Effect of seed priming on growth, yield and seed quality of chickpea (BARI chhola-6)


Abstract
A field experiment was conducted at the Agronomy research field of Sher-e-Bangla Agricultural University, Dhaka, during the period from November 2013 to March 2014 to study the response of seed priming on growth, yield and seed quality of chickpea. The experiment comprised as one factor: seed priming with gibrallic acid (GA3) - 5 levels: GA3 75 ppm – T1, GA3 150 ppm – T2, GA3 225 ppm – T3, GA3 300 ppm – T4 and hydro-priming – T5. The experiment was laid out in Randomized Complete Block Design (RCBD) with five replications. The result indicated significant variations in date of emergence, date of first flowering, date of 50% flowering, plant height, number of branches plant-1, total dry matter, number of pod plant-1, date to pod maturity, pod length, weight of 1000 seed, grain yield, stover yield, biological yield, harvest index, germination percentage and vigor index due to seed priming. Among the treatment on maximum plant height and dry matter content recorded of plant in T3 irrespective of growing period. This treatment also exhibited maximum number of pods plant-1, longest pod length and maximum number of seed pod-1, where as required minimum duration for pod maturity. The maximum weight of 1000 seed, height grain yield, harvest index and also maximum found germination percentage and vigor index were found. When chickpea was primed with 225 ppm GA3 then ensure the best production and seed quality.

Keywords: Chickpea, seed priming, GA3, yield and seed quality

1. Introduction
Chickpea (Cicer arietinum L.) is one of the major pulses crop in Bangladesh and it is the third most important food legume grown in the world after beans and peas. It is contributes about 3.87 % of total pulses production in Bangladesh (BBS, 2013). The average yield of chickpea is 1.32 t ha-1 butit is very low compared to other countries of the world. Total production of pulse in Bangladesh is 3,35,470 metric tons and total production of chickpea is 12,460 metric ton (BBS, 2013). Domestic pulse production satisfies less than half of the other countries demands. The rest, near about 1,40,000 ton, near to import at a cost of about 32.2 million USD per annum. Chickpea plays an important role the agro-economy and human healthy of Bangladesh.

Chickpea contain 20% protein, 4.8% fat, 9.1% crude fibre, 1.37% lysine, 195-205 mg/g carotene, 89 - 94 mg/g Ca and 9.2 - 9.4 mg/g Fe. Also, it is an important crop for both human consumption and animal feed due to 17 - 31% protein in seeds and biological activity of its protein ranges between 52 - 78% (Ciftci, 2004; Khan, 1981; Kaul, 1982). It supplies about four times as much protein and eight times as riboflavin and the caloric value of it is equal to rice (Anonymous, 1966). Moreover, it is known as poor man’s meat. It is a versatile source of nutrients for man, animal and soil (Miah, 1976).

Plant growth substances are another factor for growth and development of plant. PGRs comprise a large group of endogenous and exogenous chemical compounds that can regulate plant growth in numerous ways. PGRs have been and are mainly used in modern, high input crop management to shorten straw and thereby increase lodging resistance of chickpea. There are indications that GA3 have potential to modify pulse yield formation and plant stand structure additional to stem elongation. It plays an important role in flowering, pod filling and ripening and also physiochemical changes during storage. The plant growth regulator treatments significantly increased all physiological and yield characters (Meera and Poonam, 2010). Plant growth regulators (PGRs) have potential to increase chickpea yield and may also increase protein levels of legume crops (Ma et al., 1994). Chickpea plants use soil moisture accumulated during winter season to grow and to set seeds in spring. Drought stress resulting from inadequate soil moisture has negative effects on...
budding, pod set and seed yield (Sugui and Sugui, 2002). Treatment of seeds with water or different osmotic solutions before sowing is an effective mechanism to increase germination, seedling establishment and uniformity (Parera et al., 1994). Seed treatment could be done by either hydro-priming or osmotic priming with different salts (KNO3, K2PO4) and plant growth regulator (GA3) (Harris et al., 1999; Paul and Choudhury, 1991). GA3 affects activity of different enzymes, especially amylase and increase mobilization of starch granules in cotyledons thus, stimulates germination and growth (Kaur et al., 1998). Seeds treated with GA3 usually germination and grow faster have more developed root system, increase their tolerance to abiotic stress conditions, bloom and mature earlier and give better yields (Ekizce and Adak, 2005; Abd El-Fattah, 1997). Information on the effect of seed priming on growth, yield and seed quality of chickpea. Considering the present situation, the present research work was carried out with the following objective to select appropriate dose of chemicals which are used for seed priming.

2. Materials and methods
The experiment was conducted at the Agronomy experimental field of Sher-e-Bangla Agricultural University, Dhaka, Bangladesh during the period from November 2013 to March 2014 to study the effect of sowing time and seed treatment on growth and yield of chickpea. The location of the site is 23°74'N latitude and 90°35'E longitude with an elevation of 8.2 m from sea level. The soil belongs to “The Modhupur Tract”, AEZ – 28 (FAO, 1988). Top soil was silty clay in texture, olive-gray with common fine to medium distinct dark yellowish brown mottles. Soil pH was 5.6 and has organic carbon 0.45%. The geographical location of the experimental site was under the subtropical climate, characterized by 3 distinct seasons, winter season from November to February and the pre-monsoon period or hot season from March to April and monsoon period from May to October. BARI chhola-6 was collected from Bangladesh Agricultural Research Institute (BARI), Joydevpur, Gazipur. The experiment comprised as one factor of seed treatment viz. T1: GA3 75 ppm, T2: GA3 150 ppm, T3: GA3 225 ppm, T4: GA3 300 ppm and T5: hydro-priming. The experiment was laid out in Randomized Complete Block Design (RCBD) with five replications. The size of each unit plot 4.0 × 2.5 m. The spacing between blocks and polts were 1.0 m and 0.5 m. The plot selected for the experiment was opened in the last week of October, 2013 with a power tiller, and was exposed to the sun for a week, after which the land was harrowed, ploughed and cross-ploughed several times followed by laddering to obtain a good tilth. The fertilizers 50-90-40-10@urea, TSP, MP, Gypsum and borax, respectively were applied. The one third amount of urea and entire amount of TSP, MP, Gypsum, Zinc sulphate and borax were applied during the final preparation of land. Rest urea was applied in two equal installments at vegetative and flowering stage (BARI, 2011). After establishment of seedlings, various intercultural operations were accomplished for better growth and development of the chickpea. The crop was harvested at full maturity on 08 March, 2013 and harvesting was done manually from each plot. The harvested crop of each plot was bundled separately, properly tagged and brought to threshing floor. Enough care was taken for harvesting, threshing and also cleaning of chickpea seed. Fresh weight of grain and stover were recorded plot wise. The grains were cleaned and finally the weight was adjusted to a moisture content of 12%. The stover was sun dried and the yields of grain and stover plot-1 were recorded and converted to t ha-1.

Data were collected on date of emergence, date of 1st and 50% flowering, plant height (cm), number of branches plant-1, total dry matter, number of pods plant-1, days to pod maturity, pod length plant-1, number of seeds pod-1, weight of 1000 seeds (g), grain yield (Kg ha-1), stover yield (Kg ha-1), biological yield (Kg ha-1), harvest index (%), germination (%) and vigor index. The data obtained for different characters were statistically analyzed to observe the significant difference among the treatment by using the MSTAT-C computer package program. The significance of the difference among the treatments means was estimated by the Duncan’s Multiple Range Test (DMRT) at 5% level of probability (Gomez and Gomez, 1984).

3. Results and discussion
3.1 Date of emergence
Seed primed with different level of gibberellic acid along with hydro-priming showed significant variation in time required for date of emergence. The minimum time required for days to emergence was observed in T1, when seed priming with 225 ppm GA3. Whereas the maximum time required for days to emergence was recorded in T3 and T5 treatments (Figure 1).

3.2 Days of first flowering
Significant variation was observed for days of first flowering among the seed primed with GA3 along with hydro-priming. The maximum days of first flowering (62.33 days) was observed in T1, when seed priming with 225 ppm GA3. Whereas the maximum time required for days to first flowering (48.11 days) was observed in T5, when seed priming with 225 ppm GA3, and seed priming with 225 ppm GA3 (Figure 2).

3.3 Date of 50% flowering
Significant variation was observed for days of 50% flowering among the seed primed with GA3. The maximum days of 50% flowering (82.33 days) was observed in T1 and T3. The minimum days of 50% flowering (68.11 days) was observed in T5, when seed priming with 225 ppm GA3, when seed priming with 225 ppm GA3 (Figure 3). The minimum number of days for 50% flowering was observed on GA3 225 ppm treatment.
3.4 Plant height
Plant height of chickpea at 20, 40, 60 DAS and at harvest varied significantly due to seed priming with GA3. The tallest plants (11.56, 35.52, 43.45 and 40.13 cm) were observed from T3, which was statistically similar (11.09, 34.61, 41.78 and 39.57 cm) with T4 and the shortest plants (8.25, 26.11, 36.27 and 35.32 cm) were found in T5 at same days after sowing (Figure 4).

3.5 Number of branches plant$^{-1}$
Number of branches plant$^{-1}$ of chickpea were significantly influenced by seed priming with GA3 at 20, 40, 60 DAS and at harvest. The maximum number of branches plant$^{-1}$ (1.47, 9.33, 19.10 and 21.21) were observed from T3, which was statistically similar (1.44, 8.90, 18.70 and 20.54) to that of T4 and the minimum number of branches plant$^{-1}$ (1.23, 7.51, 14.87 and 16.10) were found in T5 at same days after sowing (Figure 5).
3.6 **Total dry matter content**

Total dry matter content in plant of chickpea varied significantly due to different seed priming with GA3 at 20, 40 and 60 DAS. The highest dry matter in plant (5.33, 8.07, 11.32 g) were recorded from T3, which was statistically similar (5.25, 7.66 and 11.01 g) to T4 at 20, 40 and 60 DAS, whereas the lowest dry matter content in plant (4.40, 7.18 and 9.65 g) were found in T5 at same days after sowing (Figure 6).

3.7 **Number of pods plant⁻¹**

Seed priming with GA3 exhibited significant differences between them in respect of number of pods plant⁻¹. The maximum number of pods plant⁻¹ (55.50) was recorded from T3, which statistically similar (52.38) was found in T4, whereas the lowest number of pods per plant (45.20) was found in T5 (Figure 7).

3.8 **Days to pod maturity**

Days to pod maturity of chickpea differed significantly due to seed priming with GA3. The maximum days required for pod maturity (115 days) was recorded from T5, whereas the minimum days required for pod maturity (96 days) was found T3 (Figure 8). The minimum days to pod maturity was found 225 ppm GA3 treatment.

3.9 **Number of seeds pod⁻¹**

Number of seeds pod⁻¹ of chickpea differed significantly due to seed priming with GA3. The height number of seeds pod⁻¹ (1.91) was recorded from T3, whereas the lowest number of seeds pod⁻¹ (1.27) was found T5 (Figure 10).

3.10 **Weight of 1000 seeds (g)**

Weight of 1000 seeds of chickpea differed significantly due to seed priming with GA3. The highest weight of 1000 seeds (106.16 g) was recorded from T3, whereas the lowest weight of 1000 seeds (91.35 g) was found T5 (Figure 11).

3.11 **Grain yield (Kg ha⁻¹)**

Grain yield of chickpea varied significantly due to seed priming with GA3. The highest grain yield (1687.15 Kg ha⁻¹) was observed from T3 and the lowest grain yield (981.59 Kg ha⁻¹) was found in T5 (Figure 12).
3.12 Straw yield (Kg ha⁻¹)
Straw yield of chickpea were significantly influenced by seed priming with GA₃. The highest straw yield (2701.43 Kg ha⁻¹) was observed from T₃, whereas the lowest straw yield (1522.25 Kg ha⁻¹) was found in T₅ (Figure 13).

3.13 Biological yield (kg ha⁻¹)
Seed priming with GA₃ a significant in producing biological yield. The highest biological yield (4388.58 Kg ha⁻¹) was observed from T₃, which statistically similar (4132.42 Kg ha⁻¹) to T₄. The lowest biological yield (2503.84 Kg ha⁻¹) was found in T₅ (Figure 14).

3.14 Harvest Index (%) 
A significant difference was observed for harvest index due to seed priming with GA₃. The maximum harvest index (42.62 %) was observed from T₃, whereas the minimum harvest index (38.38 %) was found from T₅, which statistically similar (38.44 %) to T₁ (Figure 15).

3.15 Germination (%)
Seed priming with GA₃ a significant in germination percentage. The highest germination percentage (91.67) were
observed from T₃. The lowest germination percentage (85.67) were found in T₁ (Figure 16).

3.16 Vigor Index
Seed priming with GA₃ a significant in vigor index. The highest vigor index (1477.00) was observed from T₃. The lowest vigor index (1093.00) was found in T₁ (Figure 17).

4. Conclusion
In this experiment, the maximum number of seeds pod⁻¹, weight of 1000 seeds, grain yield, harvest index, germination percentage and highest vigor index was observed from T₃. So, Seed priming with 225 ppm GA₃ ensure the highest seed production and quality seed of chickpea.

5. References