
| 4. | T4 | B1S4 (Flat bed +60×30 cm spacing) | 13.33 | 13.00 |
| 5. | T5 | B2S1 (Raised bed + Broadcasting) | 32.33 | 29.00 |
| 6. | T6 | B2S2 (Raised bed + 30×30 cm spacing) | 20.33 | 16.33 |
| 7. | T7 | B2S3 (Raised bed + 45×30 cm spacing) | 25.66 | 20.66 |
| 8. | T8 | B2S4 (Raised bed + 60×30 cm spacing) | 21.66 | 19.333 |
|  |  | **Factors** | **C.D.** | **SE(m) ±** | **C.D.** | **SE(m) ±** |
|  |  | Factor A (Sowing methods) | 2.21 | 1.10 | 2.12 | 1.06 |
|  |  | Factor B (Spacing) | 1.99 | 1.03 | N/A | 3.78 |
|  |  | Factor (A×B) | 2.30 | 1.15 | 2.24 | 1.12 |

**Table 2 Plant Population at 30 DAS of Soybean (5 tagged plants per plot)**

|  |  |
| --- | --- |
|  | **Main Plot** |
| **S. No.** | **Treatments** | **Sowing method** | Plant population at 30 DAS (5 tagged plants per plot) |
| 1 | B1 | Flat bed | 53.06 |
| 2 | B2 | Raised bed | 53.43 |
|  | **Sub plot treatments** |  |
| 1 | S1 | Broadcasting | 50.16 |
| 2 | S2 | 30×30cm | 58.13 |
| 3 | S3 | 45×30cm | 53.33 |
| 4 | S4 | 60×30cm | 51.36 |
|  |  |
| **S.No.** | **Treatments** | **Treatment combination** | Plant population at 30 DAS (5 tagged plants per plot) |
| 1. | T1 | B1S1 (Flat bed+Broadcasting) | 53.73 |
| 2. | T2 | B1S2 (Flat bed +30×30 cm spacing) | 48.13 |
| 3. | T3 | B1S3 (Flat bed +45×30 cm spacing) | 55.46 |
| 4. | T4 | B1S4 (Flat bed +60×30 cm spacing) | 56.40 |
| 5. | T5 | B2S1 (Raised bed + Broadcasting) | 46.60 |
| 6. | T6 | B2S2 (Raised bed + 30×30 cm spacing) | 58.53 |
| 7. | T7 | B2S3 (Raised bed + 45×30 cm spacing) | 60.80 |
| 8. | T8 | B2S4 (Raised bed + 60×30 cm spacing) | 46.33 |
|  |  | **Factors** | **C.D.** | **SE(m) ±** |
|  |  | Factor A (Sowing methods) | 2.62 | 1.31 |
|  |  | Factor B (Spacing) | 2.04 | 1.02 |
|  |  | Factor (A×B) | 1.53 | 0.75 |

**Table 3 Number of Pods at 90 DAS of Soybean (5 tagged plants per plot)**

|  |  |
| --- | --- |
|  | **Main Plot** |
| **S. No.** | **Treatments** | **Sowing method** | Number of pods at 90 DAS (5 tagged plants per plot) |
| 1 | B1 | Flat bed | 17.21 |
| 2 | B2 | Raised bed | 17.76 |
|  | **Sub plot treatments** |  |
| 1 | S1 | Broadcasting | 17.06 |
| 2 | S2 | 30×30cm | 18.63 |
| 3 | S3 | 45×30cm | 18.50 |
| 4 | S4 | 60×30cm | 15.76 |
|  |  |
| **S.No.** | **Treatments** | **Treatment combination** | Number of pods at 90 DAS (5 tagged plants per plot) |
| 1. | T1 | B1S1 (Flat bed+Broadcasting) | 15.13 |
| 2. | T2 | B1S2 (Flat bed +30×30 cm spacing) | 18.86 |
| 3. | T3 | B1S3 (Flat bed +45×30 cm spacing) | 18.73 |
| 4. | T4 | B1S4 (Flat bed +60×30 cm spacing) | 16.13 |
| 5. | T5 | B2S1 (Raised bed + Broadcasting) | 19.00 |
| 6. | T6 | B2S2 (Raised bed + 30×30 cm spacing) | 12.66 |
| 7. | T7 | B2S3 (Raised bed + 45×30 cm spacing) | 18.26 |
| 8. | T8 | B2S4 (Raised bed + 60×30 cm spacing) | 21.13 |
|  |  | **Factors** | **C.D.** | **SE(m) ±** |
|  |  | Factor A (Sowing methods) | 1.72 | 0.86 |
|  |  | Factor B (Spacing) | 2.30 | 1.16 |
|  |  | Factor (A×B) | 1.99 | 1.01 |

**Table 4 Days to 50% flowering at 90 DAS of Soybean (5 tagged plants per plot)**

|  |  |
| --- | --- |
|  | **Main Plot** |
| **S. No.** | **Treatments** | **Sowing method** | Days to 50% floweringat 90 DAS (5 tagged plants per plot) |
| 1 | B1 | Flat bed | 40.16 |
| 2 | B2 | Raised bed | 39.91 |
|  | **Sub plot treatments** |  |
| 1 | S1 | Broadcasting | 40.66 |
| 2 | S2 | 30×30cm | 39.16 |
| 3 | S3 | 45×30cm | 40.00 |
| 4 | S4 | 60×30cm | 40.33 |
|  |  |
| **S.No.** | **Treatments** | **Treatment combination** | Days to 50% floweringat 90 DAS (5 tagged plants per plot) |
| 1. | T1 | B1S1 (Flat bed+Broad casting) | 40.33 |
| 2. | T2 | B1S2 (Flat bed +30×30 cm spacing) | 40.65 |
| 3. | T3 | B1S3 (Flat bed +45×30 cm spacing) | 40.66 |
| 4. | T4 | B1S4 (Flat bed +60×30 cm spacing) | 39.13 |
| 5. | T5 | B2S1 (Raised bed + Broadcasting) | 41.00 |
| 6. | T6 | B2S2 (Raised bed + 30×30 cm spacing) | 39.33 |
| 7. | T7 | B2S3 (Raised bed + 45×30 cm spacing) | 40.00 |
| 8. | T8 | B2S4 (Raised bed + 60×30 cm spacing) | 39.00 |
|  |  | **Factors** | **C.D.** | **SE(m) ±** |
|  |  | Factor A (Sowing methods) | 2.10 | 1.11 |
|  |  | Factor B (Spacing) | 1.92 | 0.96 |
|  |  | Factor (A×B) | 1.62 | 0.81 |