# Impacts of varying sowing dates on the profitability and production of cultivars of Pigeonpea (*Cajanus cajan* L. Mill sp.).

## Abstract

At the experimental farm of the College of Agriculture, Badnapur, VNMKV, Parbhani, a suitable range of field experiments were done during the kharif season, with an optimal time of sowing. The experiment was carried out using five varieties in the sub plot, $V_1$-BSMR-736, $V_2$-BSMR-853, $V_3$-BDN-711, $V_4$-BDN-708, and $V_5$-Vipula, and four sowing dates in the main plot, $D_1$: (15 $^{th}$ June), $D_2$: (30 $^{th}$ June), $D_3$: (15 $^{th}$ July), and $D_4$: (30$^{th}$ July). The soil had a medium-black color, a clayey texture, a high base saturation level, an alkaline reaction, and a higher concentration of total soluble salts. It also had low levels of nitrogen and phosphorus and high levels of potassium and lime. The dibbling method of sowing was used. According to the experiment's results, sowing of pigeonpea on June 15 $^{th}$ was the best date to achieve greater yield metrics, specifically number of pods per plant, pod weight plant$^{-1}$ (g), grain weight plant$^{-1}$ (g), and test weight (g). in addition to economic indicators including GMR (119080 Rs ha$^{-1}$), NMR (96573 Rs ha$^{-1}$), and B:C (5.29), in addition to harvest index (HI), biological yield (kg ha$^{-1}$) and seed yield (kg ha$^{-1}$). Comparatively speaking to the other kinds, the pigeonpea variety BSMR-736 was shown to be very prolific.

***Keywords*:** Genotype, Pigeonpea, Sowing dates, Varieties, Yield and Economics.

## Introduction

Pulses play a significant role in a diet that is primarily vegetarian and are a valuable source of protein that helps vegetarians meet their protein needs in a balanced and nutritious way. The most significant kharif grain legume crop is pigeonpea, also known as red gram, arhar, and tur [*Cajanus cajan* L. Millsp.]. It is a member of the Leguminoseae family, a subfamily of the papilionaceae family, and it originated in Africa. It can be grown in a broad pH range of 5 to 8, although it has the lowest harvest index (19%). It is a rich source of protein and amino acids, including lycine, tryocene, cysteine, and arginine. The non-monetary input of sowing time has a significant impact on the crop's growth and output. It guarantees perfect balance between the climatic rhythm and the vegetative and reproductive periods. The crop's ability to accumulate dry matter is influenced by the timing of seeding. A crop sown too early may accumulate too much dry matter and reduce podding, whereas a crop sown too late may diminish the buildup of biomass and, as a result, yield. Low pigeonpea grain yields are the consequence of sowing seeds after the optimal time (Kumar et al. 2005). Furthermore, different genotypes have varying productivity (Egbe et al., 2013), and each genotype is crucial to achieving the crop's potential yield.Sequence cropping systems may experience a delay in the seeding of subsequent crops, like wheat, due to the longer maturation times of long duration genotypes, which yield better yields than early maturing genotypes. All of these considerations led to the conduct of the current experiment in 2015, which sought to determine the ideal sowing timing as well as the suitable type of Pigeonpea for rainfed conditions.

## Material and Methods

Finding ideal sowing dates for Pigeonpea varieties, evaluating how well they perform at various sowing dates, and examining the interactions between Pigeonpea varieties and sowing dates were the objectives of the current investigation. The experiment's gross and net plot sizes were 7.2 X 5.0 m and 5.4 X 4.6 m, respectively. The varieties employed were BSMR-736, BSMR-853, BDN-711, BDN-708, and Vipula. The sowing was done using the dibbling method on June 15$^{th}$, June 30$^{th}$, July 15$^{th}$, and July 30$^{th}$, 2015 for $D_1$, $D_2$, $D_3$, and $D_4$, respectively, at a spacing of 90 cm x 20 cm. During sowing, the recommended dose of fertilizer (RDF)- 25:50:00 NPK kg ha$^{-1}$was administered. The experiment's growth observations were recorded at 30-day intervals from the start of the experiment until harvest, in order to assess the influence of the treatment. Meanwhile, observations on the features that contribute to yield and post-harvest investigations were documented at the appropriate stages. During the $D_1$, $D_2$, $D_3$, and $D_4$sowing dates, the crop was harvested on December 25$^{th}$, 2015, January 9$^{th}$, 2016, January 25$^{th}$,2016 and February 9$^{th}$, 2016, correspondingly, at the maturity stage.

## Result and Discussion

The different treatments had a considerable impact on the mean pod yield (g) per plant. The pod yield per plant recorded on June 15$^{th}$ was much higher at (74.20 g). This was followed by June 30$^{th}$ at (60.51 g), July 15$^{th}$ at (52.70 g) and July 30$^{th}$ at (43.05 g). Mishra (2008) both came to similar conclusions. In comparison to BSMR-853, BDN-711, Vipula, and BDN-708, variety BSMR-736 performed noticeably better in terms of yield attributing characteristics, such as number of pods per plant, pod weight per plant, seed yield per plant, and test weight (Table No. 1). The varieties genetic composition may be the likely cause of this, as it has improved photosynthetic activity through enhanced source capacity and effective photosynthate translocation to the sink (seed). Improvements in Pigeonpea varieties with distinct genetic compositions were noted by Singh *et al.* (2014).

It was found that the mean seed yield (g plant$^{-1}$) varied significantly between the sowing dates. The highest mean seed yield (41.67 g plant$^{-1}$) was obtained from the June 15$^{th}$ sowing. This was followed by sowings on June 30th (38.83 g plant$^{-1}$), July 15th (34.73 g plant$^{-1}$), and July 30$^{th}$ (29.77 g). The similar result was reported by Dialoke *et al.* (2014) and Reddy *et al.* (2012).Pod formation started 120 DAS, and pod development proceeded until it reached maturity. Genotype BSMR-736 showed a higher potential for yield compared to BSMR-853, BDN-711, Vipula, and BDN-708; it produced significantly more pods and seed per plant. (Table no. 2). Results from Tuppad *et al.* (2012) and Bharathkumar *et al.* (2015) were comparable.

Various sowing dates were found to have no significant impact on the test weight (100 seeds). On June 15$^{th}$, however, the sowing date of 11.51 g produced the greatest test weight, which was then followed by June 30$^{th}$, June 15$^{th}$, July 15$^{th}$, and July 30$^{th}$, 10.11 g. Reddy and colleagues (2015) and Singh *et al.* (2006) reported comparable outcomes. The Pigeonpea varieties exhibited a commendable performance concerning seed yield, as indicated by Table No. 2, which exhibited a comparable tendency to yield features. Vipula, BDN-711, BSMR-853, and BDN-708 were all considerably inferior to the greater seed production of 930 kg ha$^{-1}$ that the Pigeonpea variety BSMR-736 reported. The improved various yield attributing features may indicate a higher production efficiency, which could account for the observed rise in seed yield of the BSMR-736 genotype. Parmeshwarappa (2002), Tuppad *et al.* (2012) and Saxena *et al.* (2014) all reported findings that were similar.

(Table no. 2) presents information on mean seed yield kg ha$^{-1}$ as influenced by various sowing dates. The information revealed that, compared to the other sowing dates, the sowing on June 15$^{th}$ had a noticeably greater mean seed yield (1456 kg ha$^{-1}$). The seeding on June 30$^{th}$, 1324 kg ha$^{-1}$, came in second place, ahead of the sowing on July 15$^{th}$, 1165 kg ha$^{-1}$, and July 30$^{th}$, 987 kg ha$^{-1}$. Reddy *et al.* (2012), Dialoke *et al.* (2014 b) and Patel and Mehta (2001) all reported findings that were similar. Different sowing dates were shown to have a substantial impact on the amount of straw yield kg ha$^{-1}$. In comparison to the other treatments, the seeding on June 15$^{th}$ produced the highest mean straw yield kg ha$^{-1}$ (5161 kg ha$^{-1}$). The sowing on June 30$^{th}$, at (4986 kg ha$^{-1}$), came in second, followed by July 15$^{th}$, at (4672 kg ha$^{-1}$), and July 30$^{th}$, at (4211 kg ha$^{-1}$). Tuppad *et al.* (2012) also found comparable outcomes. It was discovered that there was significant data on biological yield kg ha$^{-1}$ as influenced by various sowing dates. In comparison to the other treatments, the seeding on June 15$^{th}$ produced a mean biological yield that was substantially greater at (6617 kg ha$^{-1}$).

The sowing dates of June 30$^{th}$, (6310 kg ha$^{-1}$), July 15$^{th}$, (5837 kg ha$^{-1}$), and July 30$^{th}$, (5198 kg ha$^{-1}$), came in second and third, respectively. Prasad *et al*. (2014) reported the same outcomes.When compared to BDN-711, Vipula, and BDN-708, the Pigeonpea varieties BSMR-736 performed much better and achieved a biological yield of (2912 kg ha$^{-1}$) that was comparable to variety BSMR-853. increased biomass potential and more dry matter buildup may be the cause of BSMR-736's increased biological yield when compared to BSMR-853, BDN-711, Vipula, and BDN-708. The results of Nadaf A. A. (2014), Bharatkumar *et al.* (2015), and Sonwane *et al*. (2015) are consistent with these findings.Data on harvest index showed that there was no any significant effect of sowing dates on harvest index. The highest harvest index was observed (22.04) by the sowing at (15$^{th}$ June). Same result was reported by R.S. Singh (2006). The performance of Pigeonpea varieties differed significantly in harvest index (Table no. 2). The varieties BSMR-736 recorded higher harvest index as compared to BSMR-853, BDN-711, Vipula and BDN-708 which might be due to its higher production efficiency similar trend was observed by Sonwane *et al*. (2015).

The data on gross monetary returns it was revealed that the sowing of (15$^{th}$ June) gave highest gross monetary returns (119080Rs ha$^{-1}$) followed by sowing date 30$^{th}$ June (108430Rs ha$^{-1}$), 15$^{th}$ July (95541 Rs ha$^{-1}$) and 30$^{th}$ July (82451 Rs ha$^{-1}$). The data on gross monetary returns it was revealed that the variety BSMR-736 gave highest gross monetary returns (117280 Rs ha$^{-1}$) which was significantly superior over BSMR-853(106830 Rs ha$^{-1}$), BDN-711(100690 Rs ha$^{-1}$), Vipula (94620 Rs ha$^{-1}$) and BDN-708 (87465 Rs ha$^{-1}$).

The data on net monetary returnsha$^{-1}$revealed that the sowing of (15$^{th}$ June) gave higher net monetary returns (96573 Rs ha$^{-1}$) followed by 30$^{th}$ June sowing date (85922 Rs ha$^{-1}$), 15$^{th}$ July (73033 Rs ha$^{-1}$) and 30$^{th}$ July sowing date (58610 Rs ha$^{-1}$). The data on net monetary returns/ha revealed that the variety BSMR-736 gave higher net monetary returns (94767 Rs ha$^{-1}$) which was significantly superior over BSMR-853 (84323 Rs ha$^{-1}$), BDN-711(76512 Rs ha$^{-1}$), Vipula (72112 Rs ha$^{-1}$) and BDN-708 (64957 Rs ha$^{-1}$).

Data on benefit: cost ratio it was seen that the sowing of (15$^{th}$ June) gave higher Benefit:Cost ratio (5.29) followed by the sowing date 30$^{th}$ June (4.81), 15$^{th}$ July (4.24) and 30$^{th}$ July (3.60). Data on Benefit:Cost ratio it was seen that variety BSMR-736 gave higher Benefit:Cost ratio (5.21) followed by BSMR-853 (4.74), BDN-711 (4.40), Vipula (4.20) and BDN-708 (3.88).

**Table 1:Mean No. Pods plant$^{-1}$,Pod yield plant$^{-1}$ (g),Seed yield plant$^{-1}$ (g)and Seedindex of Pigeonpea as influenced by various treatment at harvest.**

| Treatments | No. of pods plant$^{-1}$ | Pod weight plant$^{-1}$ (g) | Grain weight plant$^{-1}$ (g) | Test weight (g) |
|---|---|---|---|---|
| **Sowing dates (D)** | | | | |
| $D_1$:15$^{th}$ June | 172.54 | 74.20 | 41.67 | 11.51 |
| $D_2$:30$^{th}$ June | 141.13 | 60.51 | 38.83 | 11.15 |
| $D_3$:15$^{th}$ July | 122.57 | 52.70 | 34.73 | 10.66 |
| $D_4$: 30$^{th}$ July | 99.93 | 43.05 | 29.77 | 10.11 |
| SE ± | 2.38 | 0.80 | 0.53 | 0.33 |
| CD at 5 % | 6.61 | 2.23 | 1.46 | 0.93 |
| **Varieties (V)** | | | | |
| $V_1$: BSMR-736 | 156.09 | 67.11 | 40.66 | 11.64 |
| $V_2$: BSMR-853 | 142.18 | 61.13 | 38.24 | 11.14 |
| $V_3$: BDN-711 | 136.14 | 58.32 | 35.86 | 10.60 |
| $V_4$: BDN-708 | 111.16 | 47.79 | 32.11 | 10.37 |
| $V_5$: VIPULA | 124.66 | 53.72 | 34.39 | 10.54 |
| SE ± | 3.88 | 1.29 | 1.23 | 0.41 |
| CD at 5 % | 10.75 | 3.57 | 3.42 | 1.16 |
| **Interaction (D x V)** | | | | |
| SE ± | 7.76 | 2.58 | 2.47 | 0.83 |
| CD at 5 % | NS | NS | NS | NS |
| **General Mean** | **134.05** | **57.62** | **36.25** | **10.86** |

**Table 2: Mean seed yield, straw yield, biological yield (kg ha$^{-1}$) and harvest index as influenced by various treatments.**

| Treatments | Seed yield (kg ha$^{-1}$) | Straw yield (kg ha$^{-1}$) | Biological yield (kg ha$^{-1}$) | Harvest index (%) |
|---|---|---|---|---|
| **Sowing dates (D)** | | | | |
| $D_1$:15$^{th}$ June | 1456 | 5111 | 6567 | 22.17 |
| $D_2$:30$^{th}$ June | 1324 | 5036 | 6360 | 20.81 |
| $D_3$:15$^{th}$ July | 1165 | 4672 | 5837 | 19.98 |
| $D_4$:30$^{th}$ July | 987 | 4211 | 5198 | 19.01 |
| SE ± | 22.77 | 50.63 | 56.45 | - |
| CD at 5 % | 63.02 | 140.12 | 156.24 | - |
| **Varieties (V)** | | | | |
| $V_1$: BSMR-736 | 1433 | 5189 | 6623 | 21.62 |
| $V_2$: BSMR-853 | 1305 | 4805 | 6110 | 21.31 |
| $V_3$: BDN-711 | 1207 | 4750 | 5958 | 20.21 |
| $V_4$: BDN-708 | 1065 | 4453 | 5518 | 19.30 |
| $V_5$: VIPULA | 1154 | 4590 | 5744 | 20.08 |
| SE ± | 47.32 | 130.91 | 136.87 | - |
| CD at 5 % | 130.96 | 362.29 | 378.80 | - |
| **Interaction (D x V)** | | | | |
| SE ± | 94.64 | 261.81 | 273.75 | - |
| CD at 5 % | NS | NS | NS | - |
| **General Mean** | **1233** | **4757** | **5991** | **20.51** |

**Table 3: Gross monetary returns (Rs ha$^{-1}$), net monetary returns (Rs ha$^{-1}$)and Benefit : Cost (B:C) ratio as influenced by different treatments.**

| Treatments | Gross monetary returns (Rs ha$^{-1}$) | Net monetary return (Rsha$^{-1}$) | B:C ratio |
|---|---|---|---|
| **Sowing dates (D)** | | | |
| $D_1$:15$^{th}$ June | 119080 | 96573 | 5.29 |
| $D_2$: 30$^{th}$ June | 108430 | 85922 | 4.81 |
| $D_3$:15$^{th}$ July | 95541 | 73033 | 4.24 |
| $D_4$: 30$^{th}$ July | 82451 | 58610 | 3.60 |
| SE ± | 1124.3 | 1107.1 | - |
| CD at 5 % | 3111.5 | 3063.8 | - |
| **Varieties (V)** | | | |
| $V_1$: BSMR-736 | 117280 | 94767 | 5.21 |
| $V_2$: BSMR-853 | 106830 | 84323 | 4.74 |
| $V_3$: BDN-711 | 100690 | 76512 | 4.40 |
| $V_4$: BDN-708 | 87465 | 64957 | 3.88 |
| $V_5$: VIPULA | 94620 | 72112 | 4.20 |
| SE ± | 2329 | 2151.5 | - |
| CD at 5 % | 6445.7 | 5954.2 | - |
| **Interaction (D x V)** | | | |
| SE ± | 4658.1 | 4302.9 | - |
| CD at 5 % | NS | NS | - |
| **General Mean** | **101380** | **78534** | **4.48** |

**Conclusion**

The early sowing on June 15th was shown to be the most effective date for achieving increased seed production and GMR, NMR, and B:C ratio among other Pigeonpea sowing dates, based on a season of field experiments. In comparison to BSMR-853, BDN-711, VIPULA, and BDN-708, it was discovered that the Pigeonpea variety BSMR-736 was very prolific. To make a meaningful conclusion, though, more validation is needed as the results are based on a single year of study.

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