INFLUENCE OF PRE-SOWING MICROBIAL AND FUNGICIDES SEED TREATMENTS ON SEED QUALITY IN GROUNDNUT *(Arachis hypogaea* L.)

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ABSTRACT

The present study was undertaken during three different seasons of year 2011 viz., summer, kharif and rabi, with a view to examine the effect of pre-sowing microbial and fungicides seed treatments on seed quality in groundnut cv. Gujarat Groundnut-20 (GG-20) under laboratory conditions. The seeds were first soaked in distilled water (hydro priming) for six hours followed by drying under shade. The biological strains viz., Rhizobiumleguminosarum, Pseudomonas fluorescens, Trichodermaviride, Trichodermaharzianum and chemical fungicides viz., Thirum, Vitavax, Carbendazim, Tebuconazole and Control (untreated seeds) were applied at the time of germination test. All the treatments significantly affected germination percentage, first count of germination, speed of germination, shoot length, root length, root fresh weight, shoot fresh weight, root dry weight, shoot dry weight, seedling length, seedling dry weight, vigour index length and vigour index mass during all the three seasons (summer, kharif, and rabi) as well as pooled over periods. The enhancing effect of seed inoculation was also noticed with Rhizobacteria for all the characters which might be attributed due to RNA and protein metabolism as enhanced by priming, improved N_2- fixing and phosphate solubilizing capacity of bacteria as well as the ability of micro-organism to produce growth promoting substances. It could be concluded that seed priming could be used as an effective tool for invigouration of groundnut seeds for vigour enhancement.

KEY WORDS: Arachishypogaea, germination, priming, quality, seed treatment, vigour index

INTRODUCTION

The groundnut (*Arachis hypogaea* L.) is one of the most important oilseed crops, commercially popular due to its superior edible oil quality and protein in the meal. It is highly self-pollinated in nature (Knauft and Wynne, 1995). India accounts for about 40 per cent of the world area and 30 per cent of the world production of groundnut. In India, about 91 per cent of total groundnut area is confined to the states of Gujarat, Andhra Pradesh, Karnataka, Tamil Nadu, Maharashtra and Orissa. The rest of the area and production is scattered mainly in the states of Rajasthan, Utter Pradesh, Madhya Pradesh and Punjab (Chopra, 2001). The average area under groundnut cultivation in India during 2012-13 was 5.00 million hectares with the production of 4.95 million tones and productivity of 990 kg/ha (USDA, 2013). Gujarat, Andhra Pradesh, Tamil Nadu and Karnataka together account for 77 per cent of the area and almost 75 per cent of the production of groundnut in India (USDA, 2013).

In Gujarat, the region of the Saurashtra considered to be the groundnut bowl of the country. The average area under groundnut cultivation in Gujarat during 2012 stood at 16.60 lakh hectares with production of 25.95 lakh tones and productivity of 1563 kg/ha(DOA, 2013). The average area under groundnut cultivation in Junagadh district during 2012 was 3.05 lakh hectares with production of 2.35 lakh tones and productivity of 770 kg/ha (DOA, 2013). Groundnut is cultivated in all the districts of Gujarat state, however, about 82 per cent areas is covering by Junagadh, Rajkot, Amreli and Surendranagar districts of Saurashtra region. Groundnut crop is grown as a rainfed during*kharif* season, but it is also taken during summer season, wherever the irrigation facilities are available. The crop is grown as monoculture in the Saurashtra region of Gujarat. Junagadh, Rajkot, Amreli, Jamnagar, Bhavnagar and Kutch districts of Gujarat State contribute about 78.52 per cent of total production of groundnut of Gujarat State(Anonymous, 2010). Unfavorable environmental condition is the major cause of poor plant stand establishment and low crop yield. However, rapid germination and good seedling growth could emerge and produce better roots which may results in better crop establishment and higher yield (Ashraf and Foolad, 2005). Pre-sowing priming improves seed performance, as the seed is brought to a stage where the metabolic processes are already initiated giving a head start over the unprimed seed. Priming also repairs any metabolic damage increased by the dry seed, including that of the nucleic acids, thus, fortifying the metabolic machinery of the seed. Another beneficial effect of priming is the synchronization of the metabolism of all the seeds in lot, thus, ensuring uniform emergence and growth in the field. Further, bio-priming (priming with beneficial micro-organisms that can improve plant performance) on the seed is effective to control seed and soil borne pathogen at the time of germination. Therefore, seed priming is a viable and economic approach to enhance rapid and uniform emergence, high vigour and better yields in legumes, vegetables, flowering and field crops. Thus, the study was initiated to study the influence of pre-sowing microbial and fungicidal seed treatments on seed quality in groundnut cultivar Gujarat Groundnut-20 (GG-20) under laboratory conditions.

MATERIALS AND METHODS

The present study was undertaken at Junagadh Agricultural University, Junagadh during the year 2011 in three different seasons, summer, *kharif*and *rabi*. Seeds of groundnut cultivar Gujarat Goundnut-20 (GG-20) were soaked in distilled water for six hours and dried under shade immediately after soaking. The treatments used were: T_1= Hydropriming (seed soaking in water for 6 hours and shade dried), T_2 = *Rhizobium leguminosarum*(5g/kg), T_3 = *Pseudomonas fluorescens*(5g/kg), T_4 = *Trichodermaviride*(5g/kg), T_5 = *Trichodermaharzianum*(5g/kg), T_6 = Thirum (3g/kg), T_7 = Vitavax (3g/kg), T_8 = Carbendazim (3g/kg), T_9 = Tebuconazole (2g/kg) and T_{10}= Control (Untreated dry seed). Respective treatments were given at the time of germination test.

Germination test was conducted by using between paper (towel paper) methods. Hundred seeds with four replications were placed on moist towel paper and rolled properly, tied with rubber band and kept in seed germinator at constant temperature 25^0C with relative humidity 80 per cent. Final germination count was taken on 8^{th} day (ISTA, 1993), which was reported as germination percentage. Speed of germination was also counted as per Maguire (1962). Vigour index I and II was calculated as per standard procedure of Abdul-Baki and Anderson (1973). Fresh and dry seedling weight was also recorded. The data on different characters was subjected to statistical analysis of variance as per Completely Randomized Design (CRD) to find out the best treatment for various traits as per Panse and Sukhatme (1985).

RESULTS AND DISCUSSION

The seed priming is a technique which involves uptake of water by the seed followed by drying to initiate the early events of germination up to point of radical emergence. The benefits of seed priming includes rapid, uniform and increased germination, improved seedling vigour and growth under a broad range of environments resulting in better stand establishment and alleviation of phytochrome-induced dormancy in some crops. In the present investigation, the microbial and fungicides seed treatments were statistically superior to control for germination percentage, but none of the fungicidal treatments was superior to microbial treatments for the production of more vigorous seedlings. There was significant effect of pre-sowing microbial and fungicides seed treatments on germination percentage (Table 2). Seeds treated with *Rhizobium leguminosarum*(T_2) recorded maximum germination (98.45%) followed by *Pseudomonas fluorescens*(T_3) (98.42%). This may be due to increased synthesis of hormones like gibberellins, which would have triggered the activity of specific enzymes that promoted early germination such as amylase, which have brought an increase in availability of starch assimilations. These results are in line with the previously reported findings by Gholami*et al.* (2009) in maize, Anjorin*et al*. (2010) in groundnut, Khalequzaman and Hossain (2008) in bush bean, Hossein*et al.* (2011) in cowpea, Mohammad and Hossain (2003) and Suramwar*et al*. (2014) in mungbean. Increase in the germination percentage could be due to RNA and protein metabolism as enhanced by priming (Khan *et al*. (2003) in cockscomb and Moeinzadeh*et al.*(2010) in sunflower. The germination percentage was decreased with Tebuconazole (T_9) and Control (T_{10}).

There was also significant effect of different seed treatments on the first count of seed germination (Table 2). The maximum first count of seed germination was observed in *Rhizobium leguminosarum*(T_2= 89.58%) followed by *Pseudomonas fluorescens*(T_3= 89.46%) as compared to Tebuconazole (T_9) and Control (T_{10}). Likewise, different seed treatments affected significantly the speed of germination (Table 2). This indicated that microbial seed treatment had positive effect on speed of germination process. The highest speed of germination (99.04) was observed in *Rhizobium leguminosarum*(T_2),as it was proved that germination ability was raised by plant growth bacteria such as *R*hizobium. Similar findings were also reported earlier by Gholami*et al.* (2009) in maize, Hossein*et al.*(2011) in cowpea, Moeinzadeh*et al.* (2010) in sunflowerandSuramwar*et al*. (2014) in mungbean. Maximum shoot and root length (5.04 cm and 14.69 cm) were achieved with *Rhizobium* *leguminosarum*, which was the highest among all the treatments. The minimum shoot and root length (1.39 cm and 5.24 cm) were noticed with Tebuconazole (Table 2). The maximum shoot and root length observed in *Rhizobium leguminosarum*seed treatment may be due to *Rhizobium* strain which resulted in to the maximum reduction of seed and root rot as reported by Khalequzaman and Hossain (2008) in bush bean; Vijayalakshmi*et al.* (2011), Suramwar*et al*. (2014) in mungbean andBaset*et al.* (2012) in rice.

In the present study, the effect of microbial seed treatment in groundnut for shoot and root fresh weight was determined and presented in Table 2. The application of *Rhizobium leguminosarum*seed treatment produced the highest fresh shoot (4078 mg) and fresh root (10595 mg) weight. These findings are akin with the finding reported earlier by Baset*et al.* (2012) in rice. There was significant impact of different seed treatments on shoot and root dry weight of groundnut seedling as shown in Table 2. The data showed that all the priming treatments increased the shoot dry weight as well as root dry weight as compared to Tebuconazole (T9) followed by control (T_{10}). The highest shoot dry weight (3642 mg) was observed in *Rhizobium leguminosarum*, while the highest root dry weight (1455 mg) was observed with *Rhizobium leguminosarum*and hydropriming. Root dry weight was augmented by *Rhizobium* is logical in the present study, because the application of plant growth promoting bacteria can result in larger root area and longer roots. These findings are in accordance with the results of Mokhtar*et al.* (2011) in fababeanand Parkash and Aggarwal (2011) in *Eucalyptus saligna*.They also reported that it may be due to increased rate of phosphorus uptake and its inflow in roots. *Rhizobium leguminosarum*seed treatment maintained the highest shoot dry weight because of improved N_2-fixing and phosphate solubllizing capacity of bacteria as well as ability of these microorganisms to produce growth promoting substances (Gholami*et al.*,2009) in maize.

The application of *Rhizobium leguminosarum*in the form of seed treatment resulted in increased seedling length and seedling dry weight (Table 2). The maximum seedling length (18.28 cm) and seedling dry weight (3542 mg) was reported with *Rhizobium leguminosarum*(T_2). The beneficial effect of *Rhizobium* inoculation on shoot dry weight was also reported by Hossein*et al.* (2011) in cowpea,Baset*et al.*(2012) in rice,Parkash and Aggarwal (2011) in *Eucalyptus saligna*. and Suramwar*et al*. (2014) in mungbean. Significantly the highest and the lowest vigour index length were observed with *Rhizobium leguminosarum*(1800.12) and control (500.40), respectively. Significantly the highest vigour index mass (34700) was recorded by *Rhizobium leguminosarum*, which was at par with *Pseudomonas fluorescens*(33375), Hydropriming (32913), *Trichodermaviride*(32876) and Thirum (32868). The beneficial effect of *Rhizobium* strain seed treatment on vigour index length may be because of better synthesis of auxins, as also reported by Gholami*et al.* (2009) in maize. *Rhizobium leguminosarum*seed treatment recorded the maximum vigour index mass, while *Pseudomonas fluorescens*seed treatment provided well establishment and adherence of bacteria to seed and enhanced seed factors such as vigour index length which in conformity with results reported by Moeinzadeh*et al.* (2010) in sunflower; Hossein*et al.* (2011) in cowpea and Suramwar*et al.* (2014) in mungbean.

CONCLUSION

It can be concluded that seed priming is very effective tool for seed invigouration in groundnut. The microbial seed treatments were superior to fungicidal treatments for most of the traits studied. The microbial seed treatment *Rhizobium leguminosarum*was found to be superior over all the treatments in respect of seed germination, seed vigour and other seed quality parameter.

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Table 1: Effect of pre-sowing microbial and fungicidal seed treatments on subsequent Seed quality parameters in groundnut cv. GG-20

Treatment	Germination Percentage	First Count	Speed of Germination Percentage	Shoot Length of Seedlings	Root Length of Seedling	Shoot Fresh Weight	Root Fresh Weight
Hydropriming (T_1)	95.42	87.65	97.61	3.13	12.32	9900	3683
Rhizobium leguminosarum(T_2)	98.45	89.58	99.04	5.04	14.69	10595	4078
Pseudomonas fluorescens(T_3)	98.42	89.46	98.82	4.54	13.97	10044	3918
Trichodermaviride(T_4)	95.28	87.35	96.98	4.22	13.60	9625	3767
Trichodermaharzianum(T_5)	95.67	87.75	97.17	4.40	13.05	9550	3450
Thirum(T_6)	95.92	87.08	97.21	4.28	11.40	9858	3700
Vitavax(T_7)	95.37	86.25	96.05	3.91	11.43	9521	3421
Carbendazim(T_8)	95.35	88.18	97.61	4.10	11.34	9817	3358
Tebuconazole(T_9)	82.14	71.11	80.12	1.39	5.24	2608	2800
Control (T_{10})	82.36	77.66	87.68	2.13	9.56	1933	2998
S.Em.±	1.08	1.92	1.82	0.39	0.48	118.64	132.09
C.D. at 5 %	3.21	5.72	5.40	1.15	1.43	352.52	392.49
C.V. %	0.67	1.05	1.15	4.70	4.51	3.30	4.33
Season							
S.Em.±	0.59	1.05	0.99	0.21	0.26	64.98	72.35
C.D. at 5 %	1.76	NS	NS	0.63	NS	NS	NS
S x T							
S.Em.±	0.31	0.45	0.55	0.09	0.27	137.54	76.23
C.D. at 5 %	0.88	1.26	1.54	0.25	0.74	387.07	214.52

Contd…..

Table 1:Contd….

Treatment	**Shoot Dry Weight**	**Root Dry Weight**	**Seedling Length**	**Seedling Dry Weight**	**Vigour Index Length**	**Vigour Index Mass**
Hydropriming (T_1)	2917	1455	15.70	3450	1497.72	32913
Rhizobium leguminosarum(T_2)	3642	1432	18.28	3542	1800.12	34700
Pseudomonas fluorescens(T_3)	3500	1380	16.82	3392	1655.46	33375
Trichodermaviride(T_4)	3556	1358	15.25	3433	1453.58	32876
Trichodermaharzianum(T_5)	3183	1372	14.83	2525	1421.97	24159
Thirum(T_6)	3292	1337	14.98	3425	1437.48	32868
Vitavax(T_7)	2075	1339	14.92	2600	1425.67	24774
Carbendazim(T_8)	2475	1378	14.60	2580	1392.42	24597
Tebuconazole(T_9)	1592	370	13.49	2175	1105.42	17772
Control (T_{10})	538	318	6.08	2348	500.40	19319
S.Em.±	259.75	43.92	0.88	87.89	76.39	629.31
C.D. at 5 %	771.77	130.49	2.62	261.15	226.98	1869.84
C.V. %	4.40	3.87	4.13	5.92	4.08	5.56
Season						
S.Em.±	142.27	24.05	0.48	48.14	41.84	344.68
C.D. at 5 %	NS	71.47	1.44	NS	124.32	NS
S x T						
S.Em.±	58.95	22.74	0.30	87.20	28.14	771.53
C.D. at 5 %	165.90	63.99	0.85	245.40	79.20	2171.30

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