

Yield and yield component of chickpea as affected by boron application

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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 in this experiment. A Randomized Complete Block Design was used for the experiment with three replications. Variety had significant effects on yield and its 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

24 protein. Chickpea (*Cicer arietinum*) is an ancient cultivated plant, domesticated during early age
25 of civilization and being cultivated throughout the world. It is an edible legumes belonging to the
26 family “Fabaceae” with slightly round, irregular shape and are slightly longer in size than the
27 normal peas. Its nomenclature in different countries is well documented as gram, chickpea,
28 hommos, chana, chiating vetch, nakhud, nakhut, kicher, pois chice, garbarzo etc. [1]. In respect
29 of area and production the total yield of chickpea was 6488 MT produced in 8250 ha in
30 Bangladesh [2]. It is the third most important pulse crop in Bangladesh with an average yield of
31 765 kg ha⁻¹ [3]. It is the cheap source of high quality protein in the diet of millions of people in
32 developing countries, who cannot afford animal protein for balanced nutrition [4]. On chemical
33 analysis of chickpea seed with and without seed coat contain (%) water, protein, fat, minerals,
34 ash, carbohydrate, energy (Cal.) at (9.9), (20.8), (5.6), (2.7), (1.2), (61.5), and (372)
35 respectively. It is also rich in Ca and Fe. Yield of chickpea is affected by varietal differences.

36

37 Boron is a micronutrient plays an important role in increasing yield of pulse legumes. It is very
38 important in cell division and in pod and seed formation. Boron ranks third places among
39 micronutrients in its concentration in seed and stem as well as its total amount after zinc [3].
40 Boron significantly affected the seed yield of chickpea [5]. The deficiency of boron has been
41 very pronounced under multiple cropping systems due to excess removal by HYV of crops and
42 hence its exogenous supply is urgently required. Boron deficiency limits chickpea productivity
43 less than Zn deficiency [6]), it has been shown to have a significant limiting effect on chickpea
44 yield in some regions with acid soil conditions [[7]. Boron application is most important when
45 boron concentration in soil is below 0.3 mg kg⁻¹ and crop response to boron application is
46 higher in chickpea than in some cereals [6]. Boron deficiency causes flower drop and,
47 consequently, poor podding in chickpeas [7] and poor yields. Seed yield of chickpea increased
48 with the application of boron @ 1.5-2.5 kg ha⁻¹ [8]. The application of boron resulted in a higher
49 production of dry matter, due to an increase of the dry weight of pods including seeds [9].

50

51 Variety also plays an important role in producing high yield of chickpea because different
52 varieties responded differently for their genotypic characters, input requirements, growth

53 process and the prevailing environment during growing season. Good quality chickpea variety
54 produces good quality seed and good quality seed produces higher yield. Varieties vary
55 morphologically and the variation is distinctly visible at different growth stages due to their
56 inherent characters. The use of varieties with low yield potential also limits gram yield to a
57 considerable extent [10]. High yielding cultivars usually have extensive root system, taller in
58 height [11], relatively more number of pods and grains pod^{-1} [12]. If we just replace our
59 present varieties with high yielding varieties which are very response to heavy fertilization and
60 may enhance our yield per unit area up to 8-12 % [10]. Chickpea is an important crop yet
61 little work has been done for the improvement of this crop in this country. Therefore, the present
62 study was undertaken to study the yield and yield components of chick pea as affected by boron
63 fertilization.

64 MATERIALS AND METHODS

65 The present research work was carried out at the Agronomy Field Laboratory, Department of
66 Agronomy and Agricultural Extension, University of Rajshahi during the period from December,
67 2012 to April, 2013 to study the yield of chickpea as affected by boron application. The
68 experiment consisted of two factors i.e. five chickpea varieties viz. BARI Chola-5, BARI Chola-
69 6, BARI Chola-7, BARI Chola-8 and BARI Chola-9 and four boron levels viz. 0, 1, 2 and 3 kg B
70 ha^{-1} . A Randomized Complete Block Design was used for the experiment. The treatments were
71 replicated three times. The physical and chemical properties of the soil and environmental
72 condition of the study period has been presented in Table 1 and Figure 1 respectively. The total
73 number of plots was $5 \times 4 \times 3 = 60$. The size of the each plot was $2\text{m} \times 2\text{m}$. The experimental field
74 was fertilized with urea, TSP, MoP @ 45, 85, 35 kg ha^{-1} respectively. All the fertilizers were
75 applied during the final land preparation. Boron was applied as per experimental treatment in
76 the form of boric acid. Seeds were sown on 6 December, 2012 in 40 cm apart rows opened by
77 specially made iron hand tine. Three weeding operations at 22, 32 and 50 DAS were done to
78 control weeds in the experimental field. Thinning was done when necessary for maintaining 5
79 cm plant to plant distance. Two irrigations were applied at 35 and 60 DAS. Data on yield and
80 yield components were recorded. Recorded data were compiled and tabulated for statistical

81 analysis. The data were analyzed statistically using the analysis of variance technique and the
82 mean differences among the treatments were adjudged by new Duncan's Multiple Range Test
83 (DMRT) with the help of MSTAT software [13].

84 RESULTS

85 Plant height

86 Significant variation was not observed in respect of plant height amongst different varieties.
87 BARI Chola-8 produced the tallest plant (75.28 cm) whereas BARI Chola-5 produced shortest
88 one (67.67 cm). Plant height did not respond significantly to the boron application. The highest
89 plant height (72.33 cm) was observed at 3 kg B ha⁻¹ and the lowest (68.24 cm) was recorded at
90 0 kg B ha⁻¹ (Table 2). The interaction between variety and boron level on plant height was not
91 statistically significant. The tallest plant (76.88cm) was obtained from BARI Chola-8 with 3 kg B
92 ha⁻¹ and the shortest one (66.73cm) from BARI Chola-5 at 0 kg B ha⁻¹ (Table 3).

93 Primary branches plant⁻¹

94 Variety had significant effect on the number of primary branches plant⁻¹. The highest number of
95 primary branches plant⁻¹ (5.10) was produced by BARI chola-8 and lowest number (4.21) was
96 produced by BARI Chola-5. The number of primary branches plant⁻¹ was significantly influenced
97 by boron level. The highest number of primary branches plant⁻¹ (4.93) was observed at 3 kg B
98 ha⁻¹ and the lowest one (4.24) was observed at control treatment (0 kg B ha⁻¹) (Table 2). Variety
99 and boron level interacted significantly on the number of primary branches plant. The maximum
100 number of primary branches plant⁻¹ (5.46) was obtained from BARI Chola-8 at the highest level
101 of boron application (3 kg B ha⁻¹) and lowest one (13.36) from BARI Chola-5 at control treatment
102 (0 kg B ha⁻¹) (Table 3).

103 Secondary branches plant⁻¹

104 The number of secondary branches plant⁻¹ was significant due to variety. The maximum number
105 of secondary braches plant⁻¹ (28.41) was produced by BARI chola-8 and the minimum one (17.39)
106 was produced by BARI Chola-5 (Table 2). Different boron levels showed significant variation in
107 respect of number of secondary branches plant⁻¹. However, the highest secondary branches plant⁻¹

¹ was recorded when 3 kg B ha⁻¹ was applied, which was higher over control (0 kg B ha⁻¹). Variety and boron level interacted significantly on number of secondary branches plant⁻¹. The maximum number of secondary branches plant⁻¹ (37.00) was obtained from BARI Chola-8 with 3 kg B ha⁻¹ whereas same variety produced minimum branches (21.40) at control application of boron (Table 3). The lowest value (13.36) for this trait was noted from the treatment combination of V₁B₁.

Nodules plant⁻¹

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

Total pods plant⁻¹

BARI Chola-8 produced the highest number of total pod plant⁻¹ (48.18) whereas BARI Chola-5 produced the lowest (39.00) for this yield component of chickpea. The number of total pod plant⁻¹ was significantly influenced by boron level. The highest number of total pods plant⁻¹ (49.52) was observed at 3 kg B ha⁻¹ and the lowest one (36.52) was observed at control treatment (Table 2). The interaction effect between variety and boron level on the number of total pod plant⁻¹ was not significant. The maximum number of total pods (55.26) was obtained from BARI Chola-8 with 3 kg B ha⁻¹. This result supported by [9]. The minimum number of total pod plant⁻¹ (29.46) was obtained from BARI Chola-5 at 0 kg B ha⁻¹ (Table 3).

131

132

Effective pods plant⁻¹

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

Non-effective pods plant⁻¹

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

Pod length

Variety had significant effect on pod length. The highest pod length (1.97cm) was produced by BARI Chola-8. The lowest pod length (1.68 cm) was given by BARI Chola-5. Pod length was significantly influenced by boron level. Numerically the highest length of pod (1.94cm) was 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

161 Chola-8 at 3 kg B ha⁻¹. The lowest pod length (1.51 cm) was recorded by the BARI Chola-5 at
162 control treatment (Table 3).

163 **Seeds pod⁻¹**

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

173 **1000-seed weight**

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

182 **Seed yield**

183 Seed yield was influenced significantly by different varieties. The highest seed yield (1.74 t ha⁻¹)
184 was produced by BARI Chola-8 followed by BARI Chola-9 (1.62 t ha⁻¹), BARI Chola-7 (1.57 t ha⁻¹)
185 ¹), BARI Chola-6 (1.48 t ha⁻¹) and BARI Chola-5 (1.39 t ha⁻¹). This is due to varieties differences
186 as a result BARI Chola-8 produced the highest seed yield. Boron doses exerted significant
187 influence on seed yield of chickpea. From the results of the experiment we can see that the

188 highest seed yield (1.70 t ha^{-1}) was obtained with the application of highest level of boron (3 kg
189 B ha^{-1}). Similar results were also reported by [3]. The lowest seed yield (1.39 t ha^{-1}) was obtained
190 from control treatment (Table 2). The effect of variety and boron level on seed yield was not
191 statistically significant. Numerically the highest seed yield (1.90 t ha^{-1}) was recorded from BARI
192 Chola-8 at 3 kg B ha^{-1} and the lowest one (1.23 t ha^{-1}) was obtained from the variety BARI
193 Chola-5 at control treatment (Table 3).

194 **Stover yield**

195 Stover yield was statistically significant within different varieties. The maximum stover yield
196 (2.28 t ha^{-1}) was obtained from BARI Chola-8 and the minimum one was obtained from BARI
197 Chola-5. Boron fertilizer also influenced the production of stover yield of chickpea. The highest
198 stover yield (2.27 t ha^{-1}) was noticed at the highest level of boron application (3 kg B ha^{-1}) and
199 the lowest one (1.85 t ha^{-1}) was in control treatment (Table 2). The effect between variety and
200 boron level failed to produce significant variation on stover yield. Numerically the highest stover
201 yield (2.45 t ha^{-1}) was obtained from the combination of V_4B_4 (BARI Chola-8 with 3 kg B ha^{-1})
202 and the lowest stover yield (1.66 t ha^{-1}) was obtained from BARI Chola-5 at 0 kg B ha^{-1} (Table
203 3).

204 **DISCUSSION**

205 Among the five varieties tested, BARI Chola-8 showed better performance in all respect. The
206 maximum number of pods plant^{-1} (48.25), 1000-seed weight (175.45) and seeds pod^{-1} (1.91)
207 were recorded from BARI Chola-8 which was significantly different over rest of the varieties. The
208 highest seed yield (1.74 t ha^{-1}) was produced by BARI Chola-8 followed by BARI Chola-9, BARI
209 Chola-7, BARI Chola-6 and BARI Chola-5. The yield difference was noticed due to varietal
210 potentialities in yield and yield components of the variety. The seed yield and yield components
211 significantly increased with the increment of boron level. The highest seed yield was recorded
212 when 3 kg B ha^{-1} was applied, which was higher over rest of the boron levels. The result
213 indicates that boron had significant influence on grain yield which was associated with the
214 number of pods plant^{-1} , grains pod^{-1} and 1000-grain weight. Boron is very important in cell
215 division and in pod and seed formation. The boron fertilizer increased the production of more

grains pod⁻¹ which might be the cause of more seed yield. This result is in conformity with the findings of [14]. Boron principally contributed to the yield and the crop performed better with subsequent higher doses up to 2.5 kg B ha⁻¹ [8]. Seed yield of chickpea (cv. BARI Chola- 5) increased significantly due to application of 1.5 kg B ha⁻¹ [15]. It is observed that under pot conditions with acidic soils at high moisture availability boron applications increased chickpea total dry matter and improved seed yield [9]. The lowest grain yield was recorded from the treatment where boron was not applied (Control). The reason of the lowest yield at control treatment is the boron deficiency in the soil. Due to severe deficiency of boron may restrict the normal flow of hormone. Resulting germination of pollen tube and receptivity of stigma sharply declined. Boron deficiency causes flower drop and, consequently, poor podding in chickpea and poor yields [7]. Soil application of boron did not cause either toxicity or a reduction in yield, perhaps because the doses used were not very high [16] since high rates can cause a reduction in yield, especially in dry conditions [6]. Although [17] did find a significant response, they carried out foliar rather than soil applications. Positive response of different genotypes in terms of seed yield was realized significantly in application of boron @ 3 kg B ha⁻¹. The highest values for seed yield of chick were obtained from V₄B₄ treatment combination and the lowest one from V₁B₁. The application of boron resulted in a more vegetative growth in acidic soils. The dry matter production increase, with increased boron supply, was mostly due to the increase in the number of pods (including seeds) plant⁻¹ [18].

Conclusion

On the basis of aforesaid findings it is evident that BARI Chola-8 showed better performance for almost all the yield components and yield of chickpea and consequently it produced the highest seed yield. Among the boron level 3 kg b ha⁻¹ was best for better yield. Finally the results suggest that combination of V₄×B₄ (BARI Chola-8 with 3 kg B ha⁻¹) is the best for obtaining highest yield of chickpea.

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291

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 ^{jl}	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 ^{el}	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

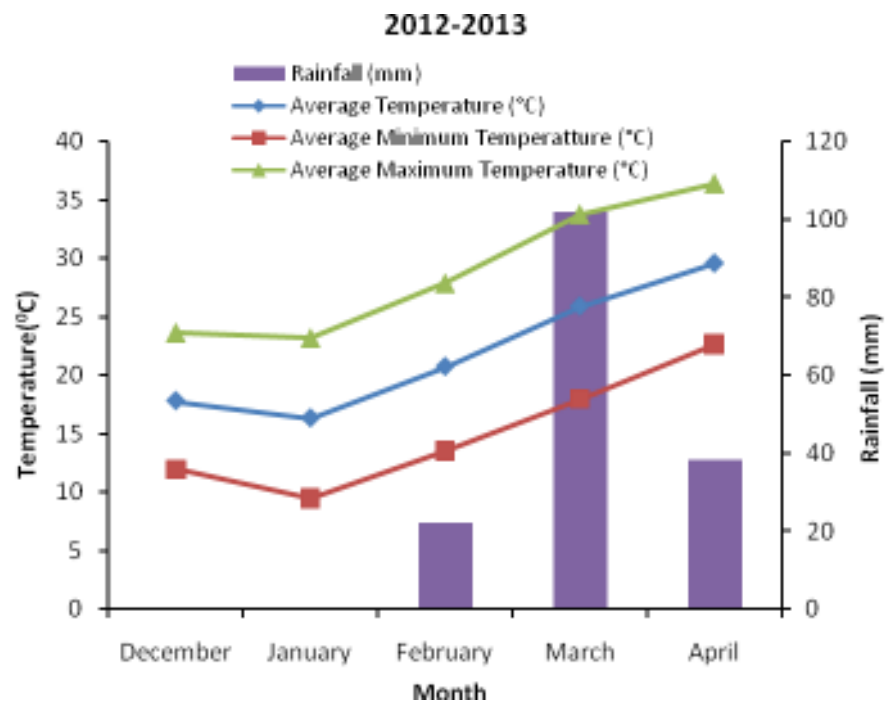


Figure 1. Monthly temperature and rainfall during the study period (December, 2012 to April, 2013).