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Effect of spacing on different sowing dates on growth attributes of green gram (*Vigna radiata* L.)

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Abstract
A field experiment was carried out at Field experimentation center of the Department of Agriculture, Ideal College of Arts and Sciences (Vidyut Nagar), Kakinada, Andhra Pradesh (A.P.) during *Kharif* - 2023. The experiment was laid out in Randomized Block Design (RBD) with nine treatments including control which were replicated thrice. The treatments are as follows, Date of sowing – 12 – 07 – 2023, 04 – 08 – 2023 and 18 – 08 – 2023 and Plant geometry (line sowing, Dibbling and Broadcasting). It is concluded that treatment combination of 04 – 08 - 2023 with broadcasting reported higher growth parameters like plant height (67.5 cm) and dry weight (31.28 gm) and Number of nodules per plant (64.6) was reported in 12 – 07 - 2023 with broadcasting method. Number of branches per plant (8.4), number of pods per plant (21.0) and number of seeds per pod (11.00) reported higher with the combination of 12 – 07 - 2023 with dibbling method. Hence it is proved that date of sowing 12 – 07 - 2023 with dibbling method was recommended higher yield attributes.

Keywords: Broadcasting, dibbling, green gram, line sowing

Introduction
Green gram is considered a sattvic legume or a complete legume. (Bhishagratna, 1916) [2] Also known as mung beans, they nourish the tissues, are astringent, have a cooling sensation, and contribute to proper digestion due to their high fiber content. It is an ancient and well-known legume belonging to the Fabaceae family, with its origins in Southeast Asia (Mogotsi, 2006) [3]. Green gram ranks second among legumes in terms of nutritional value. It contains about 4 to 25% protein, which is about two-thirds of soybeans, twice as much as wheat, and three times as much as rice. This protein is relatively rich in lysine, which is not found in grains. Therefore, a diet combining green chickpeas and grains will result in a balanced amino acid diet. Every 100 g of green gram seeds contains 56 percent carbohydrates, 3.5 percent minerals, 4.1 percent fiber, 1.3 percent fat, ascorbic acid 4.8 mg, thiamine 0.621 mg, riboflavin 0.233 mg, niacin 2,251 mg, pantothenic acid 1,910 mg, and more. of vitamins, and 114 IU vitamin A, 132 mg calcium, 6.74 mg iron, 189 mg magnesium, 367 mg phosphorus, 124 mg potassium, and has a calorific value of 334. In its cultivation, soil fertility is improved by adding about 30-40 kg of N ha-1 after harvesting the crop. . The main producing states of green gram are Rajasthan, Madhya Pradesh, Uttar Pradesh, Odisha, Maharashtra, Karnataka and Bihar. In Karnataka, it occupies an area of 421.04 hectares with a production of 142.57 tons and a productivity of 330 kg ha-1 (Anon, 2019) [1]. It is clear that India's growing population poses a green gram crisis. Variety plays an important role in crop production and the yield potential of the variety within the genetic limits determined by the environment. Therefore, a combination of genotype and environmental factors can lead to increased production. Differences in yield between genotypes can be attributed to complex processes that occur in different parts of the plant and involve many physiological changes. These physiological changes are influenced by environmental factors prevalent at different stages of plant growth. The gap between potential and existing yields of green grass can be bridged by optimizing the spacing of different green grass varieties and achieving optimal plant population to improve their production. (Satyamoorthi *et al*., 2012) [9]. Optimal spacing requirements vary by crop and variety, growing season, and planting system. Most short-flowered legume varieties require close spacing, while long-flowered varieties thrive in wide spacing. Therefore, there is a need to develop cost-effective and ecosystem-friendly integrated crop production, pest and disease management strategies. However, there is a lack of information regarding the response of newly developed green gram varieties to different

sowing dates and agricultural practices in the transition zone of southern Karnataka. In this study, an attempt was made to identify suitable varieties using appropriate agronomic practices, i.e., sowing time, optimal spacing with appropriate amount of fertilizer. Spacing is one of the most important cultural practices to determine the grain yield. Stand density affects architecture, alters growth and development pattern and influence carbohydrate production and partition. Ideally spaced equidistantly from each other competes minimally for nutrients and other growth factors. Narrow rows make more efficient use of available light and also shade the surface soil completely during the early part of the season while the soil is still moist. This results in lower moisture evaporation from the soil surface. With the utilization of higher densities, it soon became clear that distribution within the row could be a limiting factor in wide rows, preventing the full expression of the crop yield potential (Malik, 2008) [4].

Materials and Methods

This study identifies the effects of different seed preparations on the growth and yield parameters of green gram and determines which are suitable for green gram. It was carried out to find a method of seed preparation. The experiment was designed in a randomized block design with 9 treatments and was repeated three times in *Kharif* 2023. Treatments include date of sowing (12-07-2023, 04-08-2023, 18-08-2023) and plant geometry (Dibbling, line sowing and broadcasting). Green gram seeds were primed with different priming agents at different concentrations and strengths for specific periods. After priming, the seeds were dried to their original moisture content at room temperature. Subsequently, the prepared seeds were used for cultivation under field conditions. The optimal spacing is 30 cm between rows and 10 cm between plants. Drilling is recommended to ensure even seed distribution.

Results

Plant Height: Highest plant height was recorded in T_6 with the combination of 04.08.2023 in broadcasting method (67.5) significantly higher when compared to other treatments and minimum was reported in f (39.2) with the combination of 04.08.2023 in dibbling method.

Nodules per plant: More number of nodules per plant was recorded in T_3 with the combination of 12.07.2023 in broad casting method (64.6), minimum was reported in T_4 (10.0) with the combination of 04.08.2023 in line sowing method and T_1 with the combination of 12.07.2023 in line sowing (62.8) was statistically at par with T_3.

Branches per plant: maximum number of branches per plant was recorded in T_2 in combination with 12.07.2023 in dibbling method (8.4) significantly higher when compared to other treatments and minimum was reported in T_7 in combination with 18.08.2023 in line sowing method (4.4).

Dry weight: Highest dry weight was recorded in T_6 in combination with 04.08.2023 in broad casting method (31.28) significantly higher when compared to other treatments and minimum was reported in T_5 in combination with 04.08.2023 in dibbling method (19.40).

Pods per plant: More number of pods per plant was recorded in T_2 in combination with 12.07.2023 in dibbling method (21.0) significantly higher when compared to other treatments and minimum was reported in T_8 in combination with 18.08.2023 in dibbling method (6.4).

Seeds per plant: More number of seeds per pod was recorded in T_2 in combination with 12.07.2023 in dibbling method (11.00) significantly higher when compared to other treatments and minimum was reported in T_7 in combination with 18.08.2023 in line sowing method (5.00).

Discussion

Plant height was significantly accelerated with an optimal spacing of 30 cm × 10 cm. This may be because if the plant canopy, especially the lower part, does not block enough incoming solar radiation, the plant tends to stretch towards the light. Similar results were reported by Rao *et al*. report. (2013) [5] and Singh *et al*. (2015) [6]. Green gram dry weight tended to increase with increasing harvest age. Total dry weight was significantly better when treated with chicken manure and 30 cm x 10 cm spacing than all treatments. This may be mainly due to the increased plant height maintained throughout the harvest period, which improves carbohydrate synthesis and ultimately increases dry weight production. Higher grain yields were observed when treated with chicken manure. The increased grain yield may be due to the increased supply of almost all essential nutrients to plants through the rearrangement of accumulated photosynthetic products under the influence of organic nutrient sources. Additionally, photosynthetic relocation and accumulation in economic sinks increased yield characteristics, chlorophyll content, and nitrate reductase activity, increasing grain yield. This may be due to reduced vegetative growth and increased reproductive growth due to optimal sowing, as well as delayed sowing and reduced number of seeds per pod. The same was also confirmed by the findings of his Yadav *et al*. clearly. (2007) [10]. Singh *et al*. (2010) [8] and Singh *et al*. (2013) [7] also reported similar results. High temperatures, rainfall, and wind speed during the reproductive period cause heavy bud and flower shedding, resulting in reduced number of pods per plant and delayed sowing of green gram.

Table 1: Effect of Spacing and dates of sowing on Growth and yield Attributes of Greengram.

	Plant height	Number of nodules per plant	Branches per plant	Dry weight	Number of pods per plant	Number of seeds per pod
T_1	48.8	62.8	6.2	24.67	14.6	10.00
T_2	41.3	56.8	8.4	20.09	21.0	11.00
T_3	41.6	64.6	7.8	21.33	13.6	8.00
T_4	53.8	10.0	5.2	29.49	12.0	7.00
T_5	39.2	18.2	6.0	19.40	18.8	9.00
T_6	67.5	20.6	5.8	31.28	14.0	9.00
T_7	44.0	26.0	4.4	23.15	8.2	5.00
T_8	40.2	30.4	7.0	20.19	6.4	6.00
T_9	57.4	31.0	4.8	28.16	7.2	6.00
Sem	0.59	0.70	0.11	0.30	0.21	0.11
Sed	0.84	0.98	0.15	0.43	0.30	0.15
C.V	2.14	3.38	2.98	2.18	2.85	2.33
C.D	1.78	2.08	0.32	0.91	0.64	0.32

Conclusion

Hence it is proved that date of sowing 12-07-2023 with dibbling method was recommended higher yield attributes.

Early sowing can extend the growing season, allowing crops more time to complete their life cycle and reach maturity. Sowing at the right time is crucial for achieving optimal yield and quality. Late sowing can lead to reduced yields due to a shorter growing season or exposure to adverse conditions during critical growth stages.

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