EVAULATION OF SEED PRIMING ON GROWTH AND YIELDYEILD OFCHICKPEA (*Cicer arientinum*L.)

ABSTRACT

The present experimental study t entitled "Evaluation of seed priming on growth and yield of chickpea (*Cicer arientinum* L.)" was conducted during Rabi 2019 at experimental field of Pulses Research unit, Dr. PDKV, Akola to assess the suitable priming treatment for chickpea crop (variety: JAKI-9218). The experiment was laid out in randomize block design in three replicationreplications. The morpho-physiological traits viz. germination %, plant height, number branches, dry matter content, number of day required to 50% flowering were taken.. The morpho-physiological i.e. plant height, number of branches, dry matter content, germination % showed significant increased in chickpea crop when seed priming was carried out with potassium nitrate for 4 hours. The numbers of days required to 50% flowering were recorded least in seed priming GA3 for 4 hours. Protein content also recorded significantly higher in seed priming with potassium nitrate for 4 hours. Yield and yield attributes were also significantly increased in seed priming with potassium nitrate for 4 hours. It is concluded that seed priming were with potassium nitrate for 4 hours recorded higher morpho-physiological characters over priming treatment and control.

Keywords*: Seed priming, Germination, Growth parameters. GA3, Potassium nitrate*

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1. INTRODUCTION

There are about 60 domesticated grain legume species in the word **[1]**~~(Hedley, 2001)~~. The chickpea is fifth most important legume in the world, on the basis of total production after soybean, groundnut, beans and peas [2]. ~~(Muzquiz and wood, 2007).~~ Chickpeas also known as garbanzo beans, grams or Bengal gram, Egyptian pea, chana and chole. In India it is largest growing pulse crop. Botanical name of chickpea is *Cicerarietinum* L. The genus ~~cicer~~*Cicer*belongs to the family Leguminosae, sub family ~~fabaceae~~Fabaceae of the tribe Vicieae. The somatic chromosome number of chickpea is 2n=16. The genus ~~cicer~~Cicer contains about 40 species out of which 31 are perennial and 9 are annual. Chickpea probably originated from south east Turkey. Four centers of diversity were identified in the Mediterranean, central Asia, the East and India, as well as a secondary centers of origin in Ethiopia [3]. ~~Harris *et al.* (2012).~~

Seed priming is a process of controlled hydration of seeds to a level that permits pre-germination metabolic activity to proceed, but prevents actual emergence of the radicle. Benefits of seed priming includes, faster speed of emergence, enable seed to germinate and emerge even under adverse agro-climatic conditions, improve uniformity to optimize harvesting efficiency, increases shelf life of seeds, improves the resistance towards water and temperature stress, increase vigour for fast and strong plant development and increases yield potential.

Seed priming technique has been practiced in many countries including Pakistan, China and Australia and more than thousand trials has been conducted to evaluate the performance of priming in variety of crops. Fifty three farmers tested maize seed priming in kharif season in 1996 in tribal areas of Rajasthan, Gujarat and Madhya Pradesh; India (Harris et al. 1999). Almost all farmers thought that primed crops grew more vigorously, flowered and matured earlier and produced bigger cobs and higher yield. Independent measurements on a subset of 35 trials showed a mean increase in cob weight of 6% (Harris et al. 2001).

Seed priming have various techniques for improving the performance of the growth, emergence and yield of the crop. There are some techniques which are used i.e. hydro-priming, halo-priming, osmo-priming and hormonal priming.

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2. MATERIALS AND METHODS

~~The details of materials used and methods employed during the experimental period have been presented in this chapter.~~

This section presents details of the materials used and the methods used during the experimental period.

***Design and treatments of the experiment*:** The experiment was conducted in randomized block design.

Treatments were as follows:

T1:Control

T2:Hydro priming for 4 hours

T3:Priming with 0.5% urea for 4 hours

T4:Priming with 1% urea for 4 hours

T5:Priming with 0.5% Ammonium sulphate for 4 hours

T6:Priming with 1% Ammonium sulphate for 4 hours

T7:Priming with 0.5% KNO3 for 4 hours

T8:Priming with 1% KNO3 for 4 hours

T9:Priming with 50 ppm GA3 for 4 hours

T~~10:Priming~~10: Priming with 100 ppm GA3 for 4 hours

T~~11:Priming~~11: Priming with 50 ppm chlormequat chloride for 4 hours

T~~12:Priming~~12: Priming with 100 ppm chlormequat chloride for 4 hours

Field emergence and germination percentage

Field emergence was counted on the experimental plot. Emergence count was under taken on 8th day after sowing and was counted and noted for each plot and replications.

Growth Parameters

Plant height (cm)

Observations on plant height were recorded (cm) at 30, 60, and 90DAS. The height of the three observational plants from each treatment and replication was recorded with scale from the base of a plant to top most developing node. From these plants of each treatment, mean height was calculated and recorded.

Number of branches

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The number of branches counted at 30, 60, 90 DAS and at harvest.

Dry matter production studies

For dry matter study, single plant from each treatment and replication was uprooted periodically at flowering, pod formation and at harvest. The plant samples were washed with tap water carefully in order to remove soil and dust particles adhered to it. The samples were allowed to dry at room temperature separately for 48 hrs. The plant samples were then placed in the big size brown paper perforated bags. After drying the sample on open air basis, the plant sample was finally dried in hot air oven at $70^{O}C$ up to achieving the constant weight. The average total dry matter was recorded (g/plant) genotype and replication wise.

Number of days required to 50% flowering

The day on which 50% plants from the plot found bloomed was noted and recorded. Thus, total number of days required for flowering of 50% plants, from date of sowing were counted and expressed as days to 50% flowering.

Data analysis

The analysis of variance was performed to get the significance of differences between the treatments for all the characters as per the methodology suggested by Panse and Sukhatme (1967). The 'F' test whenever revealed significant, the critical differences were worked out at 5% level of significance for comparisons.

3. RESULTS AND DISCUSSION

Effect of seed priming on seed germination and germination percentage of chickpea.

The seed germination is important factor is directly affect the yield of the crop. The seed germination of chickpea was influenced significantly. The significantly higher seed germination (251 per plot) of chickpea was recorded in seed priming with 0.5 % potassium nitrate for 4 hours. The lowest seed germination of chickpea (198 per plot) was recorded in control (no seed priming). The seed germination is higher in seed priming as compared to control. Also the germination percentage of chickpea crop was influenced significantly. Significantly higher germination percentage (89.6%) was recorded in seed priming with 0.5 % potassium nitrate for 4 hours. The lowest germination percentage (70.7%) were recorded in control (no seed priming).

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The higher germination per plot and germination percentage in seed priming with 0.5 % potassium nitrate for 4 hours might be due to stimulated hypocotyl growth, increased cell elongation resulting in faster emergence and positive effect on germination. Similar observations were recorded by Choudhary*et al.* (2008) in chickpea, Golenzani*etal*. (2008), Patil*et.al* in chickpea and Selvarani*et al.* (2011) in onion.

Effect of seed priming on height of chickpea

The plant height (cm) was recorded 30, 60, 90 DAS and data is presented in table 2. Data pertaining to plant height of chickpea revealed that seed priming with 1.0 % potassium nitrate for 4 hours showed significantly higher (23.7 cm) plant height at 30 DAS, (35.8cm) at 60DAS and (39.7cm) at 90DAS. The lowest plant height was recorded in control (no seed priming) i.e. 17.1cm, 27.2cm, 34.4cm at 30, 60, 90DAS respectively.Plant height is important morphological parameter exhibiting direct relationship with grain yield. It is a visible measure of plant growth and is a function of leaf emergence and inter-nodal elongation. Since leaves and branches born on stem, leaf area development and biomass production shows close relationship with plant height. The effect of seed priming on plant height showed rapid increase in plant height over no seed priming (control). The enhancement of chickpea plant primed with 1% potassium nitrate might be due to increased cell division and seedling roots. Similar observations were recorded by Hamidi and Anosheh (2013) andPatil*et al.*(2018)in chickpea and Ahmadanad*et al.* (2012) in soybean.

Effect of seed priming on number of branches of chickpea

The number of branches was recorded at 30, 60, 90 DAS and at harvest of chickpea. The data is presented in table 3. The data recorded number of branches significantly higher in seed priming with 1.0% potassium nitrate for 4 hours (5.7) at 30DAS, (11.7) at 60DAS, (14.3) at 90DAS and (14.3) at harvest. The lowest number of branches recorded in control (no seed priming) and seed priming with normal water for 4 ~~hours.The~~hours. The treatment seed priming with 1% potassium nitrate showed significantly higher number of branches by 38.8% over control. Similar increases in number of branches of potassium primed were observed by Harris *et al.* (1999) in chickpea.

Effect of seed priming on dry matter content of chickpea

The dry matter content of chickpea was recorded at 30, 60 and 90 DAS. The data pertaining to dry matter content of chickpea reported in table 4.The dry matter content of chickpea was significantly increased due to seed priming treatment for 4 hours over control (no seed priming). Significantly higher dry matter content of chickpea (3.2gm) at 30 DAS, (14.9gm) at 60DAS, (33.7gm) at 90DAS was recorded in seed

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priming with 1.0% potassium nitrate for 4 hours. Lowest dry matter content of chickpea (2.0gm) at 30DAS, (12.1gm)at 60DAS, (27.3gm) at 90 DAS was recorded in control (no seed priming).

Plant dry matter content is the consequence of plant physiological and biological activity. Result of plant dry matter content of different seed priming treatments were found significant at 30, 60 and 90DAS. The highest dry matter content was recorded in seed priming with potassium nitrate for 4 hours. Similar observations were recorded by Ahmadavant*et al. (*2012) in soybean and Patil*et al.*(2018) in chickpea.

Effect of seed priming on number of days required for 50% flowering

The number of days required to attain 50% flowering was reduced with priming treatments. Seed priming with 100ppm GA_3 for 4 hours induced flowering (45 days) early by 5.6 days compared to control (50.6 days). The early flowering may be due to higher endogenous level of GA_3, early completion of vegetative growth and better nourishment of plants. Similar observations in advancement of flowering were reported by Khairul*et al.* (2015) in chickpea and Beedi*et al.* (2017) in chickpea.

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4. CONCLUSIONS

~~Different seed priming treatments significantly improved morpho-physiological parameter.Amongst the eleven different seed priming treatments, seed priming with 0.5% potassium nitrate for 4 hours recorded significantly highest field emergence and germination percentage, and seed priming with 1% potassium nitrate for 4 hours was recorded significantly highest plant height, no. of branches, dry matter content.~~

I recommend replacing this paragraph with:

It is concluded that the different seed priming treatments applied significantly improved the morpho-physiological parameters evaluated in this study. Among the eleven different treatments, the priming of seeds with 0.5% potassium nitrate for 4 hours registered a significantly higher percentage of emergence and germination in the field. In the priming of seeds with 1% potassium nitrate for 4 hours, significantly higher plant heights, number of branches and dry matter content were recorded.

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1. Hilly M, Adams ML, Nelson SC. A study of digit fusion in the mouse embryo. Clin Exp Allergy. 2002;32(4):489-98.

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Each figure should have a caption. The caption should be concise and typed separately, not on the figure area. Figures should be self-explanatory. Information presented in the figure should not be repeated in the table. All symbols and abbreviations used in the illustrations should be defined clearly. Figure legends should be given below the figures.

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Table 1. Effect of seed priming on germination of chickpea

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Treatments	Germination per plot	Germination (%)
T1: Control (no seed priming)	198	70.71
T2: Seed priming with normal water for 4 hrs	233	83.33
T3: Seed priming with 0.5% urea for 4 hrs	239	85.48
T4: Seed priming with 1.0% urea for 4 hrs	241	86.07
T5: Seed priming with 0.5% Ammonium sulphate for 4 hrs	244	87.02
T6: Seed priming with 1.0% Ammonium sulphate for 4 hrs	242	86.55
T7: Seed priming with 0.5% potassium nitrate (13:00:45) for 4 hrs	251	89.64
T8: Seed priming with 1.0% potassium nitrate (13:00:45) for 4 hrs	249	88.81
T9: Seed priming with GA3 50 ppm for 4 hrs	239	85.24
T10 Seed priming with GA3 100 ppm for 4 hrs	244	87.14
T11: Seed priming with Chlormequate chloride 50 ppm for 4 hrs	241	86.07
T12: Seed priming with Chlormequate chloride 100 ppm for 4 hrs	240	85.60
S.E. (m)+ explain here and in the others tables?	8.46	3.02
CD@5%explain here and in the others tables	24.8	8.86

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Table 2. Effect of seed priming on plant height (cm) 30, 60, 90 DAS

Treatment	30 DAS	60 DAS	90 DAS
T1: Control (no seed priming)	17.1	27.2	34.4
T2: Seed priming with normal water for 4 hrs	18.8	31.7	37.3
T3: Seed priming with 0.5% urea for 4 hrs	19.4	35.3	38.4
T4: Seed priming with 1.0% urea for 4 hrs	19.3	34.2	38.5
T5: Seed priming with 0.5% Ammonium sulphate for 4 hrs	19.0	34.7	37.5
T6: Seed priming with 1.0% Ammonium sulphate for 4 hrs	19.3	33.1	38.0
T7: Seed priming with 0.5% potassium nitrate (13:00:45) for 4 hrs	21.1	35.4	39.7
T8: Seed priming with 1.0% potassium nitrate (13:00:45) for 4 hrs	23.7	35.8	39.8
T9: Seed priming with GA3 50 ppm for 4 hrs	19.2	32.3	38.2
T10 Seed priming with GA3 100 ppm for 4 hrs	20.3	35.0	38.6
T11: Seed priming with Chlormequate chloride 50 ppm for 4 hrs	18.9	29.7	37.5
T12: Seed priming with Chlormequate chloride 100 ppm for 4 hrs	18.2	29.8	36.6
S.E. (m)+	**1.125**	**1.8**	**0.803**
CD@5%	**3.3**	**5.51**	**2.36**

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Table 3. Effect of seed priming on number of branches

Treatment	30 DAS	60 DAS	90 DAS	At harvest
T1: Control (no seed priming)	2.3	6.3	10.0	10.3
T2: Seed priming with normal water for 4 hrs	2.3	7.3	12.0	12.0
T3: Seed priming with 0.5% urea for 4 hrs	2.7	7.7	12.7	12.7
T4: Seed priming with 1.0% urea for 4 hrs	3.0	7.0	12.3	12.7
T5: Seed priming with 0.5% Ammonium sulphate for 4 hrs	3.3	8.0	12.0	12.7
T6: Seed priming with 1.0% Ammonium sulphate for 4 hrs	3.7	8.3	12.7	12.7
T7: Seed priming with 0.5% potassium nitrate (13:00:45) for 4 hrs	4.3	9.3	14.0	14.0
T8: Seed priming with 1.0% potassium nitrate (13:00:45) for 4 hrs	5.7	11.7	14.3	14.3
T9: Seed priming with GA3 50 ppm for 4 hrs	3.7	8.3	13.7	13.7
T10 Seed priming with GA3 100 ppm for 4 hrs	3.7	8.3	12.7	13.0
T11: Seed priming with Chlormequate chloride 50 ppm for 4 hrs	5.3	10.0	14.0	14.0
T12: Seed priming with Chlormequate chloride 100 ppm for 4 hrs	3.7	9.3	13.0	13.0
S.E. (m)+	**0.7**	**1.05**	**1.44**	**0.5**
CD@5%	**2.14**	**3.08**	**4.25**	**1.6**

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Table 4. Effect of seed priming on dry matter content (g) at 30, 60, 90 DAS

Treatment	30 DAS	60 DAS	90 DAS
T1: Control (no seed priming)	2.0	12.1	27.3
T2: Seed priming with normal water for 4 hrs	2.5	12.8	27.4
T3: Seed priming with 0.5% urea for 4 hrs	2.8	12.8	28.2
T4: Seed priming with 1.0% urea for 4 hrs	2.6	13.5	30.8
T5: Seed priming with 0.5% Ammonium sulphate for 4 hrs	2.7	13.6	30.9
T6: Seed priming with 1.0% Ammonium sulphate for 4 hrs	2.6	13.8	31.5
T7: Seed priming with 0.5% potassium nitrate (13:00:45) for 4 hrs	3.0	14.5	32.5
T8: Seed priming with 1.0% potassium nitrate (13:00:45) for 4 hrs	3.2	14.9	33.7
T9: Seed priming with GA3 50 ppm for 4 hrs	2.8	13.3	29.6
T10 Seed priming with GA3 100 ppm for 4 hrs	2.6	13.5	30.3
T11: Seed priming with Chlormequate chloride 50 ppm for 4 hrs	2.8	12.9	28.8
T12: Seed priming with Chlormequate chloride 100 ppm for 4 hrs	3.0	14.3	31.8
S.E. (m)+	**0.201**	**0.545**	**1.244**
CD@5%	**0.59**	**1.6**	**3.65**

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Table 5.Effect of seed priming on number of days required for 50% flowering

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Treatment	No of days required for 50%

	flowering
T1: Control (no seed priming)	50.6
T2: Seed priming with normal water for 4 hrs	49.7
T3: Seed priming with 0.5% urea for 4 hrs	49.0
T4: Seed priming with 1.0% urea for 4 hrs	50.0
T5: Seed priming with 0.5% Ammonium sulphate for 4 hrs	50.3
T6: Seed priming with 1.0% Ammonium sulphate for 4 hrs	45.3
T7: Seed priming with 0.5% potassium nitrate (13:00:45) for 4 hrs	46.0
T8: Seed priming with 1.0% potassium nitrate (13:00:45) for 4 hrs	45.7
T9: Seed priming with GA3 50 ppm for 4 hrs	45.0
T10 Seed priming with GA3 100 ppm for 4 hrs	45.0
T11: Seed priming with Chlormequate chloride 50 ppm for 4 hrs	50.0
T12: Seed priming with Chlormequate chloride 100 ppm for 4 hrs	50.3
S.E. (m)+	**1.642**
CD@5%	**4.82**

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Figure 1~~Snap 1~~: Evaluation of seed priming on Chickpea

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