

## An analysis of dry matter production, growth and yield in kabuli chickpea as influenced by dates of sowing and irrigation levels

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**Abstract:** A field experiment was conducted at College of Agriculture, Dharwad during rabi season of 1997-98 and 1998-99 to study dry matter production, growth and yield in *kabuli* chickpea [ICCV-2] as influenced by dates of sowing and irrigation levels. Significantly higher dry matter production [10.81 g/plant] and seed yield [16.18 g/plant] recorded at higher IW/CPE ratio of 0.8 over 0.4 IW/CPE ratio and control, but was at par with 0.6 IW/CPE ratio. While sowing at IIFN of October recorded significantly higher seed yield [1802 kg/ha] compared to IFN of October and II FN of November which was mainly due to more pods/plant [55.6] and 100-seed weight [26.65 g]. The non significant effect due to phosphorus levels was observed on growth, yield components, seed and bhusa yield except branches/plant. The effect of irrigation levels and interaction effects were non significant on harvest index, seed yield canopy width and pods/plant.

**Key words:** Seed yield, harvest index, IW/CPE ratio

### Introduction

Chickpea is the most important pulse crop of rabi season cultivated mainly under rainfed condition. In India, chickpea is cultivated over an area of 6.31 m ha [52.45% of world] producing 5.08 m t (54.97% of world) with an average productivity of 806 kg/ha (Anon., 2001). Karnataka is one of the major chickpea producing states in the country. In Karnataka it is grown over an area of 0.33 m ha (19.64 per cent of total pulse area i.e. 1.68 m ha) with a production of 0.11 m tones (22.44 per cent of total pulse production i.e. 0.49 m tones) having an average productivity 341 kg/ha. This is quite low as compared to national average. Several reasons have been attributed for low productivity, of which, the major one is 90 per cent of its area is under rainfed condition and essentially it is grown as a post-monsoon winter crop on conserved soil moisture. As a consequence, the plant experiences progressively increasing degree of moisture stress and thus, assumes a major limiting factor determining growth and yield of chickpea. Despite increasing irrigation potential in the country, hardly 21.2 per cent area of chickpea is under irrigation and remaining 78.8 per cent is under rainfed condition where soil moisture plays a pivotal role in chickpea production. Several research workers have reported positive response of chickpea to irrigation (Agarwal et al., 1997). Several studies have also shown that optimum yield can be obtained with irrigation at branching, flowering and pod formation stages (Prihar and Sandhu, 1968).

Date of sowing is another important agronomic factor affecting productivity of most of arable crops owing to changes in environmental conditions to which phenological stages of crop are exposed. The modified environment resulting from different dates of sowing may thus influence the crop growth and development. Chickpea is usually sown between mid

October to mid November. However, sowings are often delayed when grown in sequence with *kharif* crops. The delayed sowing in such cases results in drastic reduction in yield. Several research workers have reported the suitability of early maturing *kabuli* chickpea varieties for delayed sowing (Trivedi and Vyas, 2000). In general, *Kabuli* varieties produce higher dry matter than *desi* under late sown condition, suggesting that *Kabuli* may be better adopted to late planting. Therefore, there is a need to work out the optimum time of sowing for realizing the maximum yield potential.

With this view, an attempt was made to study dry matter production, growth and yield in *kabuli* chickpea as influenced by date of sowing and irrigation levels.

### Material and methods

An experiment to study an analysis of dry matter production, growth and yield in *kabuli* chickpea genotype as influenced by date of sowing and irrigation levels was conducted at College of Agriculture, Dharwad during rabi seasons of 1997-98 and 1998-99. The experimental site had vertisols with 7.8 pH, EC of 0.25 sD/m, 0.56% organic carbon, 285 kg/ha available N, 22.2 kg P<sub>2</sub>O<sub>5</sub>/ha and 325 kg/ha available K<sub>2</sub>O. The experiment was laid out in factorial randomized block design with three replications. There were sixteen treatment combinations comprised of four date of sowing [October IFN, October II FN, September IFN and September II FN] and four irrigation levels [control, 0.4, 0.6 and 0.8 IW/CPE ratio]. The sunnhemp crop grown for green manuring was incorporated at its 50% flowering stage with the help of rotovator. The seeds of chickpea cv. ICCV-2 were treated with Captan @ 3g/kg seeds along with rhizobium @ 375 g/ha before sowing against wilt and to encourage biological N fixation, respectively. The seeds were hand dibbled on 28.10.1997 and 29.10.1998 at 30 X10 cm spacing on different

dates of sowing. During the crop period, the total rainfall received was 696 mm and 742 mm during 1997-98 and 1998-99, respectively. The fertilizer doze of 25 kg N and 50 kg P<sub>2</sub>O<sub>5</sub> /ha was applied at sowing. The crop was harvested at 85-90 days after sowing [DAS]. At 30, 60 DAS and at harvest, five plants were randomly selected in each treatments for recording dry matter production. The plant samples were partitioned into leaves, stem and reproductive parts [pods] and oven dried at 70°C till uniform constant weight was obtained. Completely dried samples were randomly selected in each treatment for recording growth and yield parameters. The seed yield from net plot was recorded and expressed in kg/ha.

### Results and discussion

Significant differences were noticed in dry matter production at 30, 60 DAS and at harvest due to chickpea genotypes [Table -1]

The irrigation levels showed significant effects on dry

matter production at various growth stages [Table -1]. The irrigation at 0.8 IW/CPE ratio recorded significantly higher dry matter production at 30 [1.85 g/plant] and 60 DAS [4.10 g/plant] compared to others. While at harvest, irrigation at 0.8 IW/CPE ratio recorded significantly higher dry matter production [10.81 g/plant] compared to others, but at par with 0.6 IW/CPE ratio [10.68 g/plant]. Sowing during second fortnight of October produced significantly higher dry matter production at all the stage of growth, but it was at par with the sowing during first fortnight of November in case of 30 DAS. The interaction effects showed that sowing on I FN November with irrigation at 0.8 IW/CPE ratio recorded significantly higher dry matter production [11.35 g/plant] at harvest compared to others, but remaining at par with sowing on II FN October with irrigation at 0.8 IW/CPE ratio and 0.6 IW/CPE ratio. The similar findings were reported by Yadav *et al.*, [1994] in chickpea.

Significant differences were observed in growth yield and yield compounds due to different dates of sowing [Table -

Table 1. Influence of irrigation levels and dates of sowing on total matter production (g plant<sup>-1</sup>) in *Kabuli* chickpea (Pooled for two years)

| Tr. No.                   | Treatments                                      | 30 DAS   | 60 DAS | Harvest  |       |          |
|---------------------------|---|----------|--------|----------|-------|----------|
| 1                         | First fortnight of October                      | 1.495    | 3.268  | 08.56    |       |          |
| 2                         | Second fortnight of October                     | 1.533    | 3.390  | 09.12    |       |          |
| 3                         | First fortnight of November                     | 1.502    | 3.195  | 08.83    |       |          |
| 4                         | Second fortnight of November                    | 1.305    | 2.368  | 07.49    |       |          |
| 5                         | 0.4 IW/CPE ratio + First fortnight of October   | 1.65     | 3.313  | 08.65    |       |          |
| 6                         | 0.4 IW/CPE ratio + Second fortnight of October  | 1.597    | 3.433  | 09.35    |       |          |
| 7                         | 0.4 IW/CPE ratio + First fortnight of November  | 1.642    | 3.368  | 09.17    |       |          |
| 8                         | 0.4 IW/CPE ratio + Second fortnight of November | 1.378    | 2.657  | 07.83    |       |          |
| 9                         | 0.6 IW/CPE ratio + First fortnight of October   | 1.400    | 3.835  | 11.02    |       |          |
| 10                        | 0.6 IW/CPE ratio + Second fortnight of October  | 1.640    | 4.043  | 11.21    |       |          |
| 11                        | 0.6 IW/CPE ratio + First fortnight of November  | 1.628    | 3.917  | 10.98    |       |          |
| 12                        | 0.6 IW/CPE ratio + Second fortnight of November | 1.475    | 2.892  | 09.55    |       |          |
| 13                        | 0.8 IW/CPE ratio + First fortnight of October   | 1.958    | 4.138  | 10.97    |       |          |
| 14                        | 0.8 IW/CPE ratio + Second fortnight of October  | 1.968    | 4.215  | 11.21    |       |          |
| 15                        | 0.8 IW/CPE ratio + First fortnight of November  | 1.863    | 4.150  | 11.35    |       |          |
| 16                        | 0.8 IW/CPE ratio + Second fortnight of November | 1.617    | 3.805  | 09.71    |       |          |
| Mean of irrigation levels |   |          |        |          |       |          |
|                           | Control   | 1.459    | 3.055  | 08.50    |       |          |
|                           | 0.4 IW/CPE ratio                                | 1.545    | 3.191  | 08.75    |       |          |
|                           | 0.6 IW/CPE ratio                                | 1.536    | 3.672  | 10.68    |       |          |
|                           | 0.8 IW/CPE ratio                                | 1.852    | 4.077  | 10.81    |       |          |
| Mean of dates of sowing   |   |          |        |          |       |          |
|                           | First fortnight of October                      | 1.605    | 3.639  | 09.57    |       |          |
|                           | Second fortnight of October                     | 1.685    | 3.770  | 09.99    |       |          |
|                           | First fortnight of November                     | 1.659    | 3.658  | 09.85    |       |          |
|                           | Second fortnight of November                    | 1.444    | 2.929  | 08.41    |       |          |
| Source                    | S.Em±   | CD at 5% | S.Em±  | CD at 5% | S.Em± | CD at 5% |
| Irrigation (I)            | 0.011   | 0.034    | 0.025  | 0.077    | 0.050 | 0.154    |
| Dates of sowing (D)       | 0.019   | 0.053    | 0.026  | 0.072    | 0.043 | 0.119    |
| I X D                     | 0.038   | 0.105    | 0.053  | 0.147    | 0.090 | 0.249    |

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1]. The results showed the significant increase in seed yield and yield components due to different dates of sowing [Table-1]. The results showed the significant increase in seed yield from 1454 in control to 1618 kg/ha with irrigation at 0.8 IW/CPE ratio which accounts for 11% higher seed yield over control. The

growth, yield components, the dry matter production at various growth stages and yield were significantly differed due to dates of sowing [Table 1]. The chickpea sowing in II FN of October recorded significantly higher seed yield [1802 kg/ha] over IFN of October [1517 kg/ha] and II FN November [1153 kg/ha]. Mehar

Table 2. Effect of date of sowing and irrigation levels on growth yield components and seed yield in *Kabuli* chickpea (Pooled for two years)

| Tr. No.                      | Treatments                                      | Plant height [cm] | Branches/ plant | Canopy width [cm] | Pods/ plant | 100-Seed weight [g] | Seed yield [kg/ha] | Bhusa yield [kg/ha] | H.I. [%] |
|------------------------------|---|-------------------|-----------------|-------------------|-------------|---------------------|--------------------|---------------------|----------|
| 1                            | First fortnight of October                      | 30.8              | 3.4             | 31.7              | 42.5        | 24.99               | 1518               | 1573                | 49.1     |
| 2                            | Second fortnight of October                     | 31.8              | 3.5             | 33.4              | 55.1        | 26.25               | 1711               | 1877                | 47.6     |
| 3                            | First fortnight of November                     | 29.7              | 3.3             | 32.5              | 46.1        | 25.59               | 1654               | 1842                | 47.3     |
| 4                            | Second fortnight of November                    | 30.1              | 3.1             | 41.5              | 42.5        | 24.26               | 0935               | 1099                | 45.9     |
| 5                            | 0.4 IW/CPE ratio + First fortnight of October   | 36.1              | 3.7             | 36.0              | 45.2        | 25.83               | 1611               | 1797                | 47.2     |
| 6                            | 0.4 IW/CPE ratio + Second fortnight of October  | 37.2              | 3.8             | 37.4              | 59.2        | 26.89               | 1815               | 1942                | 48.3     |
| 7                            | 0.4 IW/CPE ratio + First fortnight of November  | 36.2              | 3.6             | 36.2              | 47.0        | 25.50               | 1688               | 1964                | 46.2     |
| 8                            | 0.4 IW/CPE ratio + Second fortnight of November | 30.7              | 3.6             | 44.3              | 45.7        | 24.81               | 1130               | 1296                | 46.5     |
| 9                            | 0.6 IW/CPE ratio + First fortnight of October   | 36.7              | 3.8             | 34.4              | 44.6        | 26.08               | 1363               | 1416                | 49.0     |
| 10                           | 0.6 IW/CPE ratio + Second fortnight of October  | 36.3              | 3.8             | 34.2              | 54.4        | 26.87               | 1918               | 1875                | 50.5     |
| 11                           | 0.6 IW/CPE ratio + First fortnight of November  | 37.0              | 3.9             | 32.1              | 48.0        | 25.16               | 1813               | 1899                | 48.8     |
| 12                           | 0.6 IW/CPE ratio + Second fortnight of November | 32.0              | 3.5             | 36.0              | 49.3        | 24.72               | 1165               | 1250                | 48.2     |
| 13                           | 0.8 IW/CPE ratio + First fortnight of October   | 36.9              | 3.8             | 32.4              | 45.5        | 25.36               | 1576               | 1730                | 47.6     |
| 14                           | 0.8 IW/CPE ratio + Second fortnight of October  | 37.9              | 3.7             | 32.5              | 53.9        | 26.60               | 1764               | 1856                | 48.6     |
| 15                           | 0.8 IW/CPE ratio + First fortnight of November  | 36.3              | 3.8             | 33.9              | 45.5        | 25.72               | 1751               | 1804                | 49.2     |
| 16                           | 0.8 IW/CPE ratio + Second fortnight of November | 31.0              | 3.6             | 40.3              | 49.6        | 24.98               | 1382               | 1655                | 45.5.    |
| Mean of irrigation levels    |   |                   |                 |                   |             |                     |                    |                     |          |
| Control                      |   | 30.6              | 3.3             | 34.8              | 46.6        | 25.27               | 1454               | 1598                | 47.6     |
| 0.4 IW/CPE ratio             |   | 35.1              | 3.7             | 38.5              | 49.3        | 25.76               | 1561               | 1610                | 44.4     |
| 0.6 IW/CPE ratio             |   | 35.5              | 3.8             | 34.2              | 49.1        | 25.71               | 1565               | 1610                | 49.2     |
| 0.8 IW/CPE ratio             |   | 35.5              | 3.7             | 34.8              | 48.6        | 25.67               | 1618               | 1761                | 47.8     |
| Mean of dates of sowing      |   |                   |                 |                   |             |                     |                    |                     |          |
| First fortnight of October   |   | 34.6              | 3.3             | 33.6              | 44.5        | 25.57               | 1517               | 1629                | 48.2     |
| Second fortnight of October  |   | 35.3              | 3.7             | 34.4              | 55.6        | 26.65               | 1802               | 1887                | 48.8     |
| First fortnight of November  |   | 34.3              | 3.8             | 33.7              | 46.6        | 25.49               | 1727               | 1877                | 47.9     |
| Second fortnight of November |   | 30.4              | 3.7             | 40.5              | 46.8        | 24.69               | 1153               | 1325                | 46.5     |
| Source                       |   |                   |                 |                   |             |                     |                    |                     |          |
| Irrigation (I)               | S. Em ±   | 0.1               | 0.03            | 0.5               | 0.5         | 0.11                | 33                 | 43                  | 0.2      |
| C.D. [5%]                    |   | 0.4               | 0.09            | 1.5               | 1.6         | 0.34                | 102                | 134                 | NS       |
| Dates of sowing (D)          | S. Em ±   | 0.1               | 0.02            | 0.5               | 0.9         | 0.09                | 41                 | 47                  | 0.3      |
| C.D. [5%]                    |   | 0.3               | 0.06            | 1.6               | 2.5         | 0.25                | 115                | 132                 | 0.8      |
| I X D                        | S. Em ±   | 0.2               | 0.04            | 1.1               | 1.8         | 0.18                | 83                 | 96                  | 0.5      |
| C.D. [5%]                    |   | 0.7               | 0.13            | NS                | NS          | 0.50                | NS                 | 264                 | NS       |

Singh *et al.*, [2001] reported the similar results in chickpea. The higher seed yield was mainly attributed to more pods/plant [55.6], 100-seed weight [26.65 g] and total dry matter production [9.99 g/plant]. These observations are in agreement with the findings of Parihar [1990].

The interaction effects were significant on plant height, branches/plant, 100-seed weight and bhusa yield. While canopy

width, pods/plant and seed yield did not differ significantly. However, sowing on II FN of October with irrigation at 0.6 IW/CPE ratio recorded maximum seed yield [1918 kg/ha] compared to others. Among the growth and yield components, 100-seed weight [26.89 g] and pods/plant [59.22] were higher at 0.4 IW/CPE ratio and sowing on II FN of November compared to others. Similar results were reported by Singh and Dixit [1992] and Arya and Khushwa [2000] in chickpea.

Thus, it can be inferred that sowing of kabuli chickpea on II fortnight of October and irrigation at 0.8 IW/CPE ratios

found optimum as evidenced by dry matter production and higher seed yield.

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