EFFECT OF SEED PRIMING ON SEED YIELD AND SEED QUALITY OF GROUNDNUT (ARACHIS HYPOGAEA L.)

M. T. BHINGARDE, R. S. KADAM, L. N. TAGAD

Abstract: The study revealed that, the seed priming significantly influenced the seed yield and yield contributing characters of groundnut than untreated seeds. The maximum seed yield was recorded due to seeds primed with CaCl2 1% followed by KCl 1%. The seeds primed with CaCl2 1% recorded the higher field emergence percentage, plant height (cm), number of pods per plant, seed yield per plant (g), and seed yield per hectare (q) followed by KCl 1% . In case of flowering and maturity, the seeds hydrated with CaCl2 1% had earlier for flowering and maturity than control.

Regarding seed quality parameters viz., germination percentage (%), seedling dry weight (g) and vigour index I, were enhanced by seeds primed with CaCl2 1% followed by KCl 1% . In case of electrical conductivity of seed leachate, the seeds hydrated with CaCl2 1% recorded lower electrical conductivity than unprimed seeds. Among the genotypes studied RHRG-6083 recorded significantly higher field emergence, plant height, pods per plant, had earlier in flowering and maturity and produced higher seed yield per hectare (q) than TAG-24 .

Keywords: groundnut, growth, seed priming, seed quality, yield.

Introduction: Groundnut (Arachis hypogaea L.) is the most important oilseed crop and also a food crop of India. The overall productivity of this crop is low. The poor vigour 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 and under these circumstances, seed priming treatments may help in proper crop establishment and to avoid the loss in the yield. This is most vital when seed is a costly input as in case of groundnut. A number of seed quality enhancements treatments have shown better seedling performance and crop establishment and ultimately increased yield in several crops, including groundnut In view of this, the present study was udder taken up to find out importance of seed priming's for better crop establishment in kharif groundnut.

Materials And Methods: The fresh seeds of groundnut varieties V1-TAG-24 and V2-RHRG-6083 were subjected to eight seed priming treatments namely T1- Control (No priming), T2- seeds soaked in water for the period of 6 hr followed by shade drying, T3- seeds soaked in KH_2PO_4 for the period of 6 hr followed by shade drying, T4- seeds soaked in 1% CaCl2 solution for the period of 6 hr followed by shade drying, T5- seeds were soaked in 1% KCl solution for the period of 6 hr followed by shade drying, T6- seeds soaked in 0.5% boron solution for the period of 6 hr followed by shade drying,T7- seeds soaked in 25 ppm GA3 solution for the period of 6 hr followed by shade drying and T8- seeds soaked in 0.5% $MnSO_4$ solution for the period of 6 hr followed by shade drying. The experiment was conducted at PGI, Research farm, and Seed Technology Research Unit, MPKV, Rahuri in Factorial Randomized Block Design with three replication during kharif season-2012.The growth, yield contributing characters and yield viz., field emergence percentage, days to 50 per cent flowering, plant height (cm), final plant count plot-1, number of mature pods/plant. Days to maturity, seed yield plant-1, and seed yield ha-1 were recorded in experimental field and seed quality parameters viz., germination percentage was expressed on the basis of normal seedlings as described in ISTA rules [1]. seed ling dry weight (mg), vigour index and electrical conductivity (dSm-1) were recorded in seed testing laboratory. The experimental data collected from field for seed yield and contributing characters were analyzed statistically by adopting Factorial Randomized Block Design (FRBD) [13] and laboratory data of seed quality parameters were analyzed by Factorial Completely Randomized Design (FCRD) [14].

Result And Discussion:

Effect of varieties and priming treatments on seed yield and yield contributing character.

The field emergence percentage differed significantly due to varieties. Significantly the highest field emergence percentage (84.83%) was recorded in variety RHRG-6083 (V2); however, the lowest field emergence percentage (82.17%) was recorded in variety TAG-24(V1). Whereas significantly the highest field emergence percentage (85.83%) was recorded in seeds hydrated with CaCl2 (1%) (T4) and it was at par with (T5) and (T6).While the lowest field emergence percentage (78.50%) was noticed in untreated seeds (T1) (Table i). This might be due to hydration with CaCl2 aided in initiation of early sprouting and resulted in accelerated the germination on account of which field emergence was enhanced [9]-[12]. The field emergence percentage showed

non- significant difference due to interactions of varieties and seed priming treatments.

From the Table i, it was observed that the days to 50% flowering was significantly influenced due to varieties irrespective of priming treatment. Significantly the minimum days to 50% flowering (33.87 days) was recorded in variety TAG-24(V1) however, the maximum days to 50% flowering (38.63 days) was recorded in variety RHRG-6083 (V2).The days to 50% flowering differed significantly due to seed priming treatments. Among which, significantly the minimum days to 50% flowering (33.17 days) was recorded in seeds hydrated with $CaCl_2$ (1%) (T_4), followed by seeds hydrated with KCl (1%) (T_5) (34.17 days), whereas, significantly maximum days required to 50% flowering (39.33 days) was noticed in control (T_1) [9].The days to 50% flowering showed non-significant difference due to interactions of varieties and seed priming treatments. The plant height differed significantly due to varieties. The highest plant height (32.93 cm) was recorded in variety RHRG-6083 (V2), however the lowest plant height (30.68 cm) was recorded in variety TAG-24 (V1).The plant height showed significant difference due to seed priming treatments. Among the priming treatments, significantly the highest plant height (37.15 cm) was recorded in seeds hydrated with $CaCl_2$ (1%) (T_4), followed by seeds hydrated with KCl (1%) (T_5) (34.25 cm) while the lowest plant height (28.57 cm) was noticed in control (T_1). It was observed that the plant height showed non-significant effect due to interactions of varieties and seed priming treatments. (Table i). The enhancement in plant height with $CaCl_2$ might be due to cell enlargement and increase in normal cell division [5]-[6].

From the Table i, it was seen that the days to maturity differed significantly due to varieties. Among the varieties minimum days to maturity (107 days) was recorded in variety TAG-24 (V1) however, the variety RHRG-6083 (V2) took the highest days to maturity (122 days). The data on days to maturity of groundnut varieties differed significantly due to priming treatments. Significantly the minimum days to maturity (111 days) was recorded in seeds hydrated with $CaCl_2$ (1%) (T_4), followed by seeds hydrated with KCl (1%) (T_5) (112 days) while the highest days to maturity (119 days) were noticed in control (T_1). The days to maturity showed non-significant effect due to interactions of varieties and seed priming treatments. [8]- [9].

It was noticed that there was significant effect due to varieties on final plant count. The variety RHRG-6083 (V2) was recorded the highest final plant count (91.48). Among the priming treatments, the seed hydrated with $CaCl_2$ (1%) (T_4) was recorded the highest final plant count (94.33) and at par with seeds hydrated with KCl (1%) (93.33) and Boron 0.5% (92.67), while the lowest final plant count (86.83) was noticed in control (T_1), which was pat par with T_2 (87.33). The final plant count showed non-significant difference due to interaction. The seed primed with 1% $CaCl_2$ retained the higher number of plants at harvest. may also be attributed to better root development and also calcium serves as a specific activator for certain enzyme synthesis [12].

From the Table i, it was observed that the effect of varieties on number of pods per plant was significantly different. Significantly highest number of pods per plant (34.52) was recorded in variety RHRG-6083 (V2), however the lowest number of pods per plant (29.25) was recorded in variety TAG-24 (V1). The number of pods per plant showed significant difference due to seed priming treatments. Significantly the highest number of pods per plant (36.33) was recorded in seeds hydrated with $CaCl_2$ (1%) (T_4), followed by seeds hydrated with KCl (1%) (T_5) (33.83), while the lowest number of pods per plant (28.50) was noticed in untreated seeds (T_1), which was at par with T_2 (29.50). The number of pods per plant showed non-significant difference due to interactions. This might be due to calcium improves pod filling in groundnut, which resulted in increase the number of well- filled pods [11]-[10]. The seed yield per plant was significant due to varieties. The highest seed yield per plant (36.01 g) was recorded in variety RHRG-6083 (V2) and (38.95 g) was recorded in seeds hydrated with $CaCl_2$ (1%) (T_4), which was at par with seeds hydrated with KCl (1%). The seed yield per plant showed non significant difference due to interactions. 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 [3].

Significantly the highest seed yield per hectare (34.05 q) was recorded in variety RHRG-6083 (V2) and (34.04 q) in seeds hydrated with $CaCl_2$ (1%) (T_4) and at par with seeds hydrated with KCl (1%) (T_5) (29.03 q). The seed yield per hectare showed non-significant difference due to interactions. The increase in yield by $CaCl_2$ seed priming can be attributed due to increase in the yield attributing traits such as field emergence percentage ,number of pods per plant, final plant count and seed yield per plant. [9].

Effect of varieties and priming treatments on seed quality characters.

From the Table ii, it is observed that, the germination percentage was significantly influenced due to varieties irrespective of priming treatments. The highest germination percentage (92.54%) was recorded in variety RHRG-6083 (V2). The lowest germination percentage (91.08%) was recorded in variety

TAG-24 (V1). Among seed priming treatments, significantly the highest germination percentage (94.83%) was recorded in seeds hydrated with $CaCl_2$ (1%) (T_4), followed by seeds hydrated with KCl (1%) (T_5) (93.67%) while the lowest germination percentage

(88.83%) was noticed in control. The germination percentage showed non-significant difference due to interactions. [2]- [4] reported that 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. [10]. The highest vigour index (2042.94) was recorded in variety RHRG-6083 (V2) and seeds hydrated with CaCl2 (1%) (2409.72). Among the interactions, highest vigour index (2578.50) recorded in interaction V2T4. The increased in vigour index was due to increase in germination percentage and root shoot length by seed priming treatments [9]. The effect of varieties on seedling dry weight was differed significantly. Significantly the highest seedling dry weight (0.527 g) was recorded in variety RHRG-6083 (V2) and in seeds hydrated with CaCl2 (1%) (T4)(0.539 g). Among the interactions significantly the highest seedling dry weight (0.582 g) recorded in V2T4. Greater efficiency of priming with CaCl2 and KCl is possibly related to the osmotic advantage that both K+ and Ca2+ have in improving cell water saturation, and that they act as co-factors in the activities of numerous enzymes. Therefore, dry matter of seedling is increased. [9].

The lowest electrical conductivity (0.437 dSm-1) was recorded in variety RHRG-6083. While lowest electrical conductivity (0.445 dSm-1) was recorded in seeds hydrated with CaCl2 (1%) (T4). Among the interactions, lowest electrical conductivity (0.423 dSm-1) recorded in V2T4 interaction. The lower electrical conductivity of seed leachate for CaCl2 treated seeds might be due to beneficial effect of CaCl2 in strengthening the cell membrane integrity and permeability in groundnut [7].

References:

1. Anonymous. 1999. International rules for seed testing. Rules and annexes. Seed Sci. and Tech. 13 no. 2 (1999): 299-513.
2. M. N. Chrysiansen, and C. D. Foy, "Fate and function of calcium in tissue". Commun. Soil Sci. Pl. Anal. 10 (1979): 427-442.
3. K. K. Dhedhi, C. J. Dangaria, G. J. Parsana, and Joshi, A. K. Effect of pre sowing seed treatments for better crop establishment in summer groundnut. Seed Res. 35, no. 1 (2007): 17-21.
4. Hecht-Buchholz, C. Calcium deficiency and plant ultra structure. Commun. Soil Sci. Pl. Anal., 10 (1979): 67-81.
5. T. V. Karivartharaju, and V. Ramakrishnan, Seed hardening studies in two varieties of ragi. Indian J. Pl. Physiol. 28 (1985): 243-248.
6. G. M. Khan, K. Keshavulu, B. M. Reddy, and K. Radhika, Effect of pre-sowing seed treatments on the establishment of sunflower, Seed Res. 31 no.1 (2003): 94-97.
7. A. K. Limbani. Effect of provenance, season and invigouration treatments on seed yieldand quality of groundnut [Arachis hypogaeaL.] M. Sc thesis. Uni. of agric. Sci. Dharwad, Karnataka. 2007.
8. B. Narayanareddy, and N. K. Biradarpatil. Effect of pre-sowing invigouration seed treatments on seed quality and crop establishment in sunflower hybrid KBSH-1. Karnataka J. agric. Sci. 25 no.1 (2012): 43-46.
9. S. Narayanaswamy, R. Siddaraju, and S. Rajendraprasad. Effect of vigour levels and pre-sowing seed treatments on initial seed quality and crop performance in groundnut cv. TMV-2.Mysore J. of agric. Sci. 46 no.1 (2012): 1519.
10. S. Narayanswamy, and K. G. Shambulingappa. Effect of pre-sowing seed treatment on seed yield in groundnut. Current Res. 27: (1998): 35-36.
11. K. S. Shanmugam. Gypsum for groundnut. Seeds and Farms. 1-2 (1984): 56-57.
12. R. Subbaraman, and J. A. Selvaraj. Effect of pre-sowing treatment on seed yield and qualiy in groundnut CV. JL-24. Seeds and Farm. 4 (1989): 5-9.
13. V. G. Panse and P. V. Sukhtane. Statistical methods for Agricultural Workers. ICAR, publication, New Delhi, (1967) pp. 100- 116.
14. G.W. Snedecor and W.G. Cochran. Statistical methods. 6th Edn: Oxford and IBH Publications. Co. Culcutta.(1967) 16 pp. 339- 380.

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Dr. M.T. Bhingarde/ Associate Professor/ Department of Agricultural Botany/ MPKV/ Rahuri – 413 722 Dist.Ahmednagar (M S.)/ INDIA. / mtbhingarde@gmail.com

Mr. R.S. Kadam/ Department of Agricultural Botany/ MPKV/ Rahuri – 413 722/ Dist Ahmednagar (M S.)/ INDIA/ rskadam@gmail.com

Dr. L. N. Tagad/ Sr. Res. Asstt. Department of Agricultural Botany/ MPKV/ Rahuri – 413 722 Dist. Ahmednagar (M S.)/ INDIA./lntagad@gmail.com

Table i. Effect of variety, seed priming treatments on growth and yield contributing characters

Priming treatments	Field emergence (%)			50 %flowering			Plant height (cm)			Days to maturity		
	V1	**V2**	Mean	V1	**V2**	Mean	V1	V2	Mean	V1	V2	Mean
T_1- Controll (No priming)	78.00 (62.03)	79.00 (62.73)	78.50 (67.92)	36.67	42.00	39.33	27.27	29.87	28.57	112.67	126.00	119.33
T_2- Hydration with water	79.33 (62.99)	80.33 (63.69)	79.83 (69.00)	35.67	41.00	38.33	28.40	30.17	29.28	111.33	124.67	118.00
T_3- Hydration with KH_2PO_4 (1%)	82.00 (64.92)	82.67 (65.45)	82.33 (71.01)	34.00	39.33	36.67	30.27	29.43	29.85	107.67	122.33	115.00
T_4- Hydration with $CaCl_2$ (1%)	85.67 (67.83)	86.00 (68.34)	85.83 (74.06)	31.33	35.00	33.17	35.40	38.90	37.15	104.00	119.00	111.50
T_5- Hydration with KCl (1%)	84.33 (66.79)	85.00 (67.32)	84.67 (73.00)	32.33	36.00	34.17	32.63	35.87	34.25	104.33	120.00	112.16
T_6- Hydration with Boron (0.5%)	83.67 (66.19)	84.33 (66.71)	84.00 (72.41)	33.00	37.00	35.00	31.30	34.43	32.87	105.00	121.00	113.00
T_7- Hydration with GA3 (25 ppm)	82.67 (65.43)	83.67 (66.23)	83.17 (71.77)	33.33	38.00	35.67	30.83	34.07	32.45	106.33	121.67	114.00
T_8- Hydration with $MnSO_4$ (0.5%)	81.67 (64.65)	81.67 (64.66)	81.67 (70.33)	34.67	40.67	37.67	29.30	30.70	30.00	109.33	123.00	116.17
Mean	82.17 (65.09)	84.83 (65.64)	83.50 (71.19)	33.87	38.63	36.26	30.68	32.93	31.80	107.33	122.21	114.77
S.E.± CD@5%	V 0.64 1.91	P 0.41 1.12	Int. 1.43 NS	V 0.47 1.36	P 0.31 0.88	Int. 1.03 NS	V 0.21 1.99	P 0.33 1.63	Int. 1.14 NS	V 0.93 2.68	P 0.70 1.73	Int. 0.08 NS

Table i. contd... Effect of variety, seed priming treatments on growth and yield contributing characters

Priming treatments	Final plant count			No. of pods plant^{-1}			Seed yield plant-1(g)			Seed yield hectare^{-1}(q)		
	V1	**V2**	Mean	V1	**V2**	Mean	V1	V2	Mean	V1	V2	Mean
T_1- Controll (No priming)	86.00	87.67	86.83	26.00	31.00	28.50	31.87	32.99	32.43	18.28	29.87	24.08
T_2- Hydration with water	87.00	88.67	87.83	27.00	32.00	29.50	32.90	33.13	33.87	18.98	33.03	26.21
T_3- Hydration with KH_2PO_4 (1%)	89.33	91.67	90.50	28.67	33.33	31.00	34.60	35.11	34.86	20.47	33.83	27.15
T_4- Hydration with $CaCl_2$ (1%)	93.67	95.00	94.33	33.67	39.00	36.33	37.55	40.35	38.95	23.46	36.62	30.04
T_5- Hydration with KCl (1%)	93.00	93.67	93.33	31.00	36.67	33.83	36.92	39.08	38.00	22.24	35.82	29.03
T_6- Hydration with Boron (0.5%)	92.00	93.33	92.67	30.33	36.00	33.17	35.62	36.63	36.13	22.12	34.95	28.54
T_7- Hydration with GA3 (25 ppm)	91.00	92.33	91.67	29.00	34.33	31.67	35.17	35.83	35.50	21.32	34.58	27.95
T_8- Hydration with $MnSO_4$ (0.5%)	88.00	89.33	88.67	28.33	32.33	30.33	33.10	33.25	33.18	19.71	33.25	26.48
Mean	90.00	91.48	90.43	29.25	34.52	31.83	34.72	36.01	35.36	20.82	34.05	27.44

	V	P	Int.	V	P	Int.	V	P	Int.	V	P	Int.
S.E.±	0.63	0.41	1.41	0.50	0.32	1.11	0.55	0.36	1.23	0.67	0.43	1.49
CD@5%	1.81	1.18	NS	1.83	0.92	NS	1.59	1.03	NS	1.92	1.24	NS

Table ii. Effect of variety, seed priming treatments on seed quality parameters

Priming treatments	Germination (%)			Vigour Index			Dry matter content of seedling (g)			Electrical conductivity (dSm^{-1})		
	V1	**V2**	Mean	V1	**V2**	Mean	V1	V2	Mean	V1	V2	Mean
T_{1}- Controll (No priming)	88.33 (75.05)	89.33 (70.97)	88.83 (76.79)	1515.60	1653.97	1584.78	0.413	0.450	0.432	0.493	0.449	0.471
T_{2}- Hydration with water	89.00 (70.67)	90.00 (71.85)	89.50 (77.42)	1636.17	1757.37	1696.77	0.461	0.498	0.480	0.490	0.446	0.468
T_{3}- Hydration with KH_2PO_4 (1%)	91.33 (72.92)	92.67 (74.32)	92.00 (79.97)	1801.67	1967.93	1884.80	0.437	0.527	0.482	0.481	0.440	0.460
T_{4}- Hydration with $CaCl_2$ (1%)	94.00 (78.85)	95.67 (78.00)	94.83 (83.17)	2240.93	2578.50	2409.72	0.495	0.582	0.539	0.467	0.423	0.445
T_{5}- Hydration with KCl (1%)	92.67 (74.30)	94.67 (76.66)	93.67 (81.87)	2055.20	2337.70	2196.45	0.448	0.571	0.509	0.472	0.427	0.450
T_{6}- Hydration with Boron (0.5%)	92.33 (74.01)	93.67 (75.43)	93.00 (81.04)	1979.70	2200.77	2090.23	0.444	0.543	0.494	0.474	0.432	0.453
T_{7}- Hydration with GA3 (25 ppm)	91.33 (72.92)	93.33 (75.10)	92.33 (80.45)	1871.10	2037.90	1954.50	0.440	0.535	0.488	0.478	0.437	0.458
T_{8}- Hydration with $MnSO_4$ (0.5%)	89.67 (71.28)	91.00 (72.56)	90.33 (78.28)	1715.07	1809.37	1762.22	0.433	0.512	0.473	0.487	0.442	0.464
Mean	91.08 (72.75)	92.54 (74.33	91.81 (79.87)	1851.93	2042.94	1947.43	0.446	0.527	0.487	0.480	0.437	0.458
S.E.±	V	P	Int.	V	P	Int.	V	P	Int.	V	P	Int.
CD@5%	0.39	0.25	0.89	15.93	9.93	34.42	0.003	0.002	0.008	0.003	0.003	0.009
	1.16	0.75	NS	44.34	28.62	99.15	0.008	0.005	0.021	0.009	0.010	0.026