

Yield and yield component of chickpea as affected by boron application

ABSTRACT

The present research work was carried to study the yield of chickpea as affected by boron application. Five varieties of chickpea namely BARI Chola-5, BARI Chola-6, BARI Chola-7, BARI Chola-8 and BARI Chola-9 and four levels of boron (0, 1, 2, 3 kg B ha⁻¹) were used for experiment. A Randomized Complete Block Design was used for the experiment with three applications. Variety had significant effects on yield and components of chickpea. BARI Chola-8 showed better performance and produced the highest seed yield (1.74) as compared to other varieties used in the study. Application of boron significantly improved yield and yield attributes of chickpea. The highest seed yield (1.70 t ha⁻¹) was obtained at 3 kg B ha⁻¹ as compared to other levels of boron application. Results revealed that BARI Chola-8 integrated with 3 kg B ha⁻¹ was found to be the best treatment for higher yield of chickpea.

Key words: Boron, chick pea, variety, yield.

INTRODUCTION

Pulse is one of the most important legume crops in Bangladesh. Pulse occupies the important place in the daily diet of the people. Most of the people in our country eat pulses as a source of protein. Chickpea (*Cicer arietinum*) is an ancient cultivated plant, domesticated during early age of civilization and being cultivated throughout the world. It is an edible legumes belonging to the family "Fabaceae" with slightly round, irregular shape and are slightly longer in size than the normal peas. Its nomenclature in different countries is well documented as gram, chickpea, hommos, chana, chiating vetch, nakhud, nakhut, kicher, pois chice, garbarzo etc. [1]. In respect of area and production the total yield of chickpea was 6488 MT produced in 8250 ha in Bangladesh [2]. It is the third most important pulse crop in Bangladesh in respect of area and production with an average yield of 765 kg ha⁻¹. ~~It is used for human consumption as well as for~~

27 ~~feeding green leaves is used as green vegetables.~~ It is the cheap source of high quality protein
28 in the diet of millions of people in developing countries, who cannot afford animal protein for
29 balanced nutrition [3]. On chemical analysis of chickpea seed with and without seed coat
30 contain (%) water, protein, fat, minerals, ash, carbohydrate, energy (Cal.) at (9.9), (20.8), (5.6),
31 (2.7), (1.2), (61.5), and (372) respectively. It is also rich in Ca and Fe. Yield of chickpea is
32 affected by varietal differences.

33 Boron (B) is a micronutrient plays an important role in increasing yield of pulse legumes. It is
34 very important in cell division and in pod and seed formation. Boron ranks third places among
35 micronutrients in its concentration in seed and stem as well as its total amount after zinc [4].
36 Boron significantly affected the seed yield of chickpea [5]. On station studies of BARI indicated
37 that chickpea yield of more than 1 t ha⁻¹ can be obtained by applying 3 kg ha⁻¹ of boron.
38 Chickpea is an important crop yet little work has been done for the improvement of this crop in
39 this country. Therefore, the present study was undertaken to study the yield and yield
40 components of chick pea as affected by boron fertilization.

41 MATERIALS AND METHODS

42 The present research work was carried out at the Agronomy Field Laboratory, Department of
43 Agronomy and Agricultural Extension, University of Rajshahi during the period from December,
44 2012 to April, 2013 to study the yield of chickpea as affected by boron application. The
45 experiment consisted of two factors i.e. five chickpea varieties viz. BARI Chola-5, BARI Chola-
46 6, BARI Chola-7, BARI Chola-8 and BARI Chola-9 and four boron levels viz. 0, 1, 2 and 3 kg B
47 ha⁻¹. A Randomized Complete Block Design was used for the experiment. The treatments were
48 replicated three times. The physical and chemical properties of the soil and environmental
49 condition of the study period has been presented in Table 1 and Figure 1 respectively. The total
50 number of unit plots in the entire experimental plot was 5×4×3=60. The size of the each plot was
51 2m×2m. The experimental field was fertilized with urea, TSP, MoP @ 45,85, 35 kg ha⁻¹
52 respectively. All the fertilizers were applied during the final land preparation. Boron was applied
53 as per experimental treatment in the form of boric acid. Seeds were sown on 6 December, 2012
54 in 40 cm apart rows opened by specially made iron hand tine. Three weeding operations at 22,

32 and 50 DAS were done to control weeds in the experimental field. Thinning was done when necessary for maintaining 5 cm plant to plant distance. Two irrigations were applied at 35 and 60 DAS. Data on yield and yield components were recorded. Recorded data were compiled and tabulated for statistical analysis. The data were analyzed statistically using the analysis of variance technique and the mean differences among the treatments were adjudged by new Duncan's Multiple Range Test (DMRT) with the help of MSTAT software [6].

RESULTS

Plant height

Significant variation was not observed in respect of plant height amongst different varieties. BARI Chola-8 produced the tallest plant (75.28 cm) whereas BARI Chola-5 produced shortest one (67.67 cm). Plant height did not respond significantly to the boron application. The highest plant height (72.33 cm) was observed at 3 kg B ha⁻¹ and the lowest (68.24 cm) was recorded at 0 kg B ha⁻¹ (Table 2). The interaction between variety and boron level on plant height was not statistically significant. The tallest plant (76.88cm) was obtained from BARI Chola-8 with 3 kg B ha⁻¹ and the shortest one (66.73cm) from BARI Chola-5 at 0 kg B ha⁻¹ (Table 3).

Primary branches plant⁻¹

Variety had significant effect on the number of primary branches plant⁻¹. The highest number of primary branches plant⁻¹ (5.10) was produced by BARI chola-8 and lowest number (4.21) was produced by BARI Chola-5. The number of primary branches plant⁻¹ was significantly influenced by boron level. The highest number of primary branches plant⁻¹ (4.93) was observed at 3 kg B ha⁻¹ and the lowest one (4.24) was observed at control treatment (0 kg B ha⁻¹) (Table 2). Variety and boron level interacted significantly on the number of primary branches plant. The maximum number of primary branches plant⁻¹ (5.46) was obtained from BARI Chola-8 at the highest level of boron application (3 kg B ha⁻¹) and lowest one (13.36) from BARI Chola-5 at control treatment (0 kg B ha⁻¹) (Table 3).

Secondary branches plant⁻¹

81 The number of secondary branches plant⁻¹ was significant due to variety. The maximum number
82 of secondary braches plant⁻¹ (28.41) was produced by BARI chola-8 and the minimum one (17.39)
83 was produced by BARI Chola-5. (Table 2). Different boron levels showed significant variation in
84 respect of number of secondary branches plant⁻¹. However, the highest secondary branches plant⁻¹
85 ¹ was recorded when 3 kg B ha⁻¹ was applied, which was higher over control (0 kg B ha⁻¹). Variety
86 and boron level interacted significantly on number of secondary branches plant⁻¹. The maximum
87 number of secondary branches plant⁻¹ (37.00) was obtained from BARI Chola-8 with 3 kg B ha⁻¹
88 whereas same variety produced minimum branches (21.40) at control application of boron. (Table
89 3). The lowest value (13.36) for this trait was noted from the treatment combination of V₁B₁.

90 **Nodules plant⁻¹**

91 Variety had significant effect on the number of nodules plant⁻¹. The highest number of nodules
92 plant⁻¹ (25.98) was produced by BARI Chola-8 than rest of the varieties. This is the inherent
93 characters of BARI Chola-8 in producing higher nodules plant⁻¹. Number of nodules plant⁻¹ was
94 significantly influenced by boron level. Nodules plant⁻¹ increased with the increasing level of
95 boron. The interaction between variety and boron level produced significant variation in respect
96 of number of nodules plant⁻¹. The maximum number of nodules plant⁻¹(30.77) was obtained from
97 BARI Chola-8 with 3 kg B ha⁻¹ whereas the minimum one (16.30) was observed in BARI Chola-
98 5 at 0 kg B ha⁻¹ (Table 2). (Table 3).

99 **Total pods plant⁻¹**

100 BARI Chola-8 produced the highest number of total pod plant⁻¹ (48.18) whereas BARI Chola-5
101 produced the lowest (39.00) for this yield component of chickpea. The number of total pod plant⁻¹
102 ¹ was significantly influenced by boron level. The highest number of total pods plant⁻¹ (49.52)
103 was observed at 3 kg B ha⁻¹ and the lowest one (36.52) was observed at control treatment
104 (Table 2). The interaction effect between variety and boron level on the number of total pod
105 plant⁻¹ was not significant. The maximum number of total pods (55.26) was obtained from BARI
106 Chola-8 with 3 kg B ha⁻¹. This result supported by [7]. The minimum number of total pod plant⁻¹
107 (29.46) was obtained from BARI Chola-5 at 0 kg B ha⁻¹ (Table 3).

108

109

110 **Effective pods plant⁻¹**

111 Variety had significant effect on the number of effective pod plant⁻¹. The maximum number of
112 effective pod plant⁻¹ (44.48) was produced by BARI Chola-8. Number of effective pods plant⁻¹
113 was significantly affected by boron level. The maximum number of effective pods plant⁻¹(44.94)
114 was obtained from BARI Chola-8 with 3 kg B ha⁻¹. The minimum number of effective pods plant⁻¹
115 (29.52) was obtained from control treatment (Table 2). The interaction between variety and
116 boron level failed to produce significant variation in case of number of effective pod plant⁻¹.
117 Numerically the highest number of effective pod plant⁻¹ (51.26) was obtained from BARI Chola-8
118 at the highest level of boron (3 kg B ha⁻¹) and the lowest one (34.00) was obtained from BARI
119 Chola-5 at control treatment (Table 3).

120 **Non-effective pods plant⁻¹**

121 Number of non-effective pod plant⁻¹ varied significantly in different varieties. The maximum
122 number of non-effective pod plant⁻¹ (7.47) was produced by BARI Chola-5 and minimum number
123 of non-effective pod plant⁻¹ (4.70) was produced by BARI Chola-8. Different boron levels
124 showed significant variation in terms of number of non-effective pod plant⁻¹. The maximum
125 number of non- effective pod plant⁻¹ (7.0) was found in BARI Chola-5 and the minimum one
126 (5.57) was found in BARI Chola-8 (Table 2). There was no significant effect in respect of number
127 of non-effective pod plant⁻¹ of chickpea due to interaction of variety and boron level. Numerically
128 the highest number of non-effective pod plant⁻¹ (8.53) was recorded from BARI Chola-5 at
129 control treatment and the lowest one (4.00) was recorded from BARI Chola-8 at 3 kg B ha⁻¹
130 (Table 3).

131 **Pod length**

132 Variety had significant effect on pod length. The highest pod length (1.97cm) was produced by
133 BARI Chola-8. The lowest pod length (1.68 cm) was given by BARI Chola-5. Pod length was
134 significantly influenced by boron level. Numerically the highest length of pod (1.94cm) was
135 recorded at 3 kg B ha⁻¹ and the lowest pod length (1.72cm) was observed at control treatment

(Table 2). The interaction between variety and boron level failed to produce significant variation in case of pod length. Numerically the highest pod length (2.02cm) was recorded by the BARI Chola-8 at 3 kg B ha⁻¹. The lowest pod length (1.51 cm) was recorded by the BARI Chola-5 at control treatment (Table 3).

Seeds pod⁻¹

The number of seeds pod⁻¹ varied significantly in different varieties. The highest number of seeds pod⁻¹ (1.91) was obtained from BARI Chola-8 and the lowest one from (1.50) BARI Chola-5. Significant variation was observed in respect of number of seeds pod⁻¹ due to different boron level. The highest number of seeds pod⁻¹ (1.90) was given by BARI Chola-8 with 3 kg B ha⁻¹. The lowest number of seeds pod⁻¹ (1.56) was given by BARI Chola-5 at control treatment (Table 2). The number of seeds pod⁻¹ was not statistically significant due to interaction of variety and boron level. Numerically the highest number of seeds pod⁻¹ (2.00) was produced by BARI Chola-8 at 3 kg B ha⁻¹. The lowest number of seeds pod⁻¹ (1.20) was produced by BARI Chola-5 at control treatment (Table 3).

1000-seed weight

Variety had significant effect on 1000 seed weight of chickpea. The weight of 1000-seed was highest in BARI Chola-8 (175.45g) and lowest of 1000-seed weight (129.91g) was found on BARI Chola-5. The weight of 1000-seed was not statistically significant due to different boron level. The highest 1000-seed weight (161.70g) was obtained from 3 kg B ha⁻¹ and the lowest one (143.40g) was obtained from control treatment (Table 2). 1000-seed weight was not significantly influenced by the interaction of variety and boron level. Numerically the highest weight of 1000-seed (204.50g) was obtained from BARI Chola-8 at 3 kg B ha⁻¹. The lowest weight of 1000 seed (120.66g) was recorded from BARI Chola-5 at control treatment (Table 3).

Seed yield

Seed yield was influenced significantly by different varieties. The highest seed yield (1.74 t ha⁻¹) was produced by BARI Chola-8 followed by BARI Chola-9 (1.62 t ha⁻¹), BARI Chola-7 (1.57 t ha⁻¹), BARI Chola-6 (1.48 t ha⁻¹) and BARI Chola-5 (1.39 t ha⁻¹). This is due to varietal differences

163 as a result BARI Chola-8 produced the highest seed yield. Boron doses exerted significant
164 influence on seed yield of chickpea. From the results of the experiment we can see that the
165 highest seed yield (1.70 t ha^{-1}) was obtained with the application of highest level of boron (3 kg
166 B ha^{-1}). Similar results were also reported by [4]. The lowest seed yield (1.39 t ha^{-1}) was obtained
167 from control treatment (Table 2). The effect of variety and boron level on seed yield was not
168 statistically significant. Numerically the highest seed yield (1.90 t ha^{-1}) was recorded from BARI
169 Chola-8 at 3 kg B ha^{-1} and the lowest one (1.23 t ha^{-1}) was obtained from the variety BARI
170 Chola-5 at control treatment (Table 3).

171 Stover yield

172 Stover yield was statistically significant within different varieties. The maximum stover yield
173 (2.28 t ha^{-1}) was obtained from BARI Chola-8 and the minimum one was obtained from BARI
174 Chola-5. Boron fertilizer also influenced the production of stover yield of chickpea. The highest
175 stover yield (2.27 t ha^{-1}) was noticed at the highest level of boron application (3 kg B ha^{-1}) and
176 the lowest one (1.85 t ha^{-1}) was in control treatment (Table 2). The effect between variety and
177 boron level failed to produce significant variation on stover yield. Numerically the highest stover
178 yield (2.45 t ha^{-1}) was obtained from the combination of V_4B_4 (BARI Chola-8 with 3 kg B ha^{-1})
179 and the lowest stover yield (1.66 t ha^{-1}) was obtained from BARI Chola-5 at 0 kg B ha^{-1} (Table
180 3).

181 DISCUSSION

182 Among the five varieties tested, BARI Chola-8 was found to be best in all respect. The
183 maximum number of pods plant^{-1} (48.25), 1000-seed weight (175.45) and seeds pod^{-1} (1.91)
184 were recorded from BARI Chola-8 which was significantly different over rest of the varieties. The
185 highest seed yield was produced by BARI Chola-8 followed by BARI Chola-9, BARI Chola-7,
186 BARI Chola-6 and BARI Chola-5. The yield difference was noticed due to the effect of genetic
187 variability of studied characters of the variety. The seed yield and yield components significantly
188 increased with the increment of boron level. The highest seed yield was recorded when 3 kg B
189 ha^{-1} was applied, which was higher over rest of the boron levels. The result indicates that boron
190 had significant influence on grain yield which was associated with the number of pods plant^{-1} ,

191 grains pod^{-1} and 1000-grain weight. Boron is very important in cell division and in pod and seed
192 formation. The boron fertilizer increased the production of more grains pod^{-1} which might be the
193 cause of more seed yield. This result is in conformity with the findings of [8]. Boron principally
194 contributed to the yield and the crop performed better with subsequent higher doses up to 2.5
195 kg B ha^{-1} [9]. Seed yield of chickpea (cv. BARI Chola- 5) increased significantly due to
196 application of 1.5 kg B ha^{-1} [10]. It is observed that under pot conditions with acidic soils at high
197 moisture availability boron applications increased chickpea total dry matter and improved seed
198 yield [7]. The lowest grain yield was recorded from the treatment where boron was not applied
199 (Control). The reason of the lowest yield at control treatment is the boron deficiency in the soil.
200 Due to severe deficiency of boron may restrict the normal flow of hormone. Resulting
201 germination of pollen tube and receptivity of stigma sharply declined. Boron deficiency causes
202 flower drop and, consequently, poor podding in chickpea and poor yields [11]. Soil application of
203 boron did not cause either toxicity or a reduction in yield, perhaps because the doses used were
204 not very high [12] since high rates can cause a reduction in yield, especially in dry conditions
205 [13]. Although [14] did find a significant response, they carried out foliar rather than soil
206 applications. Positive response of different genotypes in terms of seed yield was realized
207 significantly in application of boron @ 3 kg B ha^{-1} . The highest values for seed yield of chick
208 were obtained from V_4B_4 treatment combination and the lowest one from V_1B_1 . The application
209 of boron resulted in a more vegetative growth in acidic soils. The dry matter production
210 increase, with increased boron supply, was mostly due to the increase in the number of pods
211 (including seeds) plant^{-1} [15].

212 Conclusion

213 On the basis of aforesaid findings it is evident that BARI Chola-8 showed better performance
214 for almost all the yield components and yield of chickpea and consequently it produced the
215 highest seed yield. Among the boron level 3 kg b ha^{-1} was best for better yield. Finally the
216 results suggest that combination of $V_4 \times B_4$ (BARI Chola-8 with 3 kg B ha^{-1}) is the best for
217 obtaining highest yield of chickpea.

218

219 REFERENCES

- 220 1. Malik BA. Cited from Noor F, Ashraf M, Ghafoor A. 2003. Path analysis and relationship
221 among Quantitative Traits in Chickpea (*Cicer arietinum*L) Pakistan J. Biol. Sci.1994. 6 (6):551-
222 555.
- 223 2. BBS (Bangladesh Bureau of statistics).Bulletin of Tropical Legume Bangladesh. Stat.
224 Div.Ministry plann. Govt. People's Repub. of Bangladesh. 2012. p.150-160.
- 225 3. Huisman J, Vander Poel AF. Aspects of the nutritional quality and use of cool season food
226 legumes in animal feed. In F. J. Muehlbauer and W. J. Kaiser (Eds.), Expanding the production
227 and use of cool season food legumes. 1994. p. 53-76. Dordrecht: Kluwer Academic Publishers.
- 228 4. Shil NC, Noor S, Hossain MA. Effects of Boron and Molybdenum on the Yield of Chickpea. J
229 Agric. Rural Dev. 2007. 5(1&2): 17-24.
- 230 5. Khanam R, Arefin MS, Haque MR, Islam MA, Jahiruddin M. Effects of magnesium, boron and
231 molybdenum on the growth, yield and protein content of chickpea and lentil. Progress. Agric.
232 2000. 11(1 & 2): 77-80.
- 233 6. Gomez K, Gomez AA. Statistical Procedures for Agricultural Research. John Wiley and Sons.
234 Inc. NewYork. 1984. p. 214.
- 235 7. Valenciano JB, Marcelo V, Boto JA. Response of chickpea (*Cicer arietinum*) yield to
236 micronutrient application under pot conditions in Spain.Spanish Journal of Agricultural
237 Research. 2010. 8 (3):797-807
- 238 8. Rashid A, Rafique E. Boron requirement of Indian mustard (*B. juncea* L.). J. Indian Soci. Soil
239 Sci. 1992. 40: 493-495.
- 240 9. Bharti N, Murtaza M, Singh, AP. Effect of boron *Rhizobium* relationship on yield, nitrogen and
241 boron nutrition of chickpea. J. Res. Birsa Agric. Univ. 2002. 14(2):175-179.
- 242 10. Islam MB. Requirement of boron for mustard, wheat, and chickpea based rice cropping
243 patterns. Ph. D. Dissertation, Department of Soil Sci. Bangladesh Agricultural University,
244 Mymensingh. 2005.

- 245 11. Srivastava SP, Yadav CR, Rego TJ, Johansen C, Saxena NP. Diagnosis and alleviation of
246 boron deficiency causing flower and pod abortion in chickpea (*Cicer arietinum* L.) in Nepal. In:
247 Boron in soils and plants. Developments in Plant and Soil Sciences 76 (Bell R.W., Rerkasem B.,
248 eds). Iwer Academic Publishers, Dordrecht, The Netherlands. 1997. pp. 95-99.
- 249 12. Panwar BS, Gupta SP, Kala R. Responses to boron in pearl millet and chickpea in a pot
250 experiment with a non-calcareous soil in India. Acta Agron Hungarica. 1998. 46: 335-340.
- 251 13. Ahlawat IPS, Gangaiah B, Ashraf ZM. Nutrient management in chickpea. In: Chickpea
252 breeding and management (Yadav SS., Redden R., Chen W., Sharma B, eds). CAB
253 International, Wallingford, Oxon, United Kingdom. 2007. pp. 213-232.
- 254 14. Ali M, Mishra JP. Effect of foliar nutrition of boron and molybdenum on chickpea. Indian
255 Journal of Pulses Research. 2001. 14 (1): 41-43.
- 256 15. Singh A, Singh BB, Patel CS. Response of vegetable pea (*Pisum sativum*) to zinc, boron
257 and molybdenum in an acid Alsifol of Meghalaya. Indian J Agron. 1992. 37:615-616.
- 258

Table 1. Physical and chemical analysis of soil properties at 0-15cm depth of soil

Soil properties	Results
Sand (%) (0.0-0.02mm)	60
Silt (%) (0.02-0.002mm)	25
Clay (%) (<0.002mm)	15
Soil texture class	Sandy loam
p ^H	7.52
Organic matter (%)	1.12
Total nitrogen (%)	0.07
Available P (ppm)	28.1
Available K (ppm)	0.25
Available S (ppm)	17.4
Available Zn (ppm)	0.72
Available B (ppm)	0.90

Table 2. Effect of variety and boron on the yield and yield components of chickpea

Variety	Plant height (cm)	Primary branches plant ⁻¹ (No.)	Secondary branches plant ⁻¹ (No.)	Nodules plant ⁻¹ (No.)	Total pods plant ⁻¹ (No.)	Effective pods plant ⁻¹ (No.)	Non-effective pods plant ⁻¹ (No.)	Pod length (cm)	Seeds pod ⁻¹ (No.)	1000-seed weight (g)	Seed yield (t ha ⁻¹)	Stover yield (t ha ⁻¹)
V ₁	67.67	4.21 ^c	17.39 ^d	19.08 ^d	39.00 ^c	31.53 ^b	7.47 ^a	1.68 ^b	1.50 ^c	129.91 ^c	1.38 ^d	1.87 ^c
V ₂	68.00	4.41b ^c	19.03 ^c	21.08 ^c	39.09 ^c	32.79 ^b	6.25 ^b	1.79 ^a	1.68 ^b	137.25 ^{bc}	1.47 ^{cd}	1.96 ^c
V ₃	70.03	4.61 ^b	18.68 ^c	22.97 ^b	46.53 ^b	40.46 ^a	6.13 ^b	1.86 ^a	1.76 ^{ab}	141.83 ^{bc}	1.57 ^{bc}	2.13 ^b
V ₄	75.28	5.10 ^a	28.4 ^a	25.98 ^a	48.18 ^a	44.48 ^a	4.70 ^c	1.97 ^{ab}	1.91 ^a	175.45 ^a	1.74 ^a	2.28 ^a
V ₅	70.40	4.63 ^b	25.15 ^b	23.28 ^b	46.57 ^a	41.00 ^a	5.57 ^b	1.91 ^a	1.85 ^a	163.41 ^{ab}	1.62 ^b	2.14 ^b
LS	NS	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.05	0.01	0.01
CV(%)	5.93	6.03	5.29	4.68	11.94	12.77	7.10	4.98	8.09	17.22	6.41	5.11
Boron levels												
B ₁	68.24	4.24 ^c	16.69 ^d	18.51 ^d	36.52 ^c	29.52 ^c	7.00 ^a	1.72 ^c	1.56 ^c	143.40	1.39 ^c	1.85 ^c
B ₂	69.20	4.50b ^c	19.54 ^c	21.03 ^c	40.30 ^{bc}	34.01 ^c	6.29 ^b	1.81 ^b	1.69 ^{bc}	149.73	1.52 ^b	2.02 ^b
B ₃	71.33	4.70 ^{ab}	23.13 ^b	23.92 ^b	44.65 ^{ab}	39.73 ^b	5.93b ^c	1.89 ^{ab}	1.81 ^{ab}	143.46	1.62 ^{ab}	2.17 ^a
B ₄	72.33	4.93 ^a	27.57 ^a	26.46 ^a	49.52 ^a	44.94 ^a	5.57 ^c	1.94 ^a	1.90 ^a	161.70	1.70 ^a	2.27 ^a
LS	NS	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	NS	0.01	0.01
CV(%)	5.93	6.03	5.29	4.68	11.94	12.77	7.10	4.98	8.09	17.22	6.41	5.11

In a column the figures bearing similar letter (s) or without letter (s) are identical and those having dissimilar letter (s) differed significantly as per DMRT.

Table 3. Interaction effect of variety and boron level on the yield and yield components of chickpea

Variety× Boron	Plant height (cm)	Primary branches plant ⁻¹	Secondary branches plant ⁻¹	Nodules plant ⁻¹	Total pods plant ⁻¹	Effective pods plant ⁻¹	Non- effective pods plant ⁻¹	Pod length (cm)	Seeds pod ⁻¹	1000- seed wt (g)	Seed yield (tonha ⁻¹)	Stover yield (t ha ⁻¹)
V ₁ B ₁	66.73	3.86	13.36 ^l	16.30 ^k	29.46	34.00	8.53	1.51	1.20	120.66	1.233	1.660
V ₁ B ₂	67.40	4.13	15.53 ^{jk}	18.40 ^l	32.83	38.00	7.23	1.60	1.40	126.66	1.333	1.857
V ₁ B ₃	68.50	4.33	18.80 ^{gh}	20.15 ^g	34.13	42.66	7.13	1.77	1.60	133.33	1.433	1.967
V ₁ B ₄	69.33	4.06	21.86 ^e	21.50 ^l	37.26	45.20	7.00	1.83	1.80	139.00	1.550	2.020
V ₂ B ₁	68.31	4.33	15.36 ^k	17.18 ^j	44.33	25.66	7.26	1.63	1.40	127.33	1.317	1.723
V ₂ B ₂	70.69	4.53	17.96 ^{hi}	19.30 ⁿ	45.23	28.40	6.20	1.78	1.60	133.33	1.433	1.893
V ₂ B ₃	71.59	4.73	20.06 ^g	22.61 ^e	42.33	31.26	6.00	1.85	1.80	141.66	1.533	2.067
V ₂ B ₄	68.50	4.20	22.73 ^e	25.24 ^c	49.76	39.30	5.03	1.91	1.93	146.66	1.633	2.183
V ₃ B ₁	59.80	4.53	14.06 ^{kl}	18.36 ^l	33.80	22.63	6.80	1.73	1.60	132.66	1.417	1.900
V ₃ B ₂	70.69	4.73	16.60 ^{ij}	21.58 ^l	34.73	28.53	6.20	1.85	1.73	139.00	1.533	2.067
V ₃ B ₃	71.78	5.00	19.60 ^g	24.63 ^{cd}	42.63	37.20	5.43	1.90	1.86	146.00	1.630	2.223
V ₃ B ₄	73.69	5.20	24.46 ^d	27.33 ^b	47.80	42.20	5.60	1.95	1.86	149.66	1.717	2.330
V ₄ B ₁	73.69	4.73	21.40 ^{ef}	21.37 ^l	38.06	32.66	5.40	1.92	1.86	177.66	1.533	2.070
V ₄ B ₂	74.67	5.00	24.73 ^d	24.32 ^d	42.80	37.80	5.00	1.96	1.86	189.66	1.727	2.253
V ₄ B ₃	75.87	5.20	30.53 ^b	27.46 ^b	52.60	48.20	4.40	1.99	1.93	130.00	1.817	2.363
V ₄ B ₄	76.88	5.46	37.00 ^a	30.77 ^a	55.26	51.26	4.00	2.02	2.00	204.50	1.900	2.457
V ₅ B ₁	68.74	4.33	19.26 ^{gh}	19.33 ^{gh}	39.66	32.66	7.00	1.84	1.73	158.66	1.483	1.933
V ₅ B ₂	69.86	4.53	22.86 ^e	21.57 ^l	44.16	37.33	6.83	1.89	1.86	160.00	1.583	2.067
V ₅ B ₃	70.93	4.73	26.66 ^c	24.76 ^{cd}	47.53	41.33	6.20	1.95	1.86	166.33	1.690	2.233
V ₅ B ₄	72.06	4.93	31.80 ^b	27.47 ^b	50.36	44.66	5.73	1.97	1.93	168.66	1.743	2.360
LS	NS	NS	0.01	0.01	NS	NS	NS	NS	NS	NS	NS	NS
CV(%)	5.93	6.03	5.29	4.68	11.94	12.77	7.10	4.98	8.09	17.22	6.41	5.11

In a column the figures bearing similar letter (s) or without letter (s) are identical and those having dissimilar letter (s) differed significantly as per DMRT.

V₁= BARI Chola-5 V₂= BARI Chola-6 V₃= BARI Chola-7 V₄= BARI Chola-8 V₅= BARI Chola-9 B₁= 0 kg B ha⁻¹ (**Control**) B₂= 1 kg B ha⁻¹
B₃= 2 kg B ha⁻¹ B₄= 3 kg B LS= Level of significance CV= Co-efficient of variation NS= Non significant

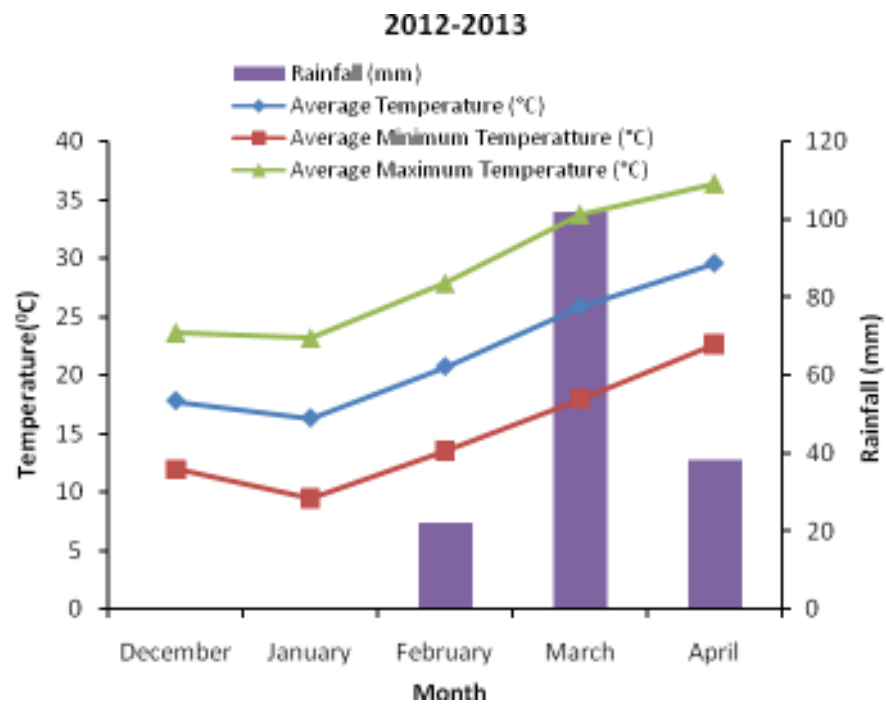


Figure 1. Monthly temperature and rainfall during the study period (December, 2012 to April, 2013).