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

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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 gibberellic 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 contributes about 3.87 % of total pulses production in Bangladesh (BBS, 2013). The average yield of chickpea is 1.32 t ha⁻¹ but it 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

blooming, 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 (KNO_3 , K_3PO_4) and plant growth regulator (GA_3) (Harris *et al.*, 1999; Paul and Choudhury, 1991). GA_3 affects activity of different enzymes, especially amylase and increase mobilization of starch granules in cotyledons thus, stimulating germination and growth (Kaur *et al.*, 1998). Seeds treat with GA_3 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 $23^{\circ}74'\text{N}$ latitude and $90^{\circ}35'\text{E}$ 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: GA_3 75 ppm, T₂: GA_3 150 ppm, T₃: GA_3 225 ppm, T₄: GA_3 300 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 plots 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 50-90-40-10-10@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 gibberelic 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 T₃, when seed priming with 225 ppm GA_3 . Whereas the maximum time required for days to emergence was recorded in T₁ 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 GA_3 along with hydro-priming. The maximum days of first flowering (62.33 days) was observed is T₁ and T₅. The minimum days of first flowering (48.11 days) was observed T₃, when seed priming with 225 ppm GA_3 , when seed priming with 225 ppm GA_3 (Figure 2).

3.3 Date of 50% flowering

Significant variation was observed for days of 50% flowering among the seed priming with GA_3 . The maximum days of 50% flowering (82.33 days) was observed T₁ and T₅. The minimum days of 50% flowering (68.11 days) was observed T₃ (Figure 3). The minimum number of days for 50% flowering was observed on GA_3 225 ppm treatment.

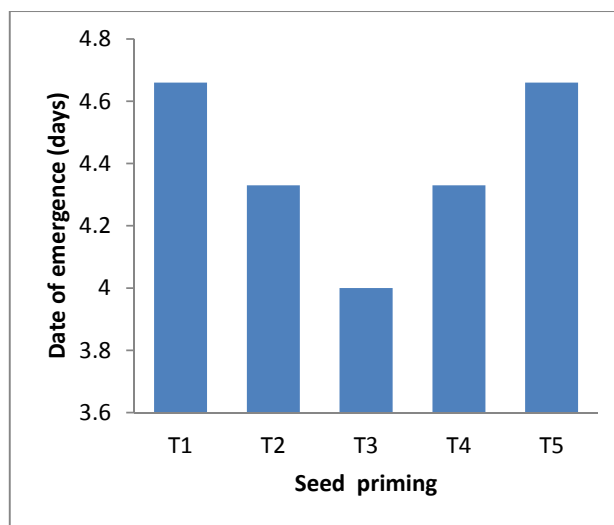


Fig 1. Effect of seed priming on date of emergence of chickpea

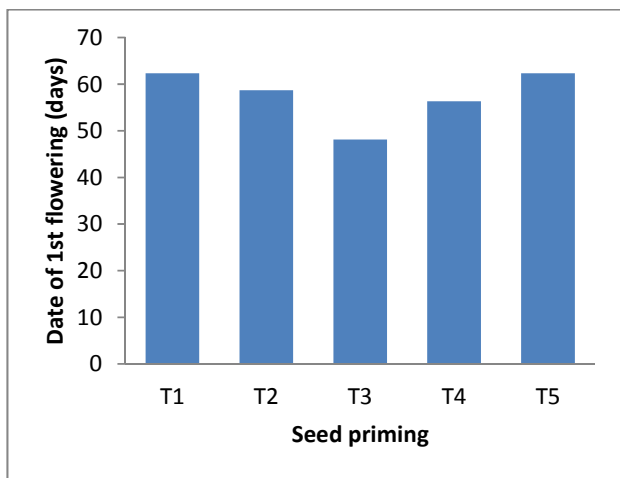


Fig 2. Effect of seed priming on date of 1st flowering of chickpea

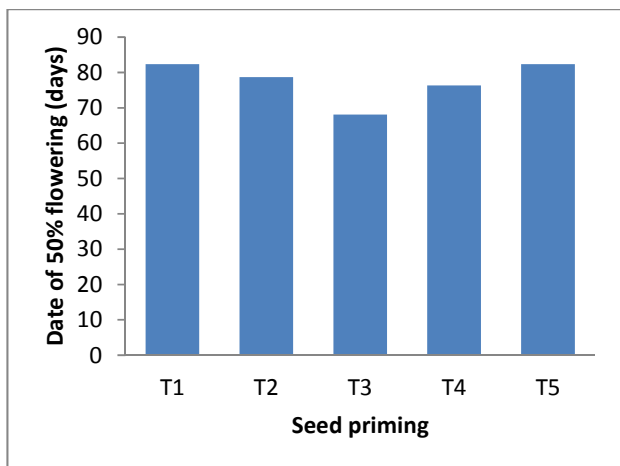


Fig 3. Effect of seed priming on date of 50% flowering of chickpea

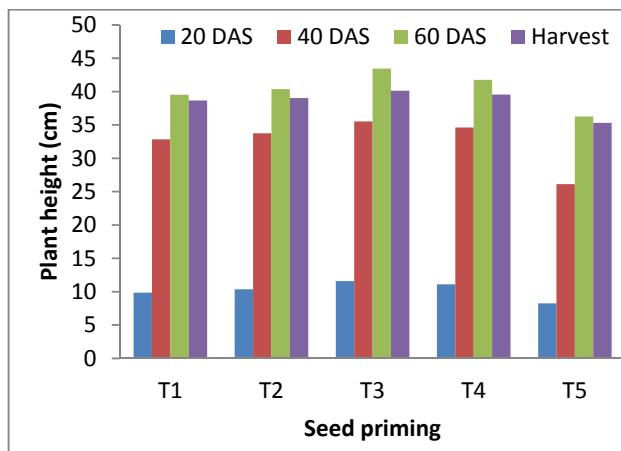


Fig 4. Effect of seed priming on plant height of chickpea

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).

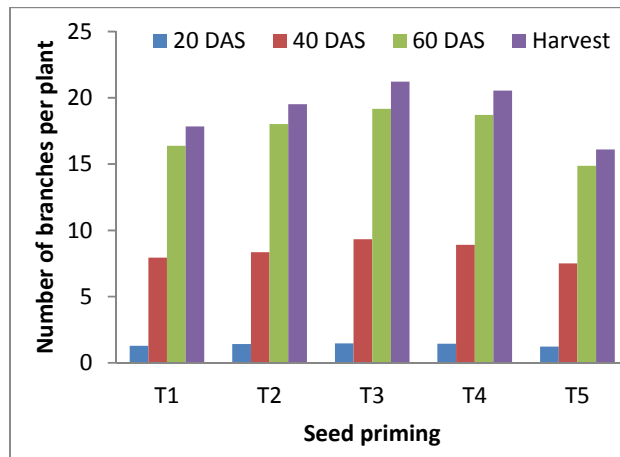


Fig 5. Effect of seed priming on number of branches plant⁻¹ of chickpea

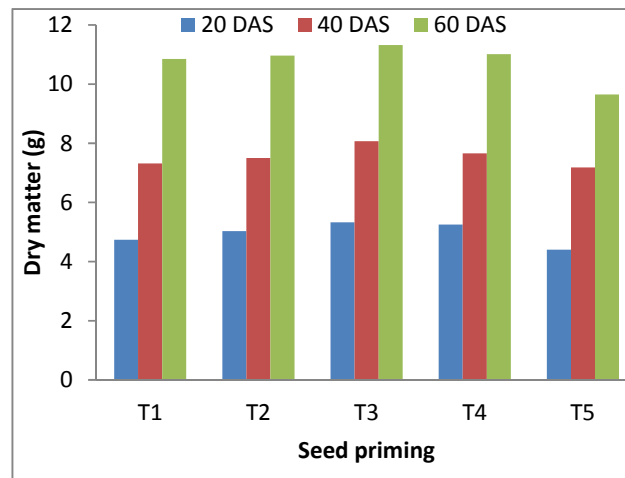


Fig 6. Effect of seed priming on dry matter content of chickpea

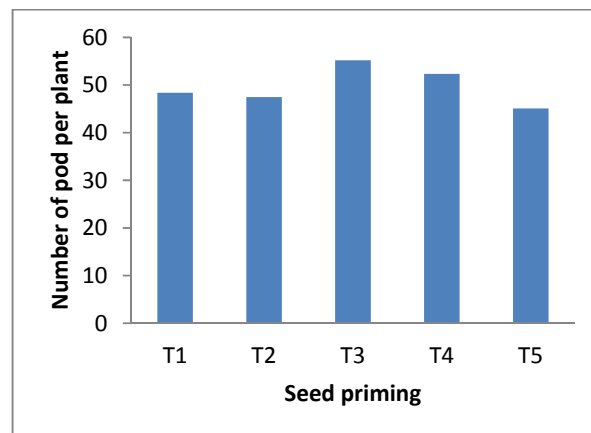


Fig 7. Effect of seed priming on number of pod plant⁻¹ of chickpea

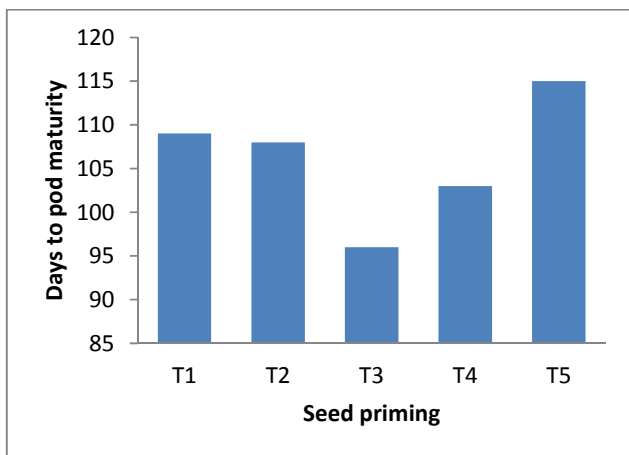


Fig 8. Effect of seed priming on days to pod maturity of chickpea

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.

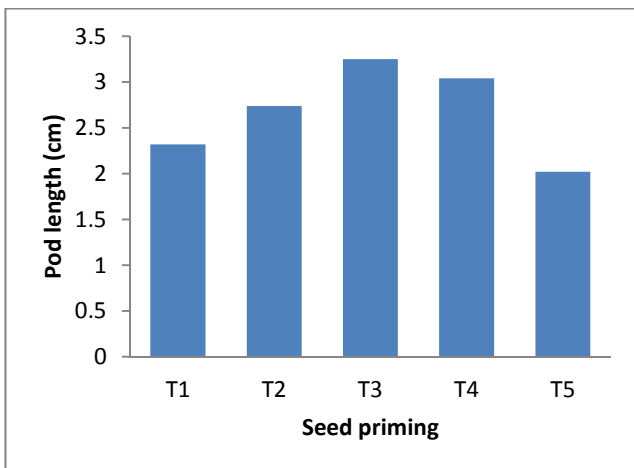


Fig 9. Effect of seed priming on pod length of chickpea

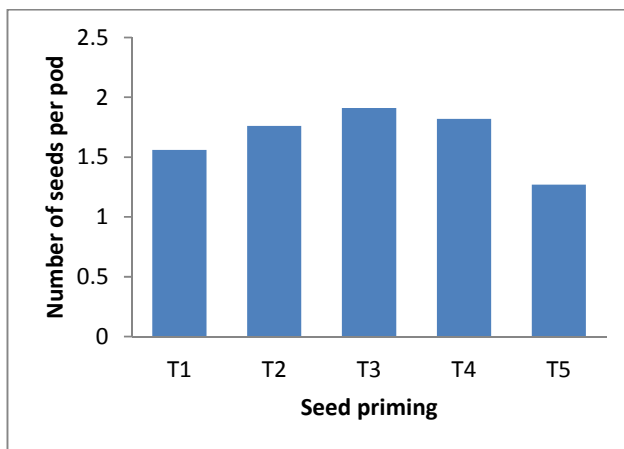


Fig 10. Effect of seed priming on number of seeds pod⁻¹ of chickpea

3.8 Pod length plant⁻¹

Pod length plant⁻¹ of chickpea differed significantly due to seed priming with GA₃. The height pod length plant⁻¹ (3.25) was recorded from T₃, which the statistically similar to T₄ (3.04 cm). The lowest pod length plant⁻¹ (2.02 cm) was found T₅ (Figure 9).

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, which statistically similar (105.90 g and 104.83 g) to T₂ and T₄. 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).

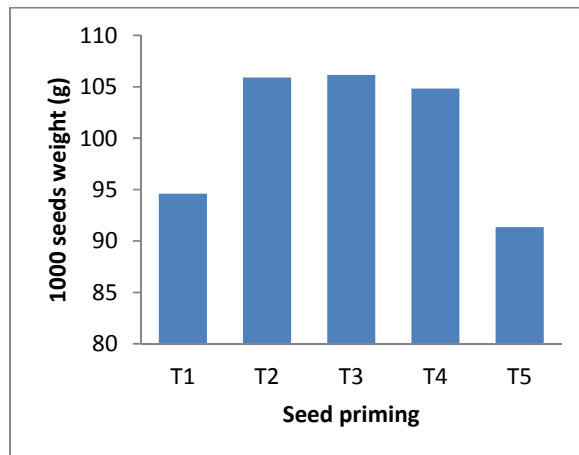


Fig 11. Effect of seed priming on 1000 seed weight of chickpea

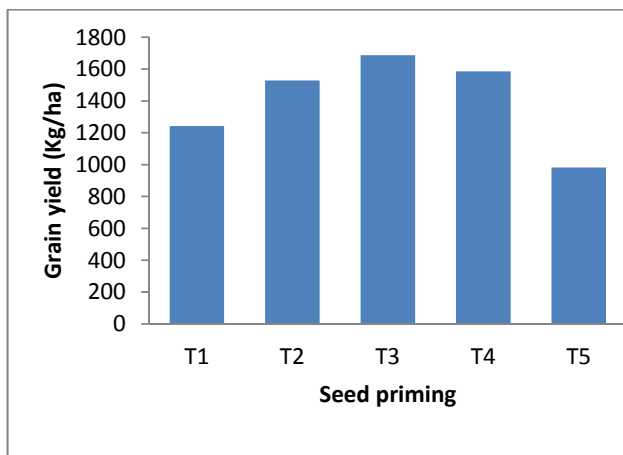


Fig 12. Effect of seed priming on grain yield of chickpea

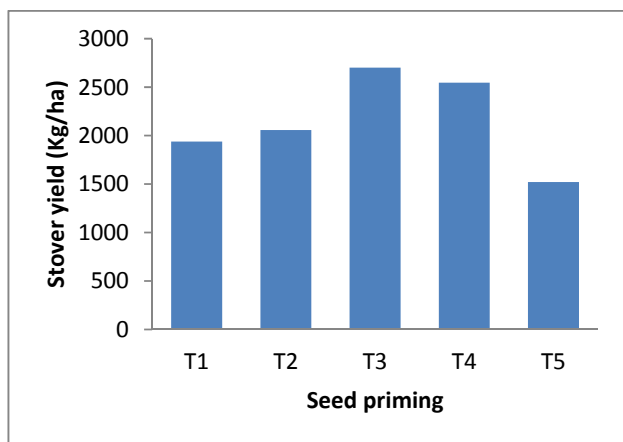


Fig 13. Effect of seed priming on stover yield of chickpea

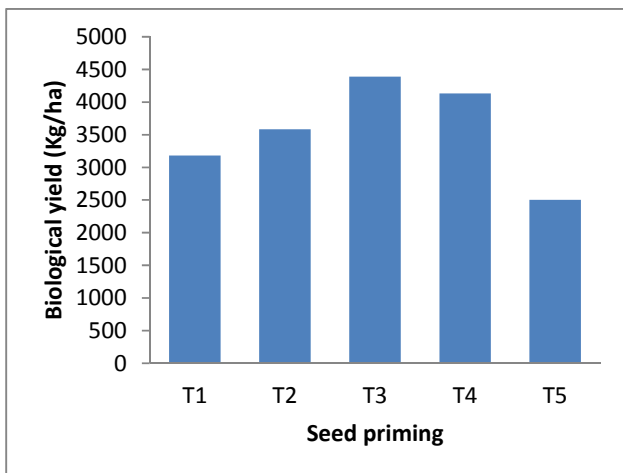


Fig 14. Effect of seed priming on biological yield of chickpea

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).

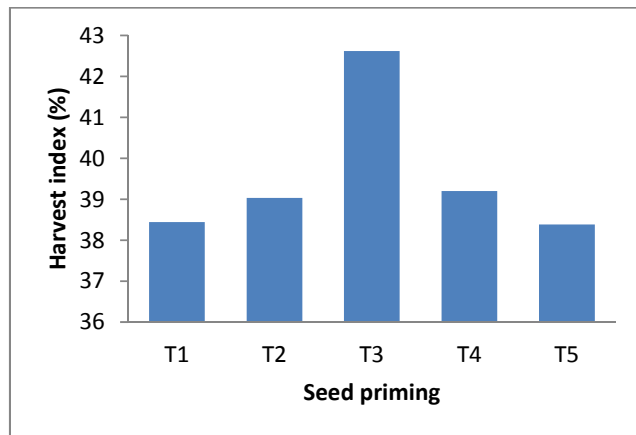


Fig 15. Effect of seed priming on harvest index (%) of chickpea

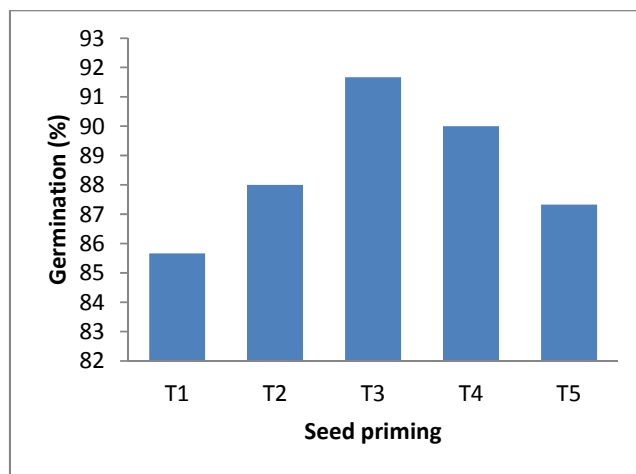


Fig 16. Effect of seed priming on germination (%) of chickpea

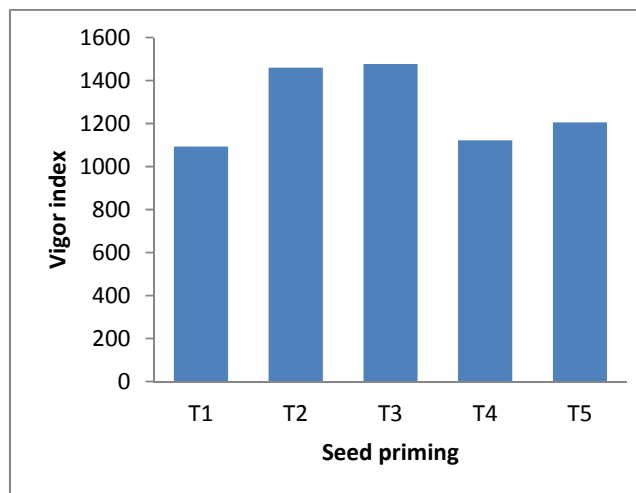


Fig 17. Effect of seed priming on vigor index of chickpea

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

1. Abd El-Fattah MA. Effect of phosphorus, boron, GA₃ and their interaction on growth, flowering, pod setting, abscission and both green pod and seed yields of broad bean plants, Alexandria. *Agril. Res.* 1997, 42:311-332.
2. Abu-Shakara S. and Tannous RI. Nutritional value and quality of chickpea. In: chickpea, Edition: C. Wabb and G. C. Haetin, CAB. Farnham Royal, England. 1981, 192-202.
3. Allam AY. Effect of sowing time, seedling rate and nitrogen sources on yield, yield components and quality of chickpea. *Assiut J. Agril. Sci.* 2002, 33(5): 131-144.
4. Anonymopus. Ministry of Healty. Univ. of Dhaka. National Institute of Healty & U. S. Department of Healty. Pakistan Nutrition Survey of East Bangla. 1966, 66:4-6.
5. BARI (Bangladesh Agricultural Research Institute). Fertilizer year book. Ministry of Agriculture, Govt. People's Repub. Bangladesh. 2011, 64.
6. Boztok, S. Investigation on the effect of sowing date and verbalization on seed production in early cauliflower cv. Ege. *Universal Zirrat Fakultesi Dergis.* 1985, 22:89-99.
7. BBS (Bangladesh Bureau of Statixtics). Statistical Year Book of Bangladesh Statistics Division, Ministry of Planning, Government of the People's Republic of Bangladesh. Dhaka. 2013, 34 & 63.
8. Ciftic CY. Dunyada ve turkiyede yemelik tane baklagiller tarimi. TMMOB ziraatn muhendisleri odasi teknik yayinlar dizisi. 2004, 5: 200.
9. Ekizce M. and Adak MS. Nohutta normal ve geciktirilmiekimlerde tohumlara uygulanan ilemlerin cimlenme, cikive verime etkileri. Turkiye vi tarla bitkileri kongresi, 5-9 Eylul 2005, Antalya, Aratirma unusu city. 2005, 1: 285-289.
10. FAO (Food and Agriculture Organization). FAO Production Yearbook, Basic Data Unit. Statistic Divition, FAO Rome, Italy. 1988.
11. Gomez KA. and Gomez AA. Statistical procedure for agricultural research. Second Edn. Intl. Rice Res. Inst., John Wiley and Sons. New York. 1984, 311-340.
12. Gurun, GB, Rijal DK. and Gurung BD. Effect of sowing time on grain yield of chickpea under rainfed condition at Pakhribas, *PAC Technical Paper Pakhribas Agril. Centre.* 1996, 172: 22.
13. Hanlan TG, Ball RA. and Vandenberg A. Canopy growth and biomass partitioning to yield in short-season chickpea. *Canadian J. Plant Sci.* 2006, 86(1): 109-119.
14. Harris D, Joshi A, Khan PA, Gothakar P. and Sodhi PS. On-farm seed priming in semi-arid agriculture: Development and evaluation in corn, rice and chickpea in India using participatory methods. *Exp. Agric.* 1999, 35: 15-29.
15. Kaul A. Pulses in Bangladesh. BARC (Bangladesh Agricultural Research Council), Farmgate, Dhaka. 1982, 27.
16. Kaur S, Gupta AK and Kaur N. GA₃ reverses the effect of salt stress in chickpea (*Cicer arietinum*) seedlings by enhancing amylase activity and mobilization of starch in cotyledons. *Plant Growth Regul.* 1988, 26: 85-90.
17. Khan MAA. The effect of CO₂ enrichment on the pattern of growth and Dev. in pulse and mustard. Ph. D. Dissertation. Royal Vet. Agril. Univ. Copenhagen. 1981, 104.
18. Ma BL, Leibovitch S. and Smith DL. Plant Growth Regulator effects on Protein Content and Yield of chickpea (*Cicer arietinum*). *J. Agron. Crop Sci.* 1994, 72(1): 9-18.
19. Maih AL. Grow more pulse to keep your pulse well. Department of Agronomy. Bangladesh Agricultural University, MYmensingh. 1976, 11-38.
20. Meera S. and Poonam S. Response of growth regulators on some physiological traits and yield of chickpea (*Cicer arietinum*). *Prog. Agric.* 2010, 10(2): 387-388.
21. Mittel SP. and Srivastava G. Seed yield inrelation to bulb size and seed stalks in onion. *Indian J. Hort.* 1964, 21: 264-269.
22. Parera CA, Qiao P. and Cantliffe DJ. Enhanced celery germination at stress temperature via solid matrix priming. *Hort. Sci.* 1994, 28 (1): 20-22.
23. Paul SR. and Choudhury AK. Effect of seed priming with potassium salts on growth and yield of wheat with chickpea under rainfed condition. *Ann. Agric. Res.* 1991, 12: 415-418
24. Sugui FP. and Sugui CC. Response of chickpea to dates of sowing in locos Norte, Philippines. Intl. Chickpea and pigeonpea Newsl. 2002, 9: 13-15.
25. Yadav VS, Yadav SS. and Panwar JDS. Effect of planting time on physiological attributes and grain yield in desi and kabuli chickpea genotypes. *Indian J. Plant Physiol.* 1988, 3(4): 292-295