Biological Forum – An International Journal **16(1): 315-318(2024)**

ISSN No. (Print): 0975-1130
ISSN No. (Online): 2249-3239

Assessment of Growth, Yield Attributes and yield of Chickpea (*Cicer arietinum* L.) Cultivars under Varying Environments

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(Received: 30 November 2023; Revised: 16 December 2023; Accepted: 29 December 2023; Published: 15 January 2024)
(Published by Research Trend)

ABSTRACT: A field experiment was conducted during winter seasons of 2020-21 and 2021-22 at the AICRP on Agrometeorology, College of Agricultural Engineering, JNKVV, Jabalpur (M.P.) to study the effect of varying environments on growth and yield of chickpea cultivars. The experiment was laid out in Split Plot Design consisting three growing environments as main plot treatment (15th November, 30th November and 15th December) and three cultivars of chickpea as sub plot treatment of (JG14, JGK1 and JG 36) with three replications. The result of study revealed that among three different sowing environments crop sown on 30th November was recorded significantly superior growth attributes, yield attributes and yield followed by early sown environment (15th November) and late sown environment (15th December). Among the chickpea cultivars, JG 14 proved the best with respect to growth parameters, yield-attributes, yield and economics followed by JG 36 and JGK 1. Cultivar JG14 with sowing environments of 30th November gave the higher values of growth parameters, yield attributes and yield of chickpea.

Keywords: Growth, yield, chickpea, cultivars, environments.

INTRODUCTION

The chickpea, scientifically known as *Cicer arietinum* L., is a significant legume crop that holds a crucial position in global agriculture, ranking second only to dried beans in terms of its worldwide significance. The cultivation area of this protein-rich food legume is around 14.5 million hectares globally, and its yearly production reaches 14.7 million tonnes. According to FAOSTAT statistics from 2020, the average yield of chickpea is recorded as 1014 kg/ha. Madhya Pradesh has allocated around 2.16 million hectares of land specifically for growing chickpeas. This has led to an output of 3.21 million tonnes of chickpeas, with a productivity rate of 1488 kg per hectare (Anonymous, 2022).

The sowing season of chickpeas differs in different regions, and is affected by the cropping patterns and the types being cultivated. Optimizing the timing of planting, together with the careful selection of cultivars with high-yield potential, is essential for maximizing crop development and production. Nevertheless, the timing of this event is influenced by various meteorological variables like temperature, humidity, and sunshine duration (Bazvand *et al*., 2015). The crop exhibits a high susceptibility to heat-stress specifically during its reproductive phase, resulting in a decrease in the number of flowers, an increase in flower abortion, and a reduction in seed production (Kaushal *et al*., 2013). Therefore, it is crucial to choose cultivars that are resistant to environmental fluctuations in order to sustain crop productivity. The correlation between the environment and the selected cultivar has a substantial impact on the ideal planting period for chickpea (Neenu *et al*., 2017). Looking to all these facts, the present research was taken up to boost the productivity in this region.

MATERIALS AND METHODS

The field experiment was conducted during winter seasons of 2020-21 and 2021-22 at the Research Farm, College of Agricultural Engineering, JNKVV, Jabalpur (M.P.). The soil of the experimental field was sandy-clay-loam having pH 6.72, electrical conductivity 0.06 dS/m^2, organic carbon 0.83 %, available N, P_2O_5 and K_2O 284, 17.35 and 259 kg/ha, respectively. The treatments comprised three environments (15th November, 30th November and 15th December) and three cultivars (JG-14, JG-36 and JGK-1). Thus, the nine treatment combinations were laid out in a split - plot design keeping three replications. The chickpea cultivars were sown according to different sowing environments with seed rate @ 80 kg/ha in rows 30 cm. The common dose of 20 kg N, 60 kg P_2O_5 and 20 kg K_2O /ha was applied in all the treatments. The crop was raised as per recommended package of practices. The crop was considered mature when 95% of pods had obtained their mature colour. The plants of the net plot area were harvested by cutting the plants to the ground level and then allowing for sun drying. After complete sun drying, the crop was threshed manually, seeds were cleaned and grain and stalk yield were expressed in kilogram per hectare. The harvest index (HI) was calculated

$$HI = \frac{\text{Economic yield (kg ha}^{-1})}{\text{Biological yield (kg ha}^{-1})} \times 100$$

The economics of each treatment was calculated based on prevailing market prices of the corresponding year.

The yield was further computed for gross and net returns as well as benefit-cost (BC) ratio to assess the profitability. The benefit-cost ratio was worked out by dividing the gross returns by the total cost of cultivation of respective treatments. The data collected from the experiment at different growth stages and harvest were subjected to statistical analysis as per the split-plot design described by Gomez and Gomez (1984). Summary tables for treatment effect have been prepared and furnished with standard error of means (S.Em ±) and critical difference (C.D.) at 5 per cent level of probability (p=0.05) has also given where the treatment differences were significant.

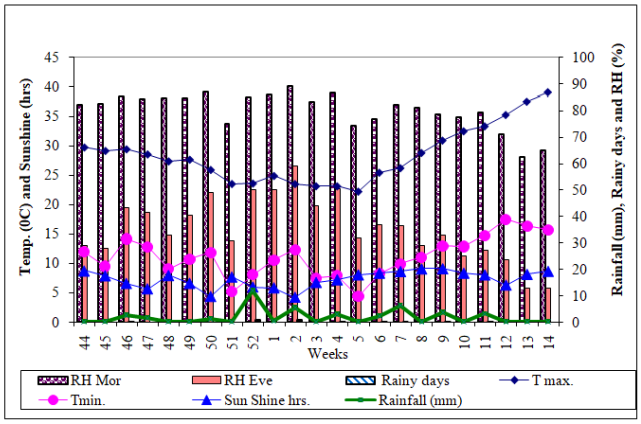

Fig. 1. Weekly Meteorological Paramaeters During Rabi Crop Season 2020-21 and 2021-22 Pooled.

RESULTS AND DISCUSSION

A. Effect of sowing environments

Results of analysis of mean data indicated that sowing environment significantly influenced the growth parameters of chickpea recorded at various growth stages (Table 1). The 30th November sown environment recorded significantly higher plant height (46.3 cm), number of branches per plant (18.1), dry weight (19.6 g/plant) this might be due to the temperature and other climatological parameters were favourable for above growth characters. These findings are in conformity with those of Neenu *et al*. (2017); Nivedita *et al.* (2022). The yield attributing parameters of chickpea were also influenced due to various sowing environment (Table 2). The number of pods per plant (47.4), 100 seed weight (26 g), seed yield (1866 kg /ha) and straw yield (2100 kg/ ha) was significantly maximum under 30th November sown environment over rest of sowing environments. Harvest index (46.5%), Gross monetary return (Rs. 102929/ha) net monetary return (Rs. 62341/ha) and B:C ratio (2.46) was also found maximum under 30th November sown environment over rest of sowing environments. Similar results were also reported by Shekhar *et al*. (2015).

B. Effect of chickpea cultivars

All the yield attributing parameters like branches per plant, pods per plant 100 seed weight were significantly varied due to different chickpea cultivars. While comparing the different chickpea cultivars, the highest 100 seed weight (28.4 g) was recorded in JG 14 which was significantly higher than JGK1 (25.6 g) and JG 36 (21.1 g), whereas number of branches (19.2/plant), number of pods (48.7/plant) were recorded significantly higher in JG 36, but JG 36 recorded lowest 100 seed weight (21.1 g) that's why the seed yield was found significantly maximum in JG 14 (1956 kg/ha). The harvest index (46.6%), gross monetary return (Rs. 107875/ha), net monetary return (Rs. 67287/ha) and B:C ratio (2.57) was also found higher in JG 14 over JG36 and JGK1. These results are in conformity with Ali *et al.* (2018).

Table 1: Growth, yield attributes and yield of chickpea as influenced by different environments and cultivars (Mean of two years).

Treatments	Plant height (cm)	Branches /plant	Dry weight /plant (g)	Pods per plant	Seed index (g)	Harvest index (%)	Seed yield (kg/ha)	Straw yield (kg/ha)	GMR (Rs/ha)	NMR (Rs/ha)	B:C ratio
Environments											
15th November	45.1	16.0	18.73	46.2	25.0	46.1	1712	1999	94551	53962	2.26
30th November	46.3	18.1	19.62	47.4	26.0	46.5	1866	2144	102929	62341	2.46
15th December	43.4	15.2	17.93	44.9	24.1	46.0	1643	1917	90729	50141	2.17
S.Em ±	0.44	0.17	0.31	0.16	0.33	0.05	25.0	25.0	-	-	-
C.D. at 5%	1.27	0.51	0.93	0.49	1.00	0.15	75.0	75.0	-	-	-
Cultivars											
JG 14	46.1	15.9	17.20	46.3	28.4	46.6	1956	2237	107875	67287	2.57
JGK 1	46.5	14.1	16.14	43.5	25.6	45.7	1496	1778	82703	42115	1.98
JG 36	42.2	19.2	22.94	48.7	21.1	46.4	1769	2045	97630	57042	2.34
S.Em ±	0.49	0.19	0.22	0.32	0.14	0.07	29.0	29.0	-	-	-
C.D. at 5%	1.42	0.56	0.68	0.98	0.42	0.21	86.0	86.0	-	-	-

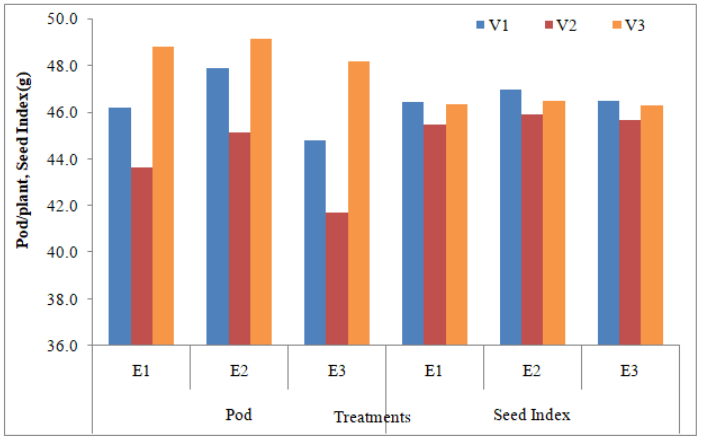

Fig. 2. Yield attributes of chickpea as influenced by different environments and cultivars.

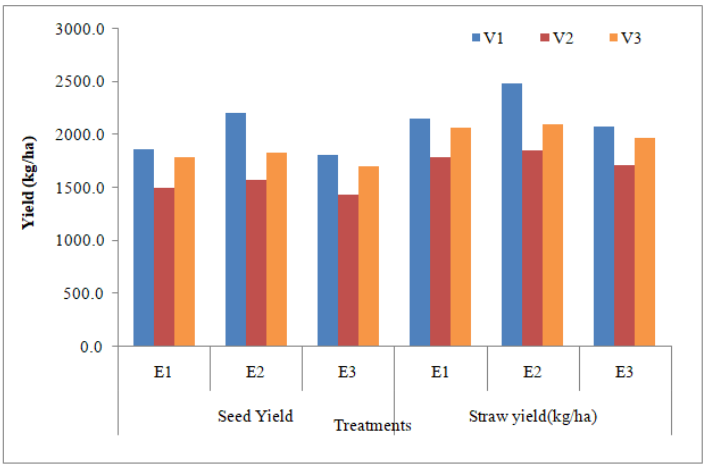

Fig. 3. Seed yield and straw yield of chickpea as influenced by different environments and cultivars.

CONCLUSIONS

Based on the foregoing discussion, it could be concluded that 30th November sown crop was noted significantly higher growth parameters, yield attributes and yield of chickpea as compared to 15th November and 15th December sowing environments. Among the chickpea cultivars, JG 14 proved the best with respect to growth parameters, yield-attributes, yield, quality and economics over the other cultivars. JG14 with sowing environments of 30th November gave the higher values of growth parameters, yield attributes and seed yield as compared to other combinations.

FUTURE SCOPE

Present finding based on two years data, which is an inadequate sample of the climatic conditions of the area, this study should be repeated for more years at different locations of Kymore plateau and Satpura Hills region to confirm the findings of the current study.

Acknowledgement. The authors are grateful to acknowledge to Professor and Head, Department of Agronomy, College of Agriculture, JNKVV, Jabalpur for providing necessary facilities to conduct the present experiments. Authors also want to express their gratitude to Head of the Department of Physics and Agrometeorology, College of Agricultural Engineering, JNKVV, Jabalpur for their cooperation during investigation.

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How to cite this article: Abhijeet Kumar Dubey, Anay Kumar Rawat, Priyanka Mishra and Ashish Tiwari (2024). Assessment of Growth, Yield Attributes and yield of Chickpea (*Cicer arietinum* L.) Cultivars under Varying Environments. *Biological Forum – An International Journal*, *16*(1): 315-318.