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# STUDIES ON GROWTH AND YIELD OF *KABULI* CHICKPEA (*CICER ARIETINUM* L.) GENOTYPES UNDER DIFFERENT PLANT DENSITIES AND FERTILITY LEVELS

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## ABSTRACT

**A field experiment was carried out during the rabi season of the year 2008-2009 to find out the studies on growth and yield of *Kabuli* chickpea (*Cicer arietinum* L.) genotypes under different plant densities and fertility levels. Genotype 'Phule G 95333' recorded higher growth and yield attributes , grain and straw yield than genotype 'Phule G 0515' . 33 plants/m$^2$ showed that significantly higher grain and straw yield , whereas number of pods/ plant and grain yield /plant were higher with 22 plants/m$^2$ . As regards the effect of higher fertility level 30 kg N + 60 kg $P_2O_5$ + 30 kg $K_2O$ + 20 kg S/ha produced significantly higher values of growth and yield attributes, grain and straw yield compared to lower fertility level 20 kg N + 40 kg $P_2O_5$ + 20 kg $K_2O$ + 20 kg S/ha**

**Key word** : Genotype, Plant densities, Fertility level, Growth, Yield, Chickpea (*Kabuli*)



Chickpea (*Cicer arietinum* L) is an important pulse crop growing all over the country in *rabi* season. In India it is grown on an area about 7710 thousand hectares with an annual production of 5600 thousand tones and average yield of 726 kg/ha (Anonymous -2006,A). Madhya Pradesh is the largest producer of chickpea, which covers 2561 thousand hectares area with the total annual production of 2371 thousand tones with an average production of 927 kg/ha (Anonymous - 2006,B). Chickpea contributes 47% of the total pulse production and about 40% of total pulse growing area in the country. Chickpea being a leguminous crop improves soil fertility by fixing atmospheric nitrogen up to 99 kg/ha (Schwenke *et al.*1998) in available from ($NH_3$ and $NH_4$) in the root through the phenomana of symbiosis. Looking to the decrease in available nitrogen content in soil and to fulfill initial requirement of the plants nitrogen is required and it is supplied through fertilizer. Phosphorus is one of the most important major nutrient of plant and *kabuli* chickpea also responds significantly to phosphorus application (Siag, 1995) Phosphorus contributes directly to both the yield and quantity of chickpea. And plays an important role in physiological function of the plant. Potassium and sulphur are also required for higher yield of chickpea. Plant density is one of the important characters , which can be manipulated to obtain the maximum production from per unit land area. The optimum plant density with proper geometry of planting is depending on variety, its growth habit and agro-climatic condition. The seed yield of chickpea is highly dependent on plant population (Ayaz *et al.*

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1999). Seed yield increases with increased plant density up to an optimum, which changes according to genotype.

The field experiment was conducted at the research farm of R.A.K. College of Agriculture , Sehore (M.P.) during the *rabi* season of 2008-2009 . The experiment was aimed to find out optimum plant densities and economic dose of fertilizer under various genotypes. The soil depth of the experimental area was 2-3 m, medium black clay loam in texture with slightly alkaline (pH 7.8), low in available nitrogen (151.2 kg/ha), medium in available phosphorus (13.8 kg./ha) , high in available potash (308 kg/ha) . The experiment consisted of eight treatment combinations of two genotypes Phule G 95333 (bold seeded ,42.0 g seed index) and Phule G 0515 ( extra large seeded ,62.5 g seed index) two plant densities 33 plants/$m^2$ (30x10cm) and 22 plants/ $m^2$ (45x10cm) and two fertility levels 20 kg N + 40 kg $P_2O_5$ + 20 kg $K_2O$ + 20 kg S and 30 kg N + 60 kg $P_2O_5$ + 30 kg $K_2O$ + 20 kg S/ha were replicated three times in a factorial randomized block design with a gross plot size of 5.0 m x 2.7 m and net plot size 4.5 m x 1.8 m. The experiment was conducted under rainfed condition. However, one light pre-sowing (palewa) irrigation was given for better germination and date of sowing was 30th November, 2008. The different dose of fertilizer as per the treatment were applied in the form of DAP, single super phosphate, muriate of potash, urea and gypsum, respectively as basal dose at the time of sowing. Crop was harvested 13th March, 2009.

**Relative performance of genotype**

Genotype 'Phule G 95333' recorded significantly higher in various growth characters, yield attributing traits grain and straw yield as compared to genotype 'Phule G 0515' (Tables, 1and 2). The differential behavior in these attributes could be ascribed to genetic character of genotypes. The improved plant growth and development of yield attributes in 'Phule G 95333' resulted in higher grain and straw yield. The bolder grain size alone in 'PhuleG 0515' could not compensate for more pods , grains/pod and grain yield .

**Effect of plant densities**

At higher plant density of 33 plants/$m^2$ with 30 cm rows resulted in significantly higher grain and straw yield over 22 plants/ $m^2$ with 45 cm row spacing (Table-2). The data on growth (except plant height) and yield attributes such as pods/plant and grain yield/plant increased in wider row spacing (45 cm.) having lower plant densities 22 plants/$m^2$ (Tables- 1and 2) because of the less competition for nutrient, water and solar

**Table 1 :** Effect of different treatments on plant height, number of branches and plant dry weight at maturity stage

| Treatments | Plant height ( cm) | No. of branches per plant | Dry weight per plant (g) |
|---|---|---|---|
| **Genotypes** | | | |
| Phule G-95333 | 56.64 | 6.43 | 41.47 |
| Phule G-0515 | 52.62 | 6.30 | 30.00 |
| S.Em ± | 0.54 | 0.04 | 0.61 |
| CD at 5% | 1.64 | 0.12 | 1.85 |
| **Plant densities** | | | |
| 33 plants /$m^2$(30 x10 cm) | 55.40 | 5.88 | 34.21 |
| 22 plants /$m^2$(45 x10 cm) | 53.86 | 6.85 | 37.27 |
| S.Em ± | 0.54 | 0.04 | 0.61 |
| CD at 5% | NS | 0.12 | 1.85 |
| **Fertility levels (kg/ha)** | | | |
| 20 N + 40 $P_2O_5$ + 20 $K_2O$ + 20 S | 53.41 | 6.25 | 34.80 |
| 30 N + 60 $P_2O_5$ + 30 $K_2O$ + 20 S | 55.85 | 6.48 | 36.67 |
| S.Em ± | 0.54 | 0.04 | 0.61 |
| CD at 5% | 1.64 | 0.12 | 1.85 |

**Table 2 :** Effect of different treatments on yield attributing characters, grain and straw yield of kabuli chickpea

| Treatments | Number of pods/plant | Number of grains/pod | Grain yield/plant (g) | Grain yield (kg/ha) | Strawyield (Kg/ha) |
|---|---|---|---|---|---|
| **Genotypes** | | | | | |
| Phule G-95333 | 29.78 | 1.08 | 22.41 | 1438.86 | 2105.52 |
| Phule G-0515 | 19.61 | 1.05 | 16.67 | 1231.37 | 1525.60 |
| S.Em ± | 0.19 | 0.01 | 0.84 | 33.43 | 19.89 |
| CD at 5% | 0.57 | 0.03 | 2.07 | 101.42 | 60.34 |
| **Plant densities** | | | | | |
| 33 plants /$m^2$(30x 10 cm) | 24.35 | 1.08 | 18.43 | 1699.78 | 2257.34 |
| 22 plants /$m^2$(45 x10 cm) | 25.03 | 1.06 | 20.65 | 970.44 | 1373.78 |
| S.Em ± | 0.19 | 0.01 | 0.84 | 33.43 | 19.89 |
| CD at 5% | 0.57 | NS | 2.07 | 101.42 | 60.34 |
| **Fertility levels (kg/ha)** | | | | | |
| 20 N + 40 $P_2O_5$ + 20 $K_2O$+ 20 S | 24.23 | 1.06 | 18.34 | 1269.42 | 1718.99 |
| 30 N + 60 $P_2O_5$ + 30 $K_2O$ +20 S | 25.16 | 1.08 | 20.74 | 1400.80 | 1912.43 |
| S.Em ± | 0.19 | 0.01 | 0.84 | 33.43 | 19.89 |
| CD at 5% | 0.57 | NS | 2.07 | 101.42 | 60.34 |

radiation etc. Similar results were also reported Roy and Sharma (1986).

### Effect of fertility levels

Application of higher fertilizer dose 30 kg N + 60 kg $P_2O_5$ + 30 kg $K_2O$ + 20 kg S/ha was recorded significantly higher growth and yield attributes, grain and straw yield compared to lower fertility level 20 kg N + 40 kg $P_2O_5$ + 20 kg $K_2O$ + 20 kg S /ha (Tables-1and2). Higher grain yield with higher fertilizer dose (30 kg N + 60 kg $P_2O_5$ + 30 kg $K_2O$ + 20 kg S/ha) must be the contribution of higher pods/plant and grain yield /plant (Table-2). Similar findings were reported by Roy and Sharma (1986) and Saraf *et al.* (1997). The higher fertilizer dose improving the dry matter production in turn might have resulted in greater synthesis of photosynthesis contributing to increase in pods/ plant . The better plant growth ( plant height and branch) and development of more pods/ plant finally led to higher grain and straw yields.

### Interaction effect

None of the interactive effects were found not significant hence they have not been described

The study shows that application of 30 kg N + 60 kg $P_2O_5$ + 30 kg $K_2O$ + 20 kg S/ha and 33 plants/$m^2$ (30 cm row) was optimum for *kabuli* chickpea under agroclimatic condition in vindhyan pleatu of Madhya Pradesh.



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