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# Standardization of crop geometry and nutrient management for *Rabi* pigeonpea

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**Abstract**
The experiment has been conducted at experimental farm of S K College of Agriculture & Research Station, Kawardha on a clayey soil during *Rabi* season of 2016-17. The experiment has carried out in four replications under Factorial Randomized Completely Block Design (FRCBD). Under the main factor was spacing and different nutrient management practices taken as sub factor in 9 $m^{-2}$ (3.6x2.5 m). Three spacing $G_1$ – 30 cm X 15 cm, $G_2$ – 45 cm X 15 cm, $G_3$ – 60 cm X 15 cm and three nutrient management $F_1$ – FYM at 5.0 t $ha^{-1}$ + RDF (NPKS:: 20-50-20-20 kg $ha^{-1}$), $F_2$ – $F_1$ + 2% Urea + 0.50% Borax spray at Flower initiation, $F_3$ – $F_1$ + 0.2% Multi micronutrient spray at 50% Flowering. The production of Seed yield (1224 kg $ha^{-1}$), Stover yield (5479 kg $ha^{-1}$) and economics in terms of gross return (Rs. 61217 $ha^{-1}$), Net return (Rs. 42825 $ha^{-1}$) and maximum B:C ratio (2.32) has strongly supported to closer spacing ($G_1$ – 30x15 cm), which is significantly higher than rest the treatments. Moreover, $F_2$ in sub plot found more superior for yield and economy as well. Similar superior result of main plot and subplot has been showing in interaction of $G_1$ and $F_2$.

**Keywords:** Crop geometry, nutrient management, rabi pigeonpea and standardization etc.

## Introduction
Pulses form an integral part of vegetarian diet in Indian subcontinent. In India, pulses have been cultivated since time immemorial under rainfed situations which is characterized by poor soil fertility and moisture stress. These crops are energy rich but cultivated largely under energy starving situations. Unlike in cereals, varietal breakthrough in pulses has not been taken place. In India total pulse occupies 25.43 m ha area and contributes 17.21 m tonnes production with an average productivity of 679 kg $ha^{-1}$ (Anonymous, 2014a). During the last four decades, the total area under pulses remained virtually stagnant (22 to 24 million ha) with almost stable production (12 to 14 million tonnes), even though the population has been increased. As a result, per capita availability of pulses has been declined from 60.7 g per day in 1951-52 to 47.2 g per day (Indiastat, 2014) [2] as against FAO/WHO's recommendation of 80 g per day. It has led to the severe shortage of pulses in India, which has aggravated the problem of malnutrition in large section of vegetarian population.
In Chhattisgarh it occupies an area of 52.85 thousand ha with production of 23.68 thousand tones with average productivity 448 kg $ha^{-1}$. Pigeonpea is grown in *kharif* season throughout the country. To explore the possibility of growing pigeonpea in within season a sincer affort is required with newly released photo insensitive cultivar. This crop is binneal in nature therefor, it can also be growing in *rabi* season. Thus, there is an urgent need to increase the production of pulses to meet the increasing demand by adopting the appropriate production technologies.
There are a lot of work has been done by different scientist in this direction but no work has been done by any scientist in *rabi* Pigeonpea for this region of Chhattisgarh.

## Materials and Methods
An experiment has conducted at research/experimental farm of Sant Kabir College of Agriculture & Research Station, Kawardha during *Rabi* season of 2016-17. The net plot size of the experimental plot has been taken in 3.6 m X 2.5 m = 9 $m^{-2}$ The soil of farm is clayey, neutral in pH, OC is 0.65%, Available N, P and Exchangeable K (kg $ha^{-1}$) is 217 (low), 12.2 (medium) and 368.1 (high), respectively. In general, weather conditions were favorable for plant growth and no pest and diseases to be noticed during the period of experimentation. The experiment has been carried out under Factorial Randomized Completely Block Design (FRCBD) with four replications. The spacing was under main factor treatment having three spacing levels G1 – 30 cm X 15 cm, G2 – 45 cm X 15 cm and G3 – 60 cm X 15 cm and the

nutrient management was under sub factor which has also three levels F1 – FYM at 5.0 t ha$^{-1}$ + RDF (NPKS:: 20-50-20-20 kg ha$^{-1}$), F2 – F1 + 2% Urea + 0.50% Borax spray at flower initiation stage, F3 – F1 + 0.2% Multi micronutrient spray at 50% Flowering and the standard and recommended fertilizer dose has been applied. The shallow furrows have manually opened in each plot as per treatment the package of recommended practices has been adopted as required to maintain the crop.

**Results and Discussion**

**1. Effect of different crop geometry (spacing) on yield and Economics of *rabi* pigeonpea**

The experiment has been carried out in on pigeonpea crop in *rabi* season at experimental field of SK college of Agriculture and research Station, Kawardha. Seed yield and stover yield (kg ha$^{-1}$) has been observed under the spacing parameters. Seed yield and Stover yield found maximum when the spacing is minimum 1224 and 5479 kg ha$^{-1}$ respectively (Table 1). Similar trend of Cost of cultivation, Gross return and Net return (18392 Rs ha$^{-1}$, 61217 Rs ha$^{-1}$ and 42825 Rs ha$^{-1}$) as yield and showed maximum on the 30 x 15 cm spacing.

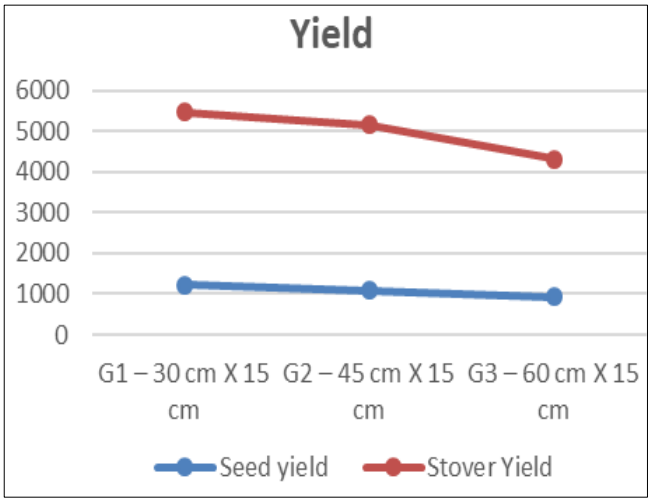


**Fig 1:** Effect of spacing on yield of *rabi* pigeonpea

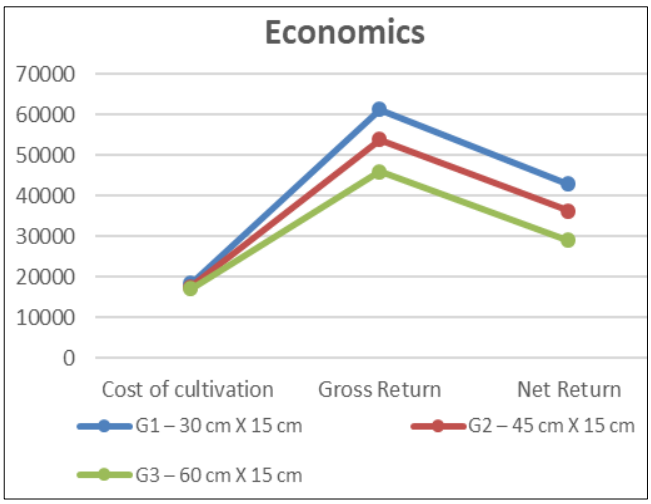


**Fig 2:** Effect of spacing on economics of *rabi* pigeonpea

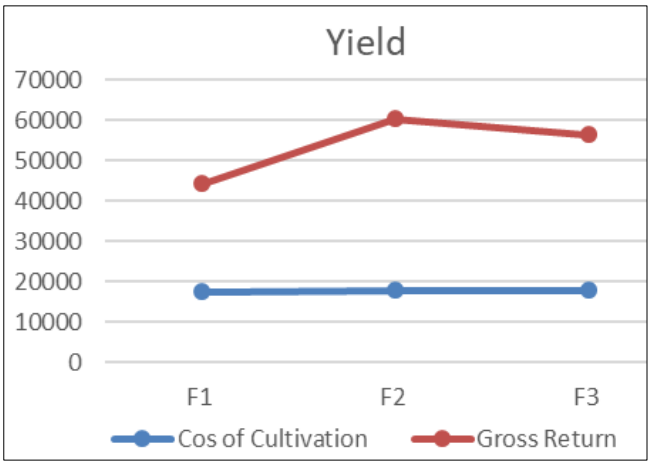


**Fig 3:** Effect of nutrient management on yield of *rabi* pigeonpea

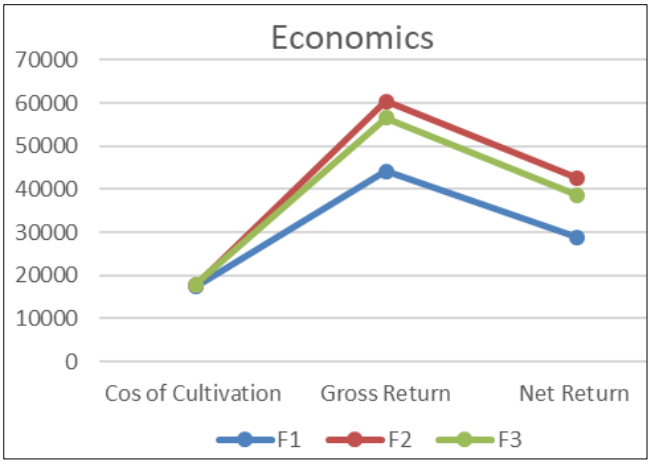


**Fig 4:** Effect of nutrient management on economics of *rabi* pigeonpea

**2. Effect of different Nutrient Management Practice (Fertilizer levels) on yield and Economics of *rabi* pigeonpea**

Table 2 showed that fertilizer levels $F_1$ $F_2$ and $F_3$ has an important role under the experiment. Maximum seed yield and stover yield 1207 kg ha$^{-1}$ and 5659 kg ha$^{-1}$ respectively has been recorded in $F_2$ followed by $F_3$. $F_1$ showed minimum in seed yield and stover yield. Similarly maximum Cost of cultivation1 7735 Rs ha$^{-1}$, Gross return 60333 Rs ha$^{-1}$ and Net return 42598 rs ha$^{-1}$ have been found in $F_2$ ($F_1$ (FYM at 5.0 t ha$^{-1}$ + RDF) + 2% Urea + 0.50% Borax spray at Flower initiation).

**3. Interaction effect of yield and net return of Pigeonpea as influenced different crop geometry and nutrient management practices**

Maximum seed yield 1512.50 Kg ha$^{-1}$ recorded in $G_1$ 30 cm x 15cm and $F_2$ ($F_1$ (FYM at 5.0 t ha$^{-1}$ + RDF) + 2% Urea + 0.50% Borax spray at Flower initiation) followed by $G_1$ and $F_3$. Minimum seed yield recorded in $G_2$ and $F_1$ (842.50 kg ha$^{-1}$) followed by $G_3$ and $F_2$ (889.50 Kg ha$^{-1}$). Moreover, maximum net return 57160 Rs ha$^{-1}$ and minimum net return 24861 Rs ha$^{-1}$ has been recorded in similar trend of seed yield (Table 2).

**4. Statistical significance**

The standard error of mean for seed yield has been recorded 43.9 and the critical difference was 128 at 5% level of significance. Which showed that crop geometry $G_1$ (1224 kg $ha^{-1}$) 30cm x 15cm is statistically significant and higher than $G_2$ (1076 Kg $ha^{-1}$). $G_3$ has significantly lower than $G_1$ and $G_2$ respectively.

Stover yield is also significantly higher in $G_1$ (5479 kg $ha^{-1}$) than $G_2$ and $G_3$. S.Em for stover yield is 135.89 and CD value at 5% level is 396.64. Coefficient of Variation (CV) value for seed yield and Stover yield has been recorded as 14.18 ad 9.44% respectively.

SEm and CD values has same as Crop geometry and $F_2$ has reported significantly higher than $F_3$ and $F_1$. Harvest index found non-significant difference Crop geometry and Fertilizer level as well. Harvest index has been found Non-Significant for both Crop geometry and fertilizer level. Islam *et al.* (2008) [4] also reported the same study about *rabi* Pigeon pea on different date of sowing from the interval of a week from third week of October to next 8 weeks and reported that the late sown crop took more time to attain 50% flowering but the active reproductive phase in those treatments (i.e. pod initiation to maturity) was very much shortened. In case $D_6$, $D_7$ and $D_8$ was 41, 36, 37 days respectively as against 64, 76, 54 and 49 days in case of $D_1$, $D_2$, $D_3$ and $D_4$ respectively.

Basu and Bandhyopadhyay (2009) [1] reported that early irrigation showed significant increase in pod numbers over rainfed condition whereas late one applied at pod formation stage failed to do so. Three irrigations applied at all the three stages produced highest pod number among all treatment combinations. This confirms with observations recorded by Patel and Patel (1995) [5]. Mahalakshmi *et al.* (2011) [6] conducted an experiment with 8 treatments (different level of drip irrigation) and three replications. All the yield attributing characters *viz*., number of pod $plant^{-1}$, Seed $pod^{-1}$ and Pod weight $plant^{-1}$ were higher in $I_2$, $I_3$ and $I_6$. Lowest yield was observed with $I_1$ treatment.

**Table 1:** Effect of different crop geometry (spacing) on yield and Economics of *rabi* pigeonpea

| Treatments | Seed Yield (kg $ha^{-1}$) | Stover Yield (kg $ha^{-1}$) | Harvest Index (%) |
|---|---|---|---|
| $G_1$ – 30 cm X 15 cm | 1224 | 5479 | 18.2 |
| $G_2$ – 45 cm X 15 cm | 1076 | 5154 | 17.2 |
| $G_3$ – 60 cm X 15 cm | 920 | 4319 | 17.7 |

**Table 2:** Effect of different Nutrient Management Practice (Fertilizer levels) on yield and Economics of *rabi* pigeonpea

| Treatments | Cost of Cultivation (Rs. $ha^{-1}$) | Gross Return (Rs $ha^{-1}$) | Net Return (Rs $ha^{-1}$) | B: C Ratio |
|---|---|---|---|---|
| $F_1$ – FYM at 5.0 t/ha + RDF | 17410 | 44217 | 28806 | 1.54 |
| $F_2$ – $F_1$+2% Urea+0.50% Borax spray at Flower initiation | 17735 | 60333 | 42598 | 2.38 |
| $F_3$ – $F_1$+0.2% Multi micronutrient spray at 50% Flowering | 17840 | 56497 | 38657 | 2.16 |

**Table:** Statistically significance of Crop geometry and fertilizer levels

| Treatments | Seed Yield (kg $ha^{-1}$) | Stover Yield (kg $ha^{-1}$) | Harvest Index (%) | Cost of cultivation (Rs. $ha^{-1}$) | Gross Return (Rs $ha^{-1}$) | Net Return (Rs $ha^{-1}$) | B: C Ratio |
|---|---|---|---|---|---|---|---|
| **Factor (A) – Crop geometry** | | | | | | | |
| $G_1$ – 30 cm X 15 cm | 1224 | 5479 | 18.2 | 18392 | 61217 | 42825 | 2.32 |
| $G_2$ – 45 cm X 15 cm | 1076 | 5154 | 17.2 | 17516 | 53814 | 36298 | 2.07 |
| $G_3$ – 60 cm X 15 cm | 920 | 4319 | 17.7 | 17080 | 46017 | 28937 | 1.69 |
| S.Em± | 43.9 | 135.89 | 0.73 | | 2197 | 2197 | 0.124 |
| CD (P=0.05) | 128 | 396.64 | NS | | 6414 | 6414 | 0.362 |
| CV % | 14.18 | 9.44 | | | 14 | | |
| **Factor (B) – Fertilizer levels** | | | | | | | |
| $F_1$ – FYM at 5.0 t/ha + RDF | 884 | 4084 | 17.8 | 17410 | 44217 | 28806 | 1.54 |
| $F_2$ – $F_1$+2% Urea+0.50% Borax spray at Flower initiation | 1207 | 5659 | 17.3 | 17735 | 60333 | 42598 | 2.38 |
| $F_3$ – $F_1$+0.2%Multi micronutrient spray at 50% Flowering | 1130 | 5210 | 17.9 | 17840 | 56497 | 38657 | 2.16 |
| S.Em± | 43.9 | 135.89 | 0.73 | | 2197 | 2197 | 0.124 |
| CD (P=0.05) | 128 | 396.64 | NS | | 6414 | 6414 | 0.362 |

**Table 4:** Interaction effect of yield and net return of Pigeonpea as influenced different crop geomatry and nutrient management practices

| Treatments | Seed Yield (kg $ha^{-1}$) | | | Net Return (Rs. $ha^{-1}$) | | |
|---|---|---|---|---|---|---|
| **Factor (A) – Crop geometry/Factor (B) – Fertilizer levels** | $F_1$ | $F_2$ | $F_3$ | $F_1$ | $F_2$ | $F_3$ |
| $G_1$ – 30 cm X 15 cm | 907.75 | 1512.50 | 1252.75 | 27247 | 57160 | 44067 |
| $G_2$ – 45 cm X 15 cm | 842.50 | 1218.00 | 1168.33 | 24861 | 43311 | 40722 |
| $G_3$ – 60 cm X 15 cm | 902.75 | 889.50 | 968.75 | 28309 | 27322 | 31179 |
| S.Em± | 76 | | | 3806 | | |
| CD (P=0.05) | 222 | | | 11109 | | |

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