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Effect of Seed Priming Treatments on Seed Yield and Seed Quality Parameters in Chickpea (*Cicer arietinum* L.) cv BDNGK-798

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ABSTRACT: A field experiment was conducted at experimental farm of AICRP on safflower, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani during *Rabi* 2022-23 using chickpea cv BDNGK-798 to evaluate the effect of different seed priming treatments on growth, seed yield and yield attributing characters in chickpea. Experiment was laid out with seven treatments including one control, replicated thrice in Randomized Block Design. The chickpea cv. Virat (BDNGK-798) seed was primed with different growth regulators *viz*., Gibberellic acid @ 100ppm, Indole Acetic Acid @ 200 ppm, Salicylic Acid @ 100 ppm, $KN0_3$ @ 100 ppm, PEG @ 7%, $CaCl_2$ @2% along with control. The observations were recorded on following characters *viz*., days to 50 per cent flowering, days to physiological maturity, plant height (30 DAS) (cm), plant height (60 DAS) (cm), primary branches / plant (30 DAS), primary branches / plant (60 DAS), secondary branches / plant (60 DAS), number of pods/ plant, pod weight /plant (g), seed yield /plant (g), biological yield /plant (g), seed yield /plot (kg), germination percentage, seed vigour -I and seed vigour -II. All the priming treatments were found effective over control. However, the treatment with calcium chloride ($CaCl_2$) @ 2% was found more effective among all treatments.

Key words: Chickpea, seed priming, seed yield and seed quality

INTRODUCTION

Chickpea (*Cicer arietinum* L.) commonly known as chana or Bengal gram, is an important *Rabi* pulse crop of India, belonging to the family Leguminosae and is a preferred crop grown in scanty moisture conditions. It is native of Turkey and Syria. The word "*Cicer*" is derived from the Greek word 'Cicero' and "*arietinum*" is derived from a latin word which refers to the ram's head shape of chickpea seed. It is cultivated in India either for dal purpose and also consumed as a roasted form.

Chickpea is the second most important pulse crop in the world after soybean and plays an important role in human diet as a major source of protein. It is widely distributed from tropical to sub-tropical zones. Among the various pulses, chickpea occupies 1st position in India and 3rd position at global level in terms of production. In India, the most important chickpea growing states are Madhya Pradesh, Rajasthan and Maharashtra producing 27.29, 26.57 and 22.39 MT respectively. Chickpea is a highly nutritious grain legume as it contains significant amount of carbohydrates (60 to 65 %), fat (6%), ash (48%) and higher protein (12 to 31 %) as compared to other pulse crops. Chickpea also contains many important vitamins and minerals like calcium, iron, molybdenum, potassium, magnesium, copper, zinc etc. It is also an important source of dietary fibre [1].

Besides the importance of chickpea for human food and animal feed, it is a very important component of cropping systems of the dry rainfed areas because of its ability to fix 80 to 120 kg of nitrogen per ha through symbiotic nitrogen fixation by rhizobium bacteria. As a result, it maintains the soil fertility by fixing the atmospheric nitrogen and improves the soil structure. Therefore, this crop is considered, as an excellent crop for natural resources management, environmental crop diversification and consequently for sustainable agriculture [2]. The productivity of chickpea has reduced due to various constraints such as biotic and abiotic factors. In order to improve the quality and its requisite production for upcoming generation and fulfilling future population need, various seed quality enhancing techniques have to be used. Seed priming is one of the techniques that will help to meet the required quality parameters for future demands, by increasing the yield and yield attributing traits. Hence the present investigation was undertaken to study the effects of seed priming treatments on seed yield and seed quality parameters in chickpea cv BDNGK-798.

MATERIALS AND METHOD

A uniform piece of land was selected and brought to a fine tilth by ploughing and harrowing. A Randomised Block Design (RBD) with three replications was used to assess the experimental material. The variety of chickpea 'BDNGK-798', obtained from seed processing and storage unit, VNMKV Parbhani was used as a seed material. The treatments consisted of -T_1-Control, T_2 – Gibberellic acid @ 100ppm, T_3 –Indole Acetic Acid @ 200 ppm, T_4-Salicylic Acid @ 100 ppm, T_5-$KN0_3$ @ 100 ppm, T_6 –PEG @ 7%, T_7– $CaCl_2$ @2%. The chickpea cv. Virat (BDNGK-798) seed was primed with different seed priming treatments and soaked for 8 hrs before sowing with 1:1 soaking solution to seed ratio. On next day morning primed seeds were dried under shade for 30 min. Sowing was done in field by dibbling method at 45 cm and 10 cm spacing between rows and plants, respectively. After seeding, a mild irrigation was applied. One plant per hill was maintained by thinning, 15 days after sowing. All other cultural practices were implemented to ensure a healthy harvest. Observations were recorded on following characters *viz*., days to 50 per cent flowering, days to physiological maturity, plant height (30 DAS) (cm), plant height (60 DAS) (cm), primary branches / plant (30 DAS), primary branches / plant (60 DAS), secondary branches / plant (60 DAS), number of pods/ plant, pod weight /plant (g), seed yield /plant (g), biological yield /plant (g), seed yield /plot (kg), germination percentage, seed vigour -I and seed vigour -II. Analysis of variance was carried out as per the standard procedure suggested by [3].

RESULTS AND DISCUSSION

Days to 50 per cent flowering

It was observed that the days to 50 per cent flowering ranged from 47 to 50 days. All the treatments recorded significantly minimum days to 50 per cent flowering as compared to control. Among all treatments gibberellic acid treatment recorded early days to 50 per cent flowering. The results are in agreement with the study by [4].

Days to maturity

Days to maturity ranged from 96 to 102 days. Seed treated with Salicylic acid @ 100 ppm 96 days followed by T_2 – Gibberellic Acid (GA_3) @ 100 ppm 97 days, T_3 – Indole Acetic Acid @ 200 ppm 97 days and T_5-$KN0_3$ @ 100 ppm 97 days recorded minimum days to attain maturity as compared to control (102 days). Earliness in some treatments can be due to the production of growth regulating substances like gibberellic acid, indole acetic acid etc which have positive impact on the plant metabolic activity that assist the plants to induce early flowering and maturity. The results are in conformation with [5] who reported that seed priming can lead to early days to maturity.

Plant height (30 DAS) cm

The plant height at 30 (DAS) ranged from 16.00-17.27 cm. The treatment T_2-Gibberellic acid @100 ppm recorded significantly highest plant height 19.80 cm followed by T_6-Poly ethylene glycol @ 7% 17.27 cm and at par with T_7- $CaCl_2$ @ 2% 17.07 cm as compared to control (16 cm). The results are conforming with the study by [5,6,7] who reported that the gibberellic acid causes elongation of cell and thus increases plant height.

Plant height (60 DAS) cm

The plant height recorded at 60 (DAS) ranged from 36-43 cm. Treatment T_5-KNO_3 (100 ppm and 43 cm) T_2-Gibberellic acid @ 100 ppm (43 cm) reported significantly highest plant height followed by T_4-Salicylic Acid @ 100 ppm (39 cm) as compared to control (36 cm). Similar findings were reported by [6,7].

Number of Primary branches per plant (30 DAS)

The number of the primary branches ranges from 1.50 to 2.80. Seed treated with T_2-Gibberellic acid @ 100 ppm (2.80) was followed by T_7-$CaCl_2$ (2%) @ 2.63 and T_1-Control (1.50). Gibberellic acid treatment resulted in more no. of primary branches due to the cell elongation and due to the greater cell division also the $CaCl_2$ plays a vital role in cell formation and more cell division that ultimately promotes the vegetative growth. The results are similar to the study by [8,9] who reported that the number of primary branches per plant increases significantly under the above mentioned treatments.

Number of Secondary branches per plant (60 DAS)

Number of secondary branches ranges from 7.80 to10.90. Treatment with gibberellic acid @ 100 ppm (10.90) and IAA @ 200 ppm (9.73) recorded the highest no. of secondary branches than other treatment and over control (7.80). Gibberellic acid promotes a greater number of secondary branches as their effect on plant metabolic activity and thereby increasing the cell elongation, early maturation that has ultimately effect on increasing the secondary branches of the plant. whereas Indole acetic acid acts as the shoot promoting hormone that has made direct effect on enhancing the secondary branches of the plant. The results are coherent with the findings made by [10] who reported that the no. of secondary branches per plant increases in case of the IAA treatment.

Number of pods per plant

Number of pods per plant ranges from 58.00 to 72.00. Seed material primed with $CaCl_2$ @ 2% (72.00) and Salicylic acid @ 100 ppm (70.33) were at par with the Gibberellic acid @ 100 ppm (69.67) and they recorded the highest number of pods per plant than the other treatments and over control (58.00). Calcium plays a crucial role in cell wall formation as well as is constituent for seed as well as pod formation whereas salicylic acid promotes secondary branches which has direct relation to increase in the number of pods per plant. The results are consistent with the study by [11, 12] who reported that seed priming treatment with $CaCl_2$ and Salicylic acid significantly increased the number of pods per plants.

Pod weight per plant (g)

Pod weight per plant ranged from 44.51 to 102.53 g. The result indicated that the treatment with T_7-$CaCl_2$ @ 2% 102.53 g followed by T_5-KNO_3 @100 ppm 92.56 g recorded highest pod weight than other treatments and T_1-Control (44.51 g). The results are conforming with the study by [10,13] who illustrated that seed priming treatment significantly increased the pod weight per plants.

Seed yield per plant (g)

The seed yield per plant ranged from 10.47 to 21.17 g. Seed material treated with T_7-$CaCl_2$ @2% (21.17 g) followed by T_5-KNO_3 @100 ppm (20.50 g) recorded highest seed yield per plant than other treatments and T_1-Control (10.47 g). The calciumcontent plays a crucial role in cell wall formation whereas KNO_3 treatment has direct effect on branches, number of pods, pod weight per plant, seed yield per plant. The results are similar to the findings made by [14] who reported that seed priming treatment with $CaCl_2$ and KNO_3 significantly increased the pod weight per plants.

Germination percent (%)

After taking laboratory observations, germination percent of plant ranged from 85% to 90 %. Treatment T_6-Poly ethylene glycol (PEG) @ 7% (90 %) followed by T_7-$CaCl_2$ @ 2% (89%) were found to have highest germination per cent than other treatments and T_1-Control (85%). The results are comparable with the findings made by [15] who reported that seed priming treatment with PEG and $CaCl_2$ significantly increased the germination percentage.

Seed Vigour -I

Seed vigour-I of plant ranges from 877 to 2247. Seed material treated with T_3-Indole Acetic Acid @200 ppm (2247.33) followed by T_7-$CaCl_2$ @ 2% (1822) recorded highest seed vigour-I than other treatments and T_1-Control (877). The results are aligned with the study by [16, 17] who reported that seed priming treatment with IAA and $CaCl_2$ significantly increased the seed vigour -I.

Table 1. Mean performance of different priming treatments on physiological parameters

Treatments	Days to 50 percent flowering	Days to maturity	Plant height 30 DAS (cm)	Plant height 60 DAS (cm)	Primary branches 30 (DAS)	Secondary branches 60 (DAS)
T1-Control	50.00	102.00	16.00	36.00	1.50	7.80
T2-GA_3 @ 100 ppm	47.00	97.00	19.80	43.00	2.80	10.90
T3-IAA @ 200 ppm	48.00	97.00	16.47	40.00	2.00	9.73
T4-SA @ 100 ppm	48.00	96.00	16.80	39.00	2.50	8.60
T5-KNO_3 @ 100 ppm	48.00	97.00	16.40	43.00	1.83	9.17
T6-PEG @ 7%	48.00	98.00	17.27	38.00	2.33	9.47
T7-$CaCl_2$ @ 2%	47.00	99.00	17.07	36.00	2.63	8.10
Mean	47.86	98.02	17.37	39.36	2.23	9.11
SE	0.31	0.36	0.65	1.57	0.13	0.16
CD@5%	0.87	0.99	1.79	4.34	0.35	0.44
CV%	1.14	0.63	6.44	6.90	9.86	3.04

Table 2. Mean performance of different priming treatments on various yield parameters

Treatments	Germination percent (%)	Number of pods/ plants	Pod weight/ plant (g)	Seed yield / plant (g)	Seed Vigour -I	Seed vigour-II
T1-Control	85.00	58.00	44.51	10.47	877	33
T2-GA_3 @ 100 ppm	88.00	69.67	57.47	16.70	1476	39
T3-IAA @ 200 ppm	86.00	61.67	47.60	14.19	2247	46
T4-SA @ 100 ppm	89.00	70.33	45.56	17.66	1192	42
T5-KNo_3 @ 100 ppm	87.00	69.33	92.56	20.50	1516	38
T6-PEG @ 7%	90.0	60.00	49.96	12.53	1366	39
T7-$CaCl_2$ @ 2%	89.00	72.00	102.53	21.17	1822	40
Mean	90.0	65.86	62.88	16.17	1499.42	39.57
SE	0.16	2.85	2.26	0.91	83.50	1.50
CD@5%	0.43	7.90	6.26	2.53	231.42	4.17
CV%	0.31	7.50	6.22	9.77	9.65	6.59

Seed Vigour -II

Seed vigour-II ranged from 33 to 46. Treatment with T_3-Indole Acetic Acid @ 200 ppm (46) followed by T_4-Salicylic Acid @ 100 ppm (42) had superior seed vigour-II than other treatments and T_1-Control (33). The results are comparable with the study by [17] who reported that seed priming treatment with IAA significantly increased the Seed vigour -II.

CONCLUSION

The seed priming treatment with Gibberelic acid (GA_3) @100 ppm was found effective in increasing the early germination of seedlings and number of primary branches and early flowering as compared to others. Potassium nitrate (KNO_3) @ 100 ppm was found effective to attain more secondary branches and had significant effect on the pod weight/plant, seed yield/plant. Salicylic acid @ 100 ppm was found effective to increase number of pods per plant. Indole Acetic Acid (IAA) @ 200 ppm was found effective for increasing shoot length and had direct effect on seed vigour-II of seed after harvest. The seed priming treatment with calcium chloride ($CaCl_2$) @ 2% was found effective especially in yield and yield attributing characters; attained more plant height and number of primary branches per plant that indirectly had effect on number of pods per plant, pod weight per plant, seed yield per plant and seed vigour-I.

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