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Studies on Seed Priming on Seedling Vigour, Crop Growth and Yield of Groundnut (*Arachis hypogaea* L.) Under Rainfed Conditons

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ABSTRACT

A field experiment was conducted to study the effect of priming treatments on seedling vigour, growth and yield contributing characters in groundnut under rainfed conditions. The maximum seed yield (2255 kg/ha) was recorded due to seed primed with $CaCl_2$ 2% followed by $CaCl_2$ 1% (2036 kg/ha). The seed primed with $CaCl_2$ 2% recorded the higher field emergence percentage(89.67 %), plant height (39.87 cm), number of pods per plant (27), and 100 seed weight (38 g) followed by $CaCl_2$ (1%). In case of flowering and maturity, the seeds hydrated with $CaCl_2$ 2% had earlier for flowering and maturity than control. Regarding seed quality parameters viz., germination percentage (94.17%), root length (12.28cm), shoot length(18.41cm),total seedling length (29.10 cm) and vigour index I(2739.41), were enhanced by seeds primed with $CaCl_2$ 2% followed by $CaCl_2$ 1% . In case of electrical conductivity of seed leachate, the seeds hydrated with CaCl2 2% recorded lower electrical conductivity (0.411dsm^{-1}) than unprimed seeds.

Key words: *Groundnut, Seed priming, Seedling vigour, Seed quality and Kernal yield.*

INTRODUCTION

Groundnut (*Arachis hypogaea* L.) is the most important oilseed crop and also a food crop of India. The overall productivity of groundnut is low. The poor vigor and viability of seeds with adverse environmental conditions and improper storage facilities may result in poor crop establishment and non availability of certified fresh seed and use of old seeds ultimately decreased yield. Seed priming treatments may help in proper crop establishment and avoid the loss in the yield. This is most vital as groundnut seed is a costly input. The primary effect of seed treatment is attributed to certain enzymatic activities taking place in seed, it is being held in moist condition. Chrysiansen and Foy[3] and Hecht-Buchholz[5] reported that seed calcium concentration and germination percentage were positively correlated which suggests the role of calcium as an important component in membrane stabilization and as an enzyme co-factor.

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In view of this, the present study was under taken up to find out importance of seed priming's for better crop establishment in kharif groundnut.

MATERIAL AND METHODS

The seeds of groundnut variety K-6 was subjected to seven seed priming treatments namely T_1- Control (No priming), T_2- seeds soaked in water for the period of 6 hr followed by shade drying, T_3- seeds soaked in 1% $CaCl_2$ solution for the period of 6 hr followed by shade drying, T_4- seeds soaked in 1% KCl solution for the period of 6 hr followed by shade drying, T_5- seeds soaked in 1% KH_2PO4 solution for the period of 6 hr followed by shade drying, T_6- seeds soaked in 1% NaCl solution for the period of 6 hr followed by shade drying and T_7- seeds soaked in 2% $CaCl_2$ solution for the period of 6 hr followed by shade drying. The experiment was conducted at Seed Technology Research & Production Centre, Thangadancha, ANGRAU in Randomized Block Design with three replication during kharif 2017. Prior to the experimentation, about 10 and 20 grams of each salt were dissolved in one litre of distilled water to prepare 1 and 2 per cent concentration solutions in sufficient quantities for seed soaking purpose. Subsequently seeds were soaked in respective salt concentrations in 1:5 ratios for 6 hours. Further they were decanted and surface dried for their original weight. The soaked seed and dried seed were utilized for field experiment. The growth, yield contributing characters and yield *viz.,* field emergence percentage, plant height (cm), days to 50 per cent flowering, number of pods/plant, seed yield plant^{-1} and seed yield ha^{-1} were recorded in experimental field. The experimental data collected from field for seed yield and contributing characters were statistically analyzed as per the method described by Panse and Sukhatme[11].

RESULTS AND DISCUSSION

The field emergence percent differed significantly the higher field emergence percentage (89.33%) was recorded in seeds hydrated with $CaCl_2$ (2%) and it was at par with (T3) and (T6).While the lower field emergence percentage (60.0%) was noticed in untreated seeds (Table 1). This might be due to hydration with $CaCl_2$ aided in initiation of early sprouting and resulted in accelerated the germination on account of which field emergence was enhanced. The beneficial influences of $CaCl_2$ pre-sowing treatment on field emergence were reported by Narayanaswamy and Shambulingappa[8] in groundnut and Pawar *et al.*[12] and Narayanareddy and N. K. Biradarpatil[10] in sunflower.The days to 50% flowering differed significantly due to seed priming treatments. Among which, significantly the minimum days to 50% flowering (31.45 days) was recorded in seeds hydrated with $CaCl_2$ (2%) (T7), followed by seeds hydrated with $CaCl_2$ (1%) (T3) (32.31 days), whereas, significantly maximum days required to 50% flowering (36.71 days) was noticed in control (T1). (Table2). Similar results were reported in groundnut by Bhingarde *et al.*[2], in soybean by Bhaarthi *et al.*[1] and Narayanareddya and N. K. Biradarpatil[10] in sunflower. The plant height showed significant difference due to seed priming treatments. Among the priming treatments, significantly the highest plant height (39.87 cm) was recorded in seeds hydrated with $CaCl_2$ (2%) (T_7), followed by seeds hydrated with $CaCl_2$ (1%) (T3) (39.04 cm) while the lowest plant height (33.57 cm) was noticed in control (T_1) at the time of harvest (Table1). The enhancement in plant height with $CaCl_2$ might be due to cell enlargement and increase in normal cell division. Similar increase in plant height and yield in sorghum was observed by Kadiri and Hussaini[6] and Pawar *et al.*[12] in sunflower. Similar results were reported in groundnut by Bhingarde *et al.*[2] and in soybean by Bhaarthi *et al.*[1]. The data on days to maturity differed significantly due to priming treatments. Significantly the minimum days to maturity (111 days) was recorded in seeds hydrated with $CaCl_2$ (2%) (T7), followed by seeds hydrated with $CaCl_2$ (1%) (T5) (113days) while the highest days to maturity (118 days) were noticed in control (T1). Similar results were reported in

groundnut by Bhingarde *et al*.[2] and in soybean by Bhaarthi *et al*.[1].

The number of pods per plant showed significant difference due to seed priming treatments. Significantly the highest number of pods per plant (27.0) was recorded in seeds hydrated with $CaCl_2$ (1%) (T7), followed by seeds hydrated with $CaCl_2$ (1%) (T3) (22.07), while the lowest number of pods per plant (19.33) was noticed in untreated seeds (T1), which was at par with T2 (29.50). This might be due to calcium improves pod filling in groundnut, which resulted in increase the number of well- filled pods yield per plant Narayanswamy and K. G. Shambulingappa[8]. Calcium has been found to be beneficial in the fruiting medium for the production of filled fruits and for development of kernels therefore, increased in the seed yield per plant. Dhedhi *et al*.[4]. Increase in yield with $CaCl_2$ invigouration can be attributed to increased yield and yield attributing traits such as field emergence percentage, number of pods per plant, and seed yield per plant. Narayanswamy and K. G. Shambulingappa[8] The higher shelling percent plant (72.0) was recorded in seeds hydrated with $CaCl_2$ (2%) (T_7), which was at par with seeds hydrated with $CaCl_2$ (1%) (T5) (71.47). The higher 100 seed weight (38gm) was recorded in seeds hydrated with CaCl2 (2%) (T7), which was at par with seeds hydrated with $CaCl_2$ (1%) (T3) (37.33gm). Calcium has been found to be beneficial in the fruiting medium for the production of filled fruits and for development of kernels therefore, increased in the seed yield per plant.

Regarding seed quality parameters, significantly the higher germination percentage (94.17%) was recorded in seeds hydrated with $CaCl_2$ (2%) (T7), followed by seeds hydrated with $CaCl_2$ (1%) (T3) (92.0%) while the lowest germination percentage (77.68 %) was noticed in control (Table 2).The calcium concentration of seed and germination percentage were positively correlated which suggests the role of calcium as an important component in membrane stabilization and as an enzyme co-factor Chrysiansen *et al*.[3]. The higher vigour index (2739.41) was recorded in seeds hydrated with $CaCl_2$ (2%) (T7).The increased in vigour index was due to increase in germination percentage and root shoot length by seed priming treatments. Greater efficiency of priming with $CaCl_2$ is possibly related to the osmotic advantage that both K^+ and Ca^{2+} have in improving cell water saturation, and that they act as co-factors in the activities of numerous enzymes Narayanaswamy *et al*.[9]. The lower electrical conductivity ($0.411 dSm^{-1}$) was recorded in seeds hydrated with CaCl2 (2%) (T7). The lower electrical conductivity of seed leachate for $CaCl_2$ treated seeds might be due to beneficial effect of $CaCl_2$ in strengthening the cell membrane integrity and permeability[7]. Similar result of decreased electrical conductivity in seeds primed with $CaCl_2$ were reported by M. T. Bhingarde *et al*,[2] in groundnut.

Table 1: Effect of seed priming treatments on growth and yield contributing characters

Priming Treatments	Field emergence percent	Plant height (cm)	Days to 50% flowering	Days to maturity	Total Dry matter (gm/Plant)	No of pods/ plant	100 seed wt (gm)	Shelling percent	Kernal yield Kg/ha
T_1- Control (No priming)	63.33 (53.00)	33.34	36.70	118	151.33	19	32.66	66.10	1435
T_2- Hydration with water for 6 Hr	69.33 (56.63)	30.87	34.53	115	172.66	19	35.33	66.74	1685
T_3- Hydration with CaCl2 (1%) for 6 Hr	84.67 (67.20)	39.04	32.31	113	196.00	22	37.33	71.47	2036
T_4- Hydration with KCl (1%) for 6 Hr	75.67 (60.97)	38.93	35.73	115	179.33	21	35.33	67.35	1787
T_5- Hydration withKH2PO4 (1%) for 6 Hr	65.33 (53.97)	36.32	36.05	117	183.33	17	35.33	67.51	1559
T_6- Hydration with NaCl (1%) for 6 Hr	78.33 (62.49)	38.45	33.93	115	188.67	21	36.00	70.35	1818
T_7- Hydration with CaCl2 (2%) for 6 Hr	89.67 (71.49)	39.87	31.45	111	240.66	27	38.00	72.00	2255
SEm±	2.69	1.50	1.013	2.92	12.06	1.67	1.217	2.52	158.50
CD (P=0.05)	8.316	4.63	3.12	NS	37.16	5.14	NS	NS	493.81

Values in the parenthesis are angular transformed values.

Table 2: Effect of seed priming treatments on seed quality parameters

Treatments	Germination percent	Root length (cm)	Shoot length (cm)	Total seedling length (cm)	Seedling vigor index I	Electrical conductivity (dSm^{-1})
T_1- Control (No priming)	77.68 (61.84)	10.19	12.83	24.02	1862.88	0.543
T_2- Hydration with water for 6 Hr	89.22 (70.87)	12.04	14.43	26.27	2343.69	0.649
T_3- Hydration with $CaCl_2$ (1%) for 6 Hr	92.00 (73.61)	11.58	17.06	27.62	2541.22	0.432
T_4- Hydration with KCl (1%) for 6 Hr	86.59 (68.55)	11.95	15.07	26.68	2310.51	0.549
T_5- Hydration with KH_2PO4 (1%) for 6 Hr	86.02 (68.08)	11.27	17.94	25.88	2227.17	0.522
T_6- Hydration with NaCl (1%) for 6 Hr	81.03 (64.21)	9.24	17.53	24.35	1981.35	0.611
T_7- Hydration with $CaCl_2$ (2%) for 6 Hr	94.17 (76.06)	12.28	18.41	29.10	2739.41	0.411
SE m±	1.523	0.32	0.36	0.733	90.00	0.011
C.D (P=0.05)	4.744	1.00	1.12	2.28	280.40	0.034

Values in the parenthesis are angular transformed values.

CONCLUSION

It is concluded that the present investigation of different concentration of priming treatments showed significant effect on seed germination, vigour and yield parameters. Priming with $CaCl_2$ (2%) increased the germination (%) vigor and yield in Groundnut. Soaking of seed with CaCl2 solution is advantageous to obtain healthy seedlings. The second best option for priming is priming with $CaCl_2$ (1%).

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