

Effect of Pre-Sowing Seed Treatments for Better Crop Establishment in Summer Groundnut

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ABSTRACT Two seed lots of groundnut (*Arachis hypogaea* L.) viz., fresh seed having high germination vigour and revalidated seed (low vigour) were subjected to pre-sowing seed treatments and their efficacy was evaluated during summer seasons of 2003, 2004 and 2005. Pre-sowing seed invigoration by hydration for 16 h and air drying at room temperature followed by dressing with Thiram (75 % DS) @ 0.25 per cent registered consistently and significantly higher pod yield than the untreated seeds of revalidated seed. The higher pod yield was resulted from significantly improved germination, speed of emergence, per cent field emergence, ultimately the better crop establishment and in turn higher plant stand. The beneficial effects of hydration followed by Thiram dressing were more pronounced in the low vigour seed lot (revalidated) than in the high vigour lot (fresh). The study highlighted the efficacy of hydro priming followed by Thiram dressing.

Key words: Groundnut, hydropriming, field emergence, pod yield, Thiram

Groundnut (*Arachis hypogaea* L.) is the most important oilseed crop and also a food crop of India. During the year 2001-02 it was grown in an area of 6.4 million hectare with annual production of 7.21 million tonnes [1]. The overall productivity of this crop in India is quite low. Usually, farmers are using their own seed. The poor vigour and viability, many times combined with the adverse environmental conditions may result in poor crop establishment and ultimately the decreased yield. Sometimes non-availability of certified fresh seed may compel the use of old (revalidated) seed lot and consequently results in poor yield. Under these circumstances, seed invigoration treatments may help in proper crop establishment and to avoid the substantial loss in the yield. Not only that any class of the seed viz., breeder, foundation or certified can be given pre-sowing seed invigoration treatment. This is most vital when seed is a costly input as in case of groundnut. A number of pre-sowing seed invigoration treatments have shown better seedling performance and crop establishment, and ultimately increased yield in

several crops [2-7], including groundnut [8, 9]. In view of this, the present study was taken up to find out the impact of pre-sowing seed invigoration treatments for better crop establishment in summer groundnut.

MATERIALS AND METHODS

Two seed lots of groundnut viz., fresh seed lot (high vigour seed with germination percentage > 90 %) and old seed lot (low vigour seed with almost MSCS level of germination-revalidated) was included in the study. Both seed lots of groundnut were subjected to seven pre-sowing seed treatments namely hydration for 16h followed by air drying at room temperature (T_1), cold hydration for 72h at 10°C and surface drying (T_2), hydration with 50ppm GA_3 for 16h followed by surface drying at room temperature (T_3), osmoconditioning with PEG (poly ethylene glycol) solution (-10 bars) at 15°C for seven days (T_4), hydration for 16h and drying followed by dressing with Thiram (75% DS) @ 0.25 per cent (T_5), hydration with 2 per cent KH_2PO_4 (potassium dihydrogen phosphate) for 16h

$$\text{Speed of emergence} = \frac{\text{Number of normal seedlings emerged}}{\text{days to first count}} + \frac{\text{Number of normal seedlings emerged}}{\text{days to second count}} + \dots + \frac{\text{Number of normal seedlings emerged}}{\text{days to final count}}$$

followed by drying at room temperature (T_0), and dry seeds without any treatment used as a control (T_0). Two separate experiments using fresh and revalidated seed were conducted employing seven pre-sowing seed invigoration treatments in the field of Junagadh Agricultural University, Jamnagar, in randomized block design (RBD) with four replications adopting the recommended package of practices during summer seasons of 2003, 2004 and 2005. Two hundred counted seeds were sown in four rows of 5 m length in each plot. For estimation of speed of emergence in the field trials, a number of normal seedlings emerged out per 100 seeds, daily were counted. The speed of field emergence was calculated as suggested by Maguire [10].

Final plant stand was recorded at maturity. Pod yields were recorded on plot basis and converted to pod yield per hectare. The treated seeds of both the lots were also tested for laboratory germination as per the procedure of ISTA rules [11]. After the final germination count, 10 normal seedlings from each replication were taken randomly, oven dried at 80°C for 17h and weighed for seedling dry weight. The data of fresh and revalidated seed lots of groundnut were separately subjected to simple RBD analysis and pooled over years and results are presented in Table 1 (high vigour lot) and Table 2 (low vigour seed lot), respectively.

RESULTS AND DISCUSSION

In fresh seed lot of groundnut, significant differences in per cent germination, speed of emergence, seedling dry weight, per cent field emergence, plant stand and pod yield were observed due to different pre-sowing seed treatments in individual years as well as in the pooled one but the treatment \times year interaction was also significant for all the characters studied (Table 1). Although, pre-sowing seed invigoration

by hydration for 16h and drying at room temperature followed by dressing with Thiram @ 0.25 per cent (FT_5) recorded the highest pod yield in all the three years as well as in the pooled one but the values were not significantly higher than the control in two out of three years. Nevertheless, pooled data exhibited significantly higher pod yield in this treatment as compared to untreated seeds when tested against interaction CD. The beneficial effects of this treatment (FTs) were also found in respect to per cent germination, speed of emergence, seedling dry weight, per cent field emergence and final plant stand in all the three years. Hydration at room temperature (FT_1) or cold hydration (FT_2) did not show any significant differences when compared with control with regards to any of the parameters studied. Hydration with 50 ppm GA_3 (FT_3) and 2 per cent KH_2PO_4 (FT_6) for 16h followed by surface drying were also found to have adverse effects on per cent germination, speed of emergence, per cent field emergence and pod yield as compared to control. Osmoconditioning (FT_4) treatment had highly detrimental effects resulting in inhibition of germination and in turn all the other parameters.

In the revalidated seed lot of groundnut (Table 2), significant differences were observed among the pre-sowing seed treatments for per cent germination, speed of emergence, seedling dry weight, per cent field emergence, plant stand and pod yield in individual years as well as in pooled analysis, and the interaction (treatment \times year) was also found significant. Among the pre-sowing seed treatments, hydro-priming, followed by Thiram dressing @ 0.25 per cent (RT_5) produced consistently and significantly higher pod yield than untreated seeds in all the three years. Moreover, the value was significantly higher than the control with respect to pod yield in pooled analysis when tested against (Y \times T) interaction CD. More or less similar trend of seed invigoration (RT_5) was

Table 1. Effect of pre-sowing seed treatments on various parameters in fresh seed lot of groundnut

Treatment	Germination (%)				Speed of emergence				Seedling dry weight (mg)			
	2003	2004	2005	Pool	2003	2004	2005	Pool	2003	2004	2005	Pool
FT ₀	96.50	91.50	96.50	94.83	9.49	9.35	4.28	7.71	0.248	0.325	0.462	0.345
FT ₁	95.50	92.00	95.75	94.42	8.34	9.56	4.46	7.46	0.227	0.289	0.413	0.310
FT ₂	88.50	82.75	82.75	84.67	9.75	8.28	4.33	7.45	0.260	0.333	0.395	0.329
FT ₃	81.50	81.50	87.50	83.50	5.81	8.13	3.68	5.87	0.228	0.311	0.395	0.311
FT ₄	2.00	37.00	32.00	23.67	3.80	2.73	1.41	2.65	0.223	0.278	0.340	0.281
FT ₅	97.50	96.25	96.75	96.83	10.02	9.84	4.86	8.24	0.279	0.364	0.472	0.372
FT ₆	89.50	81.0	80.50	83.67	6.20	6.98	4.06	5.75	0.256	0.312	0.402	0.324
Treat(T) S.Em ±	1.17	3.17	2.03	4.74	0.41	0.41	0.04	0.58	0.006	0.007	0.015	0.011
Treat. CD at 5%	3.47	9.41	6.03	14.61	1.23	1.21	0.12	1.79	0.019	0.022	0.046	0.034
TxY S.Em +	-	-	-	2.27	-	-	-	0.34	-	-	-	0.011
TxY CD at 5%	-	-	-	6.45	-	-	-	0.95	-	-	-	0.030
C.V. %	2.96	7.89	4.97	5.67	10.88	10.36	2.01	10.42	5.24	4.57	7.53	6.50

Treatment	Field emergence (%)				Pod yield/ha (kg)			
	2003	2004	2005	Pool	2003	2004	2005	Pool
FT ₀	79.25	81.75	78.50	79.83	1113	652	1281	1015
FT ₁	71.75	83.75	81.00	78.83	991	666	1308	988
FT ₂	82.25	76.00	81.50	79.92	1082	605	1200	962
FT ₃	50.25	66.75	67.50	61.50	574	504	1125	735
FT ₄	35.75	26.25	24.75	28.92	360	156	160	226
FT ₅	84.50	88.00	88.00	86.83	1212	713	1658	1194
FT ₆	55.25	64.00	75.00	64.75	653	494	1060	736
Treat.(T) SEm ±	3.27	3.64	1.02	3.60	33.33	16.67	66.67	100.00
Treat. CD at 5 %	9.71	10.83	3.04	11.10	116.67	66.67	200.00	300.00
TxY SEm ±	-	-	-	2.89	-	-	-	50.00
TxY CD at 5%	-	-	-	8.19	-	-	-	133.33
C.V. %	9.97	10.49	2.89	8.41	8.64	8.50	12.38	11.25

Where, F=Fresh groundnut seed; T=Treatment; Y=Year.

Table 2. Effect of pre-sowing seed treatments on various parameters in revalidated seed lot of groundnut

Treatment	Germination (%)				Speed of emergence				Seedling dry weight (mg)			
	2003	2004	2005	Pool	2003	2004	2005	Pool	2003	2004	2005	Pool
RT ₀	75.00	74.50	69.75	73.08	3.62	7.39	3.35	4.77	0.325	0.374	0.384	0.361
RT ₁	67.75	79.50	71.25	72.83	3.16	7.64	3.46	4.76	0.280	0.335	0.392	0.336
RT ₂	54.50	69.25	66.25	63.33	1.28	6.61	3.28	3.72	0.322	0.371	0.377	0.357
RT ₃	63.00	76.50	69.50	69.67	2.04	7.66	3.31	4.34	0.343	0.383	0.337	0.354
RT ₄	0.0	31.75	16.00	15.92	0.0	1.07	0.45	0.51	0.0	0.292	0.253	0.181
RT ₅	77.50	84.50	78.50	80.17	5.51	8.47	3.77	5.92	0.330	0.402	0.387	0.373
RT ₆	35.75	71.50	65.50	57.58	2.88	6.22	3.26	4.12	0.290	0.345	0.378	0.338
Treat(T) SEm ±	2.12	3.25	2.20	4.20	0.24	0.21	0.11	0.56	0.012	0.009	0.010	0.030
Treat. CD at 5 %	6.30	9.65	6.54	12.95	0.70	0.63	0.34	1.74	0.034	0.027	0.029	0.093
TxY SEm ±	-	-	-	2.57	-	-	-	0.20	-	-	-	0.010
TxY CD at 5%	-	-	-	7.30	-	-	-	0.55	-	-	-	0.029
C.V. %	7.95	9.33	7.05	8.33	17.86	6.61	7.56	9.68	8.53	5.00	5.47	6.18

Treatment	Field emergence (%)				Pod yield/ha (kg)			
	2003	2004	2005	Pool	2003	2004	2005	Pool
RT ₀	41.50	71.75	63.00	58.75	271	557	835	554
RT ₁	33.75	73.25	66.25	57.75	261	576	1008	615
RT ₂	16.00	64.50	62.75	47.75	184	488	977	550
RT ₃	24.00	72.00	62.25	52.75	151	535	846	511
RT ₄	0.0	11.50	9.25	6.92	00	63	142	68
RT ₅	63.50	78.50	71.50	71.17	407	628	1254	763
RT ₆	32.50	66.25	62.50	53.75	243	512	919	558
Treat(T) SEm ±	2.30	2.15	1.95	4.93	16.67	16.67	33.33	66.67
Treat. CD at 5 %	6.84	6.40	5.80	15.18	50.00	50.00	116.67	233.33
TxY SEm ±	-	-	-	2.14	-	-	-	33.33
TxY CD at 5%	-	-	-	6.07	-	-	-	83.33
C.V. %	15.26	6.89	6.88	8.59	13.26	7.92	9.27	10.32

Where, R = Revalidated groundnut seed; T = Treatment; Y = Year.

observed in per cent germination, speed of emergence, seedling dry weight, per cent field emergence and final plant stand in individual as well as in pooled analysis over years. Results are in accordance with the earlier reports [12, 13]. In the present study, the year x treatment interaction was found to be significant due to inconsistency in other treatments. As in case of fresh seed lot, hydro-priming seed treatment (RT₁) prior to sowing did not show any significant effects as compared to control. The other pre-sowing seed treatments also did not manifest any significant superiority over control for pod yield and other attributes studied. On the contrary, many a times, an adverse effect was discernible. Most pronounced detrimental effect was observed due to osmoconditioning with PEG. The latter has been reported to be extremely detrimental, resulting in complete inhibition of germination [12].

The response to different pre-sowing treatments was almost similar in both fresh and revalidated seed lots. However, hydro-priming followed by Thiram dressing with 2.5 gm/kg seed was more effective in low vigour seed than in high vigour seed. Thus, pre-sowing treatment in low vigour seeds of groundnut with hydration for 16h followed by air drying and Thiram dressing @ 0.25 per cent resulted in significantly higher germination, speed of emergence, per cent field emergence, ultimately better crop establishment and in turn increase in pod yield. There are reports of germination vigour promotion and ultimately the yield by hydro-priming [14, 15] and Thiram seed dressing in groundnut as well as other crops [7, 12, 13, 16, 17]. Thiram appears to act not only as a fungicide but also as a promoter of germination vigour.

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