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# Effects of Presowing 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 presowing seed treatments and their efficacy was evaluated during summer seasons of 2003, 2004 and 2005. Presowing 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 in 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, hydro-priming, field emergence, pod yield, Thiram

Groundnut (Arachis hypogaea L.) is the most important oilseed and 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 saved seed. Hence, the vigour and viability of seed are bound to deteriorate, which is pre-dominant in summer groundnut. The poor vigour and viability, many times combined with the adverse environmental conditions result in poor crop establishment and ultimately the low yield. Sometimes non-availability of certified fresh seed may compel the use of old (revalidated) seed lot and consequently results in poor yield. Under the circumstances, seed invigoration treatments help in proper crop establishment and avoid the substantial loss in the yield. Not only that but any stage of the seed viz., breeder, foundation or certified can be given pre-sowing seed invigoration treatment for harvesting the higher seed yield. 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 presowing 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 90 %) and old seed lot (low vigour seed with almost IMSCS level of germination- revalidated) was included in the study. Both seed lots of groundnut were subjected to seven presowing seed treatments namely, hydration for 16 h followed by air drying at room temperature ($T_1$), cold hydration for 72 h at 10° C and surface drying ($T_2$), hydration with 50 ppm $GA_3$ for 16 h followed by surface drying at room temperature ($T_3$), osmoconditioning with poly ethylene glycol (PEG) solution (–10 bars) at 15°C for seven days ($T_4$), hydration for 16 h and drying followed by dressing with Thiram (75% DS) @ 0.25

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per cent ($T_5$), hydration with 2% $KH_2PO_4$ (potassium dihydrogen phosphate) for 16 h followed by drying at room temperature ($T_6$), 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. This matches the recommendation of seed rate of 100 kg/ha in groundnut. For estimation of speed of emergence in the field trials, a number of normal seedlings emerged out per 100-seeds, were counted daiiy. The speed of field emergence was calculated as suggested by Maguire [10].

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

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 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 17 h 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 presowing seed treatments in individual years as well as in the pooled one including the treatment x year interaction was significant for all the characters studied (Table 1). Although, presowing seed invigoration by hydration for 16 h 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 ($FT_5$) were 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 difference when compared with control with regards to any of the parameters studied. Hydration with 50 ppm $GA_3$ ($FT_3$) and 2% $KH_2PO_4$ ($FT_6$) for 16 h followed by surface drying were 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 presowing 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 analyses, including the interaction between treatment and year. Among the presowing 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 analyses when tested against (Y x T) interaction CD. More or less similar trend of seed invigoration ($RT_5$) was observed in per cent germination, speed of emergence, seedling dry weight, per cent field emergence and final plant stand in individual as

**Table 1. Effects of presowing 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 |
| Treatment (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 |
| Treatment 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 (%) | | | | Final plant stand/ha | | | | Pod yield/ha (kg) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 2003 | 2004 | 2005 | Pool | 2003 | 2004 | 2005 | Pool | 2003 | 2004 | 2005 | Pool |
| $FT_0$ | 79.25 | 81.75 | 78.50 | 79.83 | 264166 | 240000 | 251667 | 251944 | 1113 | 652 | 1281 | 1015 |
| $FT_1$ | 71.75 | 83.75 | 81.00 | 78.83 | 239166 | 243333 | 257500 | 246667 | 991 | 666 | 1308 | 988 |
| $FT_2$ | 82.25 | 76.00 | 81.50 | 79.92 | 274166 | 219167 | 256667 | 250000 | 1082 | 605 | 1200 | 962 |
| $FT_3$ | 50.25 | 66.75 | 67.50 | 61.50 | 167500 | 186667 | 218333 | 190833 | 574 | 504 | 1125 | 735 |
| $FT_4$ | 35.75 | 26.25 | 24.75 | 28.92 | 119167 | 54167 | 68333 | 80555 | 360 | 156 | 160 | 226 |
| $FT_5$ | 84.50 | 88.00 | 88.00 | 86.83 | 281667 | 255000 | 284166 | 273611 | 1212 | 713 | 1658 | 1194 |
| $FT_6$ | 55.25 | 64.00 | 75.00 | 64.75 | 184167 | 181667 | 243333 | 203056 | 653 | 494 | 1060 | 736 |
| Treatment (T) S.Em.± | 3.27 | 3.64 | 1.02 | 3.60 | 10900 | 10500 | 5067 | 12433 | 33.33 | 16.67 | 66.67 | 100.00 |
| Treatment CD at 5% | 9.71 | 10.83 | 3.04 | 11.10 | 32367 | 31200 | 15033 | 38333 | 116.67 | 66.67 | 200.00 | 300.00 |
| TxY S.Em.± | - | - | - | 2.89 | - | - | - | 9200 | - | - | - | 50.00 |
| TxY CD at 5% | - | - | - | 8.19 | - | - | - | 26133 | - | - | - | 133.33 |
| C.V. % | 9.97 | 10.49 | 2.89 | 8.41 | 9.97 | 10.65 | 4.48 | 8.62 | 8.64 | 8.50 | 12.38 | 11.25 |

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

well as in pooled analysis over years. Results are in accordance with the reports in past [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 ($RT_1$) prior to sowing did not show any significant effects as compared to control. The other presowing seed treatments 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 later 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 @ 2.5 gm/kg seed was more effective in low vigour seed than in high vigour seed. Thus, presowing treatment in low vigour

**Table 2. Effects of presowing 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 |
| Treatment(T) S.Em.± | 2.12 | 3.25 | 2.20 | 4.20 | 0.24 | 0.21 | 0.11 | 0.56 | 0.012 | 0.009 | 0.010 | 0.030 |
| Treatment 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 S.Em.± | - | - | - | 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 (%) | | | | Final plant stand/ha | | | | Pod yield/ha (kg) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 2003 | 2004 | 2005 | Pool | 2003 | 2004 | 2005 | Pool | 2003 | 2004 | 2005 | Pool |
| $RT_0$ | 41.50 | 71.75 | 63.00 | 58.75 | 138333 | 200833 | 202500 | 180555 | 271 | 557 | 835 | 554 |
| $RT_1$ | 33.75 | 73.25 | 66.25 | 57.75 | 112500 | 210833 | 210833 | 178056 | 261 | 576 | 1008 | 615 |
| $RT_2$ | 16.00 | 64.50 | 62.75 | 47.75 | 53333 | 180833 | 200000 | 144722 | 184 | 488 | 977 | 550 |
| $RT_3$ | 24.00 | 72.00 | 62.25 | 52.75 | 80000 | 197500 | 199166 | 158889 | 151 | 535 | 846 | 511 |
| $RT_4$ | 0.0 | 11.50 | 9.25 | 6.92 | 0 | 20833 | 25833 | 16667 | 0 | 63 | 142 | 68 |
| $RT_5$ | 63.50 | 78.50 | 71.50 | 71.17 | 211667 | 228333 | 230833 | 223611 | 407 | 628 | 1254 | 763 |
| $RT_6$ | 32.50 | 66.25 | 62.50 | 53.75 | 108333 | 190833 | 200833 | 166667 | 243 | 512 | 919 | 558 |
| Treatment(T) S.Em.± | 2.30 | 2.15 | 1.95 | 4.93 | 7667 | 7833 | 6367 | 15300 | 16.67 | 16.67 | 33.33 | 66.67 |
| Treatment CD at 5% | 6.84 | 6.40 | 5.80 | 15.18 | 22800 | 23267 | 18900 | 47133 | 50.00 | 50.00 | 116.67 | 233.33 |
| TxY S.Em.± | - | - | - | 2.14 | - | - | - | 7333 | - | - | - | 33.33 |
| TxY CD at 5% | - | - | - | 6.07 | - | - | - | 20767 | - | - | - | 83.33 |
| C.V. % | 15.26 | 6.89 | 6.88 | 8.59 | 15.26 | 8.91 | 7.01 | 9.59 | 13.26 | 7.92 | 9.27 | 10.32 |

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

seeds of groundnut with hydration for 16 h 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 increased 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 and vigour.

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