

EFFECT OF DIFFERENT SEED PRIMING TREATMENTS ON SEED YIELD AND YIELD CONTRIBUTING CHARACTERS IN GROUNDNUT (*Arachis hypogaea* L.)

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ABSTRACT

*This study was carried out in order to evaluate the effect of different seed priming treatments on seed yield and yield contributing characters in groundnut (*Arachis hypogaea* L.) at Sagdividi Farm, Department of Seed Science and Technology, College of Agriculture, Junagadh Agricultural University, Junagadh during kharif – 2018 following randomized block design (factorial) with three replications. The first factor was genotypes (GG-20 and GJG-22) and the second factor was different seed priming treatments (control, water, KH_2PO_4 (1%), CaCl_2 (1%), KCl (1%), Boron (0.5%), GA_3 (25 ppm), MnSO_4 (0.5%) and KNO_3 (1%). The results revealed that irrespective of seed priming treatments, genotype GJG-22 recorded the better performance in field emergence percentage, days to 50 per cent flowering, plant height, days to maturity, number of mature pods per plant, seed yield per plant, seed yield per plot, seed yield per hectare and harvest index as compared to GG-20 genotype. While irrespective of genotypes, seed priming with CaCl_2 (1%) found to be superior in all seed yield characters viz., field emergence percentage, days to 50 per cent flowering, plant height, days to maturity, number of mature pods per plant, seed yield per plant, seed yield per plot, seed yield per hectare and harvest index followed by treatments KCl (1%) and KH_2PO_4 (1%).*

KEY WORDS: Groundnut, Seed priming, Seed yield

INTRODUCTION

Groundnut (*Arachis hypogaea* L.) is the 13th most important food crop and 4th most important oilseed crop of the world. It is commonly called as the king of vegetable oilseeds, poor man's nut, peanut and monkey nut. The cultivated groundnut is a tetraploid with a chromosome number $2n=4x=40$. It belongs to the family *Papilionaceae*, largest and most important of the three division of *Leguminosae*. Groundnut appears to have originated in the South America i.e. North-West of Brazil. Different cultivars of groundnut are broadly

classified into the following two groups 1) Virginia - having bunchy, semi-spreading or spreading growth habit and 2) Spanish - having bunch growth habit. It is rich source of edible oil (49.2%), protein (25.8%), carbohydrates (16.1%), minerals and vitamins (Arnarson, 2015). In addition to this, groundnut biomass like leaf and stem are good source of nutritionally high quality fodder for livestock. About 12 per cent of total groundnut production in India is used for seed purpose, 6 per cent for domestic uses, 81 per cent for oil extraction and only 1 per cent for exporting (Desai *et al.*, 1999).

Strategies for improving the growth and development of crop species have been investigated for many years. A simple, low-cost, low-risk technology called 'on-farm' seed priming has been shown to improve emergence, seedling vigour and yield in a range of crops, including legumes (Harris *et al.*, 1999; Musa *et al.*, 2001; Kumar *et al.*, 2002). The direct benefits of seed priming in all crops included faster emergence, better, more and uniform stands, less need to re-sow, more vigorous plants, better drought tolerance, earlier flowering, earlier harvest and higher grain yield. The indirect benefits reported were earlier sowing of crops and increased willingness to use of fertilizer because of reduce risk of crop failure (Harris *et al.*, 2001). Rehman *et al.* (2011) reported that seed priming is a cost effective technology that can enhance early crop growth leading to earlier and more uniform stand with yield associated benefits in many field crops including oilseeds.

MATERIALS AND METHODS

A field experiment was carried out to study the effect of different seed priming treatments on seed yield and yield contributing characters in groundnut at Sagdividi Farm, Department of Seed Science and Technology, College of Agriculture, Junagadh Agricultural University, Junagadh during *kharif* - 2018. There were two genotypes [GG-20 (G_1) and GJG-22 (G_2)] of groundnut were dipped in different priming solution [Untreated seed (control) (T_1), Water (T_2), KH_2PO_4 (1%) (T_3), $CaCl_2$ (1%) (T_4), KCl (1%) (T_5), Boron (0.5%) (T_6), GA_3 (25 ppm) (T_7), $MnSO_4$ (0.5%) (T_8) and KNO_3 (1%) (T_9)] for 6 hours followed by shade drying. They were sown at 60×10 cm distance. The experiment was laid out in field as per Randomized Block Design (Factorial) with three replications. All the necessary cultural practices were carried out during crop standing. The observations on seed yield

characters in the standing crop viz., field emergence percentage, days to 50 per cent flowering, plant height (cm), days to maturity, number of mature pods per plant, seed yield per plant (g), seed yield per plot (kg), seed yield per hectare (q) and harvest index (%) were recorded. The data obtained were analyzed as per standard method suggested by Cochran and Cox (1957).

RESULTS AND DISCUSSION

Yield and yield contributing characters assessed on the resultant seeds differed significantly due to the differences in genotypes. Significantly the highest field emergence percentage (77.65%), plant height (39.88 cm), number of mature pods per plant (19.77), seed yield per plant (22.64 g), seed yield per plot (1.56 kg), seed yield per hectare (18.49 q) and harvest index (33.60%) and the lowest days to 50 per cent flowering (37.85) and days to maturity (113.59), were recorded in GJG-22 genotype (G_2) as compared to GG 20. GG 20 recorded field emergence percentage (75.38%), days to 50 per cent flowering (39.07), plant height (38.09 cm), days to maturity (116.89), number of mature pods per plant (18.72), seed yield per plant (21.22 g), seed yield per plot (1.48 kg), seed yield per hectare (17.59 q) and harvest index (32.05%). (Table 1, 2 and 3). Similar significant results on field emergence percentage, days to 50 per cent flowering, plant height, days to maturity, number of mature pods per plant, seed yield per plant, seed yield per plot and seed yield per hectare reported by Bhingarde *et al.* (2015) in groundnut and for harvest index by Tahir *et al.* (2017) in groundnut.

The seed priming treatments had significant influence in the resultant seed across all the yield and yield contributing characters tested (Table 1, 2 and 3). Significantly the maximum field emergence percentage (82.88%), plant height (43.33 cm), number of mature pods per plant

(22.27), seed yield per plant (25.78), seed yield per plot (1.62 kg), seed yield per hectare (19.27 q) and harvest index (35.73%) and the minimum days to 50 per cent flowering (35.33) and days to maturity (110.00) were recorded in treatment having seed primed with CaCl_2 (1%) (T_4), which was at par results with seed primed with KCl (1%) (T_5) and KH_2PO_4 (1%) (T_3) in field emergence percentage (81.68% and 80.12%), days to 50 per cent flowering (36.17 and 37.83), plant height (42.06 cm and 40.48 cm), days to maturity (110.83 and 112.67), number of mature pods per plant (21.47 and 20.70), seed yield per plant (24.41 g and 23.65 g), seed yield per plot (1.60 kg and 1.58 kg), seed yield per hectare (19.03 q and 18.83 q) and harvest index (35.02% and 34.67%). The lowest yield and yield contributing characters were recorded in control (no priming) (T_1). Bhingarde *et al.* (2015) reported that increase in field emergence percentage due to hydration with CaCl_2 aided in initiation of early sprouting and resulted in accelerated the germination. Pawar *et al.* (2003) reported that positive reduction in days to 50 per cent flowering is mainly due to the earlier and uniform emergence of seedlings, which was evident from the present study and might be also due to the role of calcium in plant growth and development. Bhingarde *et al.* (2015) reported that the enhancement in plant height with CaCl_2 might be due to cell enlargement and increase in normal cell division. They also reported that more number of mature pods per plant with CaCl_2 might be due to calcium improves pod filling, which resulted in increase the number of well-filled pods and the 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. Increase in yield with CaCl_2 invigouration can be attributed to increased

yield and yield contributing characters such as field emergence percentage, number of mature pods per plant and seed yield per plant. Narayanaswamy and Shambulingappa (1998), Narayanareddy and Biradarpatil (2012), Chavan *et al.* (2014), Fatemeh *et al.* (2017), Jadhav *et al.* (2017) and Venkatesh *et al.* (2018) reported similar beneficial results on yield and yield contributing characters due to priming with calcium chloride.

Interaction effect of genotypes and seed priming treatments were found non-significant (Table 1, 2 and 3) for field emergence percentage, days to 50 per cent flowering, plant height, days to maturity, number of mature pods per plant, seed yield per plant, seed yield per plot, seed yield per hectare and harvest index. Numerically the highest interaction values for all seed yield characters were recorded in G_2T_4 , while the lowest in G_1T_1 .

CONCLUSION

It can be concluded from the present study that, seeds of groundnut genotypes primed with CaCl_2 (1%) followed by KCl (1%) and KH_2PO_4 (1%) for 6 hours followed by shade drying resulted in earlier flowering and days to maturity with highest field emergence percentage, plant height, number of mature pods per plant, seed yield per plant, seed yield per plot, seed yield per hectare and harvest index.

REFERENCES

- Arnarson, A. (2015). Peanuts 101: Nutrition facts and health benefits. Available at <https://www.healthline.com/nutrition/foods/peanuts> Accessed April 22, 2018.
- Bhingarde, M. T.; Kadam, R. S. and Tagad, L. N. (2015). Effect of seed priming on seed yield and seed quality of groundnut (*Arachis hypogaea* L.). *Life Sci. Int. Res. J.*, 2(2): 25-29.

- Chavan, N. G.; Bhujbal, G. B. and Manjare, M. R. (2014). Effect of seed priming on field performance and seed yield of soybean [*Glycine max* (L.) Merrill.] varieties. *The Bioscan*, **9**(1): 111-114.
- Cochran, W. G. and Cox, G. M. (1957). *Experimental Designs*. 2nd edition, New York, Wiley. pp. 276-292.
- Desai, B. B.; Kotecha, P. M. and Salunkhe, D. K. (1999). Science and technology of groundnut biology, production, processing and utilization. Calcutta, *Naya Prakash*. pp. 2-4.
- Fatemeh, M.; Mahmoud, R.; Mansour, T. and Mohammad, G. (2017). Effects of seed priming on chlorophyll content and yield components of pinto beans. *Int. J. Biol.*, **6**(6): 1069-1085.
- Harris, D.; Joshi, A.; Khan, P. A.; Gothkar, P. and Sodhi, P. S. (1999). On-farm seed priming in semi-arid agriculture development and evaluation in maize, rice and chickpea in India using participatory method. *Exp. Agric.*, **35**(1): 15-29.
- Harris, D.; Pathan, A. U.; Gothkar, P.; Joshi, A.; Chirasa, W. and Nyamudeza, P. (2001). On-farm seed priming: using participatory methods to revive and refine a key technology. *Agric. Syst.*, **69**(1): 151-164.
- Jadhav, K. V.; Kayande, N. V.; Wandhare, M. R. and Phad, D. S. (2017). Effect of seed priming on yield and yield component of soybean. *Int. J. Plant Sci.*, **12**(1): 15-20.
- Kumar, A.; Gangwar, J. S.; Prasad, S. C. and Harris, D. (2002). 'On-farm' seed priming increased yield of direct sown finger millet (*Eleusine coracana*) in India. *Int. Sorghum Millets Newsl.*, **43**: 90-92.
- Musa, A. M.; Harris, D.; Johansen, C. and Kumar, J. (2001). Short duration chickpea to replace follow after aman rice: The role of on-farm seed priming in the high barind tract of Bangladesh. *Exp. Agric.*, **37**(4): 509-521.
- Narayanareddy, A. B. and Biradarpatil, N. K. (2012). Effect of pre-sowing invigoration seed treatments on seed quality and crop establishment in sunflower hybrid KBSH-1. *Karnataka J. Agric. Sci.*, **25**(1): 43-46.
- Narayanaswamy, S. and Shambulingappa, K. G. (1998). Effect of pre-sowing seed treatment on seed yield in groundnut. *Curr. Res.*, **27**(2): 35-36.
- Pawar, K. N.; Sajjan, A. S. and Prakash, B. G. (2003). Influence of seed hardening on growth and yield of sunflower. *Karnataka J. Agric. Sci.*, **16**(4): 539-541.
- Rehman, H. U.; Maqsood, S.; Basra, A. and Farooq, M. (2011). Field appraisal of seed priming to improve the growth, yield and quality of direct seeded rice. *Turk. J. Agric.*, **35**: 357-365.
- Tahir, A. K.; Zammurad, I. A.; Sairah, S.; Abdullah, B.; Muhammad, N. M.; Muhammad, I.; Waqas, A.; Abdul, L.; Zulfiqar, A. R. and Sumeria, M. H. (2017). Seed priming with iron and zinc improves growth and yield of groundnut (*Arachis hypogaea*L.). *Pure Appl. Biol.*, **6**(2): 553-560.
- Venkatesh, B. D.; Balaji Nayak, S. and Sujathamma, P. (2018). Studies on seed priming on seedling vigour, crop growth and yield of groundnut (*Arachis hypogaea*L.) under rainfed conditons. *Int. J. Pure App. Biosci.*, **6**(5):238-242.

Table 1: Effect of seed priming treatments to different genotypes and their interaction on field emergence percentage, days to 50 per cent flowering and plant height in groundnut

Treatments	Field Emergence Percentage	Days to 50 Per Cent Flowering	Plant Height (cm)
Genotypes (G)			
G ₁ - GG-20	75.38	39.07	38.09
G ₂ - GJG-22	77.65	37.85	39.88
S.Em±	0.76	0.42	0.59
CD at 5%	2.19	1.19	1.70
Priming treatments (T)			
T ₁ - Control (No priming)	69.38	41.17	35.25
T ₂ - Hydration with water for 6 hours	71.07	40.50	36.60
T ₃ - Hydration with KH ₂ PO ₄ (1%) for 6 hours	80.12	37.83	40.48
T ₄ - Hydration with CaCl ₂ (1%) for 6 hours	82.88	35.33	43.33
T ₅ - Hydration with KCl (1%) for 6 hours	81.68	36.17	42.06
T ₆ - Hydration with Boron (0.5%) for 6 hours	74.67	39.00	37.82
T ₇ - Hydration with GA ₃ (25 ppm) for 6 hours	77.19	38.50	38.54
T ₈ - Hydration with MnSO ₄ (0.5%) for 6 hours	72.89	39.50	37.31
T ₉ - Hydration with KNO ₃ (1%) for 6 hours	78.79	38.17	39.39
S.Em±	1.61	0.88	1.25
CD at 5%	4.64	2.53	3.60
Interaction (G × T)			
G ₁ × T ₁	68.59	42.00	33.76
G ₁ × T ₂	70.05	41.00	35.33
G ₁ × T ₃	78.76	38.33	39.28
G ₁ × T ₄	81.84	36.00	42.34
G ₁ × T ₅	80.56	36.67	41.36
G ₁ × T ₆	73.56	39.67	37.38
G ₁ × T ₇	75.73	39.00	38.07
G ₁ × T ₈	71.95	40.33	36.61
G ₁ × T ₉	77.40	38.67	38.68
G ₂ × T ₁	70.16	40.33	36.94
G ₂ × T ₂	72.09	40.00	37.87
G ₂ × T ₃	81.48	37.33	41.68
G ₂ × T ₄	83.92	34.67	44.32
G ₂ × T ₅	82.81	35.67	42.77
G ₂ × T ₆	75.78	38.33	38.26
G ₂ × T ₇	78.65	38.00	39.00
G ₂ × T ₈	73.82	38.67	38.01
G ₂ × T ₉	80.17	37.67	40.09
S.Em±	2.28	1.25	1.77
CD at 5%	NS	NS	NS
CV %	5.17	5.61	7.86

Table 2: Effect of seed priming treatments to different genotypes and their interaction on days to maturity, number of mature pods per plant and seed yield per plant in groundnut

Treatments	Days to Maturity	Number of Mature Pods Per Plant	Seed Yield Per Plant (g)
Genotypes (G)			
G ₁ - GG-20	116.89	18.72	21.22
G₂ - GJG-22	113.59	19.77	22.64
S.Em±	1.13	0.28	0.39
CD at 5%	3.25	0.81	1.11
Priming treatments (T)			
T₁ - Control (No priming)	119.83	16.17	18.18
T ₂ - Hydration with water for 6 hours	119.17	17.20	19.51
T ₃ - Hydration with KH ₂ PO ₄ (1%) for 6 hours	112.67	20.70	23.65
T₄ - Hydration with CaCl₂ (1%) for 6 hours	110.00	22.27	25.78
T ₅ - Hydration with KCl (1%) for 6 hours	110.83	21.47	24.41
T ₆ - Hydration with Boron (0.5%) for 6 hours	116.50	18.70	21.20
T ₇ - Hydration with GA ₃ (25 ppm) for 6 hours	115.33	19.07	21.74
T ₈ - Hydration with MnSO ₄ (0.5%) for 6 hours	118.50	17.93	20.42
T ₉ - Hydration with KNO ₃ (1%) for 6 hours	114.33	19.70	22.46
S.Em±	2.40	0.60	0.82
CD at 5%	6.89	1.72	2.36
Interaction (G × T)			
G₁ × T₁	121.67	15.60	17.50
G ₁ × T ₂	121.00	16.73	19.01
G ₁ × T ₃	113.67	19.93	22.94
G ₁ × T ₄	111.33	21.47	24.72
G ₁ × T ₅	112.33	20.67	23.82
G ₁ × T ₆	118.33	18.47	20.57
G ₁ × T ₇	116.67	18.80	21.06
G ₁ × T ₈	120.33	17.53	19.69
G ₁ × T ₉	116.67	19.27	21.64
G ₂ × T ₁	118.00	16.73	18.86
G ₂ × T ₂	117.33	17.67	20.01
G ₂ × T ₃	111.67	21.47	24.35
G₂ × T₄	108.67	23.07	26.83
G ₂ × T ₅	109.33	22.27	25.01
G ₂ × T ₆	114.67	18.93	21.83
G ₂ × T ₇	114.00	19.33	22.41
G ₂ × T ₈	116.67	18.33	21.15
G ₂ × T ₉	112.00	20.13	23.28
S.Em±	3.39	0.85	1.16
CD at 5%	NS	NS	NS
CV %	5.10	7.64	9.16

Table 3: Effect of seed priming treatments to different genotypes and their interaction on seed yield per plot (kg), seed yield per hectare (q) and harvest index (%) in groundnut

Treatments	Seed Yield Per Plot (kg)	Seed Yield Per Hectare(q)	Harvest Index (%)
Genotypes (G)			
G ₁ - GG-20	1.48	17.59	32.05
G₂ - GJG-22	1.56	18.49	33.60
S.Em±	0.02	0.25	0.42
CD at 5%	0.06	0.73	1.22
Priming treatments (T)			
T₁ - Control (No priming)	1.44	17.08	30.22
T ₂ - Hydration with water for 6 hours	1.45	17.28	30.91
T ₃ - Hydration with KH ₂ PO ₄ (1%) for 6 hours	1.58	18.83	34.67
T₄ - Hydration with CaCl₂ (1%) for 6 hours	1.62	19.27	35.73
T ₅ - Hydration with KCl (1%) for 6 hours	1.60	19.03	35.02
T ₆ - Hydration with Boron (0.5%) for 6 hours	1.47	17.52	31.90
T ₇ - Hydration with GA ₃ (25 ppm) for 6 hours	1.48	17.62	32.61
T ₈ - Hydration with MnSO ₄ (0.5%) for 6 hours	1.46	17.42	31.28
T ₉ - Hydration with KNO ₃ (1%) for 6 hours	1.54	18.31	33.10
S.Em±	0.05	0.54	0.90
CD at 5%	0.13	1.55	2.59
Interaction (G × T)			
G₁ × T₁	1.40	16.71	29.50
G ₁ × T ₂	1.41	16.79	30.06
G ₁ × T ₃	1.54	18.37	33.82
G ₁ × T ₄	1.57	18.73	35.38
G ₁ × T ₅	1.56	18.61	34.28
G ₁ × T ₆	1.43	17.02	31.02
G ₁ × T ₇	1.44	17.18	31.62
G ₁ × T ₈	1.42	16.94	30.36
G ₁ × T ₉	1.51	17.94	32.41
G ₂ × T ₁	1.47	17.46	30.94
G ₂ × T ₂	1.49	17.78	31.76
G ₂ × T ₃	1.62	19.29	35.53
G₂ × T₄	1.66	19.80	36.08
G ₂ × T ₅	1.63	19.44	35.75
G ₂ × T ₆	1.51	18.02	32.79
G ₂ × T ₇	1.52	18.06	33.59
G ₂ × T ₈	1.50	17.90	32.20
G ₂ × T ₉	1.57	18.69	33.78
S.Em±	0.06	0.76	1.27
CD at 5%	NS	NS	NS
CV %	7.32	7.32	6.71

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