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Optimizing sowing dates for enhanced productivity of selected cultivars of red gram (*Cajanus cajan* L.)

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Abstract

A field experiment was conducted during the rabi season of 2025-2026 at the South Farm of Karunya Institute of Technology and Sciences, Coimbatore, to determine the optimum sowing time and suitable variety of red gram. The study included four varieties, namely CO (Rg) 7, VBN (Rg) 3, VBN 1 and ICPL 87, with three sowing dates (September 17, October 1 and October 15) arranged in a Randomised Block Design with three replications. Lower productivity in farmers' fields is often due to improper sowing time, unsuitable variety selection and poor crop management practices, among which sowing time and variety choice are critical. The results showed that sowing on 1st October (S2) recorded superior yield attributes and yield, with higher grain yield ($771.17 \text{ kg ha}^{-1}$), stover yield ($3953.08 \text{ kg ha}^{-1}$), pods per plant (61) and seeds per pod (4.00). Among the varieties, ICPL 87 (V4) produced the highest grain yield (831 kg ha^{-1}) and number of pods per plant (64.67). The better performance may be attributed to favourable environmental conditions during flowering and pod development, which enhanced assimilate translocation to the reproductive parts.

Keywords: CO (Rg) 7, ICPL 87, optimum sowing time, red gram, suitable variety, VBN (Rg) 3, VBN 1

1. Introduction

Red gram, also called Bengal gram or gram, is an important pulse crop in India with high economic value. It belongs to the family Leguminosae and serves as a rich source of nutrients, helping to improve the quality of the human diet. Mahaveer *et al.* (2020) [5]. To meet the growing global demand for food driven by population growth and rising per capita incomes, crop production will need to increase by approximately 60% by 2050 (Fischer *et al.*, 2014) [2]. India is the largest producer as well as consumer of red gram in the world. In the country, the crop is grown over an area of about 5.30 million hectares with a total production of 4.87 million tonnes and an average productivity of 913 kg per hectare (Sandeep *et al.*, 2021) [6]. Red gram is highly sensitive to photoperiod, and therefore, its growth and development are greatly influenced by the time of sowing. Important traits such as plant height, number of branches, height of first branching, flowering, and pod development vary with different sowing dates. Studies have indicated that the date of sowing significantly affects both the vegetative and reproductive phases of the crop. The interaction between the cultivar and the time of planting largely determines the growth, development and yield of red gram.

Since the sowing time decides the environmental conditions that the crop experiences during its critical growth stages, it plays an important role in determining crop performance. Proper selection of sowing time along with suitable cultivars helps in maintaining optimum plant population and ensures efficient utilisation of available resources such as nutrients, solar radiation and soil moisture. Identifying the appropriate sowing window and suitable red gram varieties can also help resource-poor farmers minimise the risk of crop failure, as they may not be able to afford additional production costs (Marimuthu *et al.*, 2024) [6].

By optimising sowing date and genotype selection, the study aims to improve crop productivity and promote sustainable farming practices in semi-arid regions under changing climatic conditions.

2. Materials and Methods

2.1 Location of the experiment

The experiment was conducted in the South Farm. The experimental site lies within the southern Agro-Climatic Zone of Tamil Nadu, located at 10°55'57.5" N latitude and 76°45'02.2" E longitude, Karunya Institute of Technology and Sciences, Coimbatore, during the rabi season 2025 to 2026

2.2 Experimental materials

The experiment was laid out in a Randomised Block Design with twelve treatment combinations and three replications. The treatments were randomly arranged in each replication. The treatments consisted of four red gram varieties, namely CO (Rg) 7, VBN (Rg) 3, VBN 1 and ICPL 87, along with three dates of sowing: September 17, October 1 and October 15. The treatment combinations were as follows: T₁ - CO (Rg) 7 sown on September 17, T₂ - VBN (Rg) 3 sown on September 17, T₃ - VBN 1 sown on September 17, T₄ - ICPL 87 sown on September 17, T₅ - CO (Rg) 7 sown on October 1, T₆ - VBN (Rg) 3 sown on October 1, T₇ - VBN 1 sown on October 1, T₈ - ICPL 87 sown on October 1, T₉ - CO (Rg) 7 sown on October 15, T₁₀ - VBN (Rg) 3 sown on October 15, T₁₁ - VBN 1 sown on October 15 and T₁₂ - ICPL 87 sown on October 15. The experimental field was thoroughly ploughed to obtain a fine seedbed. Fertilisers were applied as a basal dose. The red gram seeds were sown at the recommended spacing, and gap filling and thinning were carried out to maintain an optimum plant population in the field.

2.3 Statistical analysis

The experimental data were statistically analysed using analysis of variance (ANOVA) for a factorial randomised block design following the procedure described by Gomez and Gomez (1984)^[3]. The significance of treatment effects was tested at the 5% probability level.

3. Results and Discussion

The observations on growth parameters were presented in Table 1, and the results indicated that plant height, number of branches per plant, and dry matter production were significantly influenced by different sowing dates and redgram varieties. Significantly higher plant height at harvest (107.78 cm), greater number of branches per plant (14.00) and higher dry matter production (4694 kg ha⁻¹) were recorded when the crop was sown on 1st October (S2). This was followed by the crop sown on 17th September (S1), which recorded plant height of 104.13 cm, 13.41 branches per plant and dry matter production of 4300 kg ha⁻¹. The crop sown on 15th October (S3) recorded comparatively lower growth parameters with plant height of 102.22 cm, 11.08 branches per plant and dry matter production of 4110.56 kg ha⁻¹. The early sown crop (S2) exhibited vigorous growth and attained maximum height, while the delayed sowing (S3) resulted in reduced plant height.

The effect of varieties on growth parameters was also found to be significant. Among the cultivars, CO (RG) 7 (V1) recorded higher plant height (112.00 cm) and dry matter production (4769.22 kg ha⁻¹) at harvest compared to the other varieties. VBN (RG) 3 (V2) recorded plant height of 109.02 cm and dry matter production of 4525.66 kg ha⁻¹ along with 12.60 branches per plant. ICPL 87 (V4) produced a comparatively higher number of branches (13.55 per plant) but recorded lower plant height (92.97 cm) and dry matter production (4253.78 kg ha⁻¹). VBN 1 (V3) recorded relatively lower dry matter production (3924.00 kg ha⁻¹) with a plant height of 105.02 cm and 12.60

branches per plant.

Better growth under timely sowing can be linked to favourable environmental conditions during the vegetative stage. Sowing at the optimum time helped the crop experience suitable temperature, sufficient soil moisture and adequate light, which supported active growth. These conditions likely improved leaf development and photosynthetic activity, resulting in higher accumulation of assimilates. Consequently, plants attained greater height and produced more branches. The increase in branching may also be due to better nutrient uptake and efficient use of available resources during early growth. In general, timely sowing created a favourable environment for improved plant growth and development. Similar results on enhanced plant height and branching under favourable conditions were also reported by Thombre *et al.* (2019)^[8], Dahariya *et al.* (2018)^[1] and Sandeep *et al.* (2023)^[7].

3.2 Yield attributes and yield

The observations on yield attributes are presented in Table 2. The results showed that the number of pods per plant, seeds per pod, test weight, grain yield, stover yield and harvest index were markedly influenced by both sowing dates and varieties of redgram. The crop sown on 1st October (S2) recorded higher values for most yield parameters, including 61 pods per plant, 4.00 seeds per pod, test weight of 9.30 g, grain yield of 771.17 kg ha⁻¹, and stover yield of 3953.08 kg ha⁻¹. This was followed by the crop sown on 17th September (S1), which produced 60 pods per plant, 3.67 seeds per pod, 9.05 g test weight, grain yield of 744.83 kg ha⁻¹ and stover yield of 3590.83 kg ha⁻¹. The crop sown on 15th October (S3) recorded relatively lower values for these parameters, with 56 pods per plant, 3.58 seeds per pod, 8.78 g test weight, grain yield of 674.92 kg ha⁻¹ and stover yield of 3491.58 kg ha⁻¹. In terms of harvest index, S1 recorded a slightly higher value (17.44%) compared to S2 (16.41%) and S3 (16.38%).

Varietal differences were also evident for yield attributes. ICPL 87 (V4) produced the highest number of pods per plant (64.67) and grain yield (831 kg ha⁻¹), along with a higher harvest index (19.30%). CO (RG) 7 (V1) recorded a higher test weight (9.89 g), good grain yield (781 kg ha⁻¹) and the maximum stover yield (4168.56 kg ha⁻¹). VBN (RG) 3 (V2) showed moderate performance with 60.67 pods per plant and 3.78 seeds per pod, but lower grain yield (649.11 kg ha⁻¹) and harvest index (15.38%). VBN 1 (V3) recorded a higher test weight (9.97 g) with moderate grain yield (660.11 kg ha⁻¹) and comparatively lower stover yield (3332.56 kg ha⁻¹). The variation in yield attributes observed in the present study may be attributed to favourable conditions during the reproductive phase of the crop. The higher number of pods per plant and seeds per pod might be due to better availability of nutrients in the soil during pod formation and pod filling stages, which supported the development of more productive pods and seeds. Adequate nutrient supply during these critical stages would have enhanced reproductive growth and improved the overall efficiency of the crop.

The improvement in yield attributes ultimately contributed to higher grain yield. The significant variation in grain yield among different varieties and sowing dates indicates that both genetic makeup and time of sowing play an important role in determining productivity. The differences in yield could be due to variation in growth behaviour, assimilate partitioning and the ability of the crop to utilise available resources efficiently under different sowing environments.

The better performance observed under optimal sowing

conditions may be associated with favourable environmental factors during flowering and pod development stages, which enhanced photosynthesis and translocation of assimilates towards developing seeds. Similar findings on the influence of

nutrient availability, sowing time and varietal differences on yield attributes and grain yield have also been reported by earlier researchers involving Sandeep *et al.* (2023) ^[7], Kabir *et al.* (2009) ^[4] and Thombre *et al.* (2019) ^[8].

Table 1: Effects of sowing dates and cultivars on growth attributes

Treatment	Plant Height (CM)	No of branches per plant	DMP (kg ⁻¹ ha)
Sowing Dates(S)			
S ₁	104.13	13.41	4300
S ₂	107.78	14	4694
S ₃	102.22	11.08	4110.56
SEd	2.07	0.38	121.0099
CD (p = 0.05)	4.28	0.79	249.7523
Varieties (v)			
V ₁	112.00	8.83	4769.22
V ₂	109.02	12.6	4525.66
V ₃	105.02	12.6	324
V ₄	92.97	13.55	4253.78
SEd	2.39	0.44	139.7303
CD (p = 0.05)	4.94	0.92	288.3891
Interaction (S×V)			
SEd	4.14	0.77	242.0199
CD (p = 0.05)	8.55	1.59	499.5045

Table 2: Effects of sowing dates and cultivars on yield attributes and yield

Treatment	No of pods per plant	No of seeds per pod	Test weight	Grain yield	Stover yield	Harvest index
Sowing Dates(S)						
S ₁	60	3.67	9.05	744.83	3590.83	17.44
S ₂	61	4	9.30	771.17	3953.08	16.41
S ₃	56	3.58	8.78	674.92	3491.58	16.38
SEd	1.80	0.37	0.47	22.50	166.6664	0.88
CD (p = 0.05)	3.70	0.76	0.96	46.33	343.9826	1.81
Varieties (v)						
V ₁	51.33	3.78	9.89	781	4168.56	15.73
V ₂	60.67	3.78	7.64	649.11	3700.78	15.38
V ₃	59.33	3.67	9.97	660.11	3332.56	16.57
V ₄	64.67	3.58	8.68	831	3512.11	19.30
SEd	2.07	0.42	0.54	25.98	192.4498	1.01
CD (p = 0.05)	4.28	0.87	1.11	53.62	397.1969	2.09
Interaction (S×V)						
SEd	3.59	0.73	0.93	45	333.3328	1.76
CD (p = 0.05)	7.41	1.51	1.92	92.87	687.9652	3.62

Conclusion

The results indicate that both sowing dates and varieties had a marked effect on the growth and yield of redgram. The crop sown on 1st October (S₂) showed better growth in terms of plant height, number of branches and dry matter production, which ultimately led to improved yield attributes and higher yield. Among the varieties, ICPL 87 (V₄) and CO (RG) 7 (V₁) gave better performance with respect to yield and its components. In general, selecting the right sowing time along with suitable varieties is important for achieving better growth and higher productivity in redgram.

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