INFLUENCE OF PRE-SOWING MICROBIAL AND FUNGICIDES SEED TREATMENTS ON SEED QUALITY IN MUNGBEAN (*Vigna radiata* (L.) WILZECK)

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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 mungbean (variety Gujarat Mungbean 4) 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., Rhizobium leguminosarum, Pseudomonas fluorescens, Trichoderma viride, Trichoderma harzianum and chemical fungicides viz., Thirum, Vitavax, Carbendazim, Tebaconazole 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 munbean seeds for vigour enhancement.

KEW WORDS: Germination, priming, quality, seed treatment, *Vigna radiata*, vigour index

INTRODUCTION

Mungbean (*Vigna radiata* (L.) Wilzeck) is an important wide spreading herbaceous, self-pollinated legume pulse crop. It is an excellent source of protein and minerals for vegetarian peoples of India. It is cultivated in *rabi*, summer as well as in *kharif* season throughout the country. The major growing states are Orissa, Maharashtra, Andhra Pradesh and Rajasthan mainly under rainfed conditions. Poor crop establishment is a major constraint for mungbean production and yields can be associated with early vigour (Kumar *et al*., 2005). Unfavorable environmental condition is the major cause of poor stand establishment and low crop yield. However, rapid germination and good seedling growth

could emerge and produce better roots which may results 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 mungbean variety GM 4 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 mungbean cultivar Gujarat Mungbean 4 (GM 4) were obtained from Pulses Research Station, Junagadh Agricultural University, Junagadh, to assess the effect of pre-sowing microbial and fungicides seed treatments. The seeds 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 = *Trichoderma viride* (5g/kg), T_5 = *Trichoderma harzianum* (5g/kg), T_6 = Thirum (3g/kg), T_7 = Vitavax (3g/kg), T_8 = Carbendazim (3g/kg), T_9 = Tebaconazole (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) method. 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). A combination of standard germination test with seedling length provides evaluation of seedling vigour index. 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 analysis of variance (Table 1) revealed the existence of significant differences among the seed treatments for all the characters studied in all the three seasons (*summer, kharif, and rabi*) as well as pooled over periods. This indicated that there was real difference among the seed treatments including fungicides and biological strains for all characters during all the three seasons.

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 (97.29 %) followed by *Pseudomonas fluorescens* (T_3) (97.16%). 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); Khalequzaman and Hossain (2008) and Hossein *et al.* (2011). Increase in the germination percentage could be due to RNA and protein metabolism as enhanced by priming (Moeinzadeh *et al.* 2010). The germination percentage was decreased with Tebaconazole (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 = 96.70%) followed by *Pseudomonas fluorescens* (T_3 = 96.58%) as compared to Tebaconazole (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 (96.56) 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), Hossein *et al.* (2011), Moeinzadeh *et al*. (2010) and Mokhtar *et al*. (2011). Maximum shoot and root length (12.22 cm and 15.76 cm) were achieved with *Rhizobium leguminosarum*, which was the highest among all the treatments. The minimum shoot and root length (2.16 cm and 6.31 cm) were noticed with Tebaconazole (Table 2). The maximum shoot and root length 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); Vijayalakshmi *et al*. (2011) and Baset *et al*. (2012).

In the present study, the effect of microbial seed treatment in mungbean 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 (4.37 mg) and fresh root (0.91 mg) weight. These findings are akin with the finding reported earlier by Baset *et al*. (2012). There was significant impact of different seed treatments on shoot and root dry weight of mungbean 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 Tebaconazole (T_9) followed by control (T_{10}). The highest shoot dry weight (0.76 mg) was observed in *Rhizobium leguminosarum*, while the highest root dry weight (0.18 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) and Parkash and Aggarwal (2011). 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).

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 (27.97 cm) and seedling dry weight (0.94 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); Baset *et al*. (2012) and Parkash and Aggarwal (2011). Significantly highest and lowest vigour index length was observed with *Rhizobium leguminosarum* (2722.18) and Tebaconazole (686.89), respectively. Significantly highest vigour index mass (91.46) was recorded by *Rhizobium leguminosarum* which was at par with *Pseudomonas fluorescens* (87.68), *Trichoderma viride* (81.17), Thirum (77.37) and Hydropriming (73.32). 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). *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) and Hossein *et al.* (2011).

CONCLUSION

It can be concluded that seed priming is very effective tool for seed invigouration in mungbean. 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 parameters.

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Table 1: Analysis of variance for experimental design for different characters in mungbean

Mean sum of squares								
Source of Variation	**d. f.**	**Germination Percentage**	**First Count (%)**	**Speed of Germination in Percentage**	**Shoot Length of Seedlings (cm)**	**Root Length of Seedling (cm)**	**Root Fresh Weight (mg)**	**Shoot Fresh Weight (mg)**
Summer								
Seed Treatments	9	67.321**	84.092**	99.905**	16.575**	16.345**	0.0491**	0.6776**
Error	30	0.272	0.814	1.701	0.150	0.345	0.0003	0.0378
Kharif								
Seed Treatments	9	91.242**	96.851**	96.373**	44.349**	31.240**	0.0590**	2.7472**
Error	30	0.290	0.440	1.054	0.077	0.392	0.0005	0.0469
Rabi								
Seed Treatments	9	342.299**	338.458**	341.438**	41.661**	46.532**	0.1206**	5.5929**
Error	30	0.298	0.494	1.029	0.091	0.224	0.0007	0.0525
Pooled Over Seasons								
Seasons (S)	2	3.154	0.162	10.957	68.828**	5.174	0.0157	9.8402**
Seed Treatments (T)	9	399.891**	430.725**	457.248**	93.724**	86.958**	0.1751**	6.1240**
S x T	18	50.486**	44.338**	40.234**	4.431**	3.579**	0.0268**	1.4469**
Error	90	0.287	0.583	1.262	0.106	0.320	0.0005	0.0457

Source of Variation	**d. f.**	**Root Dry Weight (mg)**	**Shoot Dry Weight (mg)**	**Seedling Length (cm)**	**Seedling Dry Weight (mg)**	**Vigour Index Length**	**Vigour Index Mass**
Summer							
Seed Treatments	9	0.0011**	0.1386**	57.598**	0.1472**	662298.977**	1542.715**
Error	30	0.0002	0.0004	0.298	0.0007	2908.720	5.787
Kharif							
Seed Treatments	9	0.0027**	0.2070**	145.654**	0.2181**	1579916.148**	2239.947**
Error	30	0.0002	0.0005	0.424	0.0007	4054.276	6.594
Rabi							
Seed Treatments	9	0.0028**	0.1975**	174.720**	0.2284**	2012406.623**	2608.785**
Error	30	0.0002	0.0003	0.364	0.0007	3652.276	5.691
Pooled over seasons							
Season (S)	2	0.0059*	0.1480	105.051**	0.1437	1019839.715**	1361.921
Seed Treatments (T)	9	0.0038**	0.4255**	352.456**	0.4828**	3985078.564**	5356.288**
S x T	18	0.0014**	0.0588**	12.758**	0.0555**	134771.592**	517.579**
Error	90	0.0002	0.0004	0.362	0.0007	3538.424	6.024

*****, * Significant at 5 and 1 per cent levels of significance, respectively.***

Table 2: Influence of pre-sowing microbial and fungicidal seed treatments on subsequent seed quality parameters in mungbean cv. GM 4

Treatment	Germination Percentage	First Count (%)	Speed of Germination Percentage	Shoot Length of Seedlings (cm)	Root Length of Seedling (cm)	Root Fresh Weight (mg)	Shoot Fresh Weight (mg)
Hydropriming (T_1)	94.96	94.77	94.55	10.40	13.12	0.73	3.16
Rhizobium leguminosarum (T_2)	97.29	96.70	96.56	12.22	15.76	0.91	4.37
Pseudomonas fluorescens (T_3)	97.16	96.58	96.08	11.54	14.80	0.84	3.73
Trichoderma viride (T_4)	95.41	94.43	93.97	10.44	14.41	0.85	3.51
Trichoderma harzianum (T_5)	95.64	94.87	94.11	9.96	13.89	0.75	3.36
Thirum (T_6)	95.03	94.20	94.19	9.91	12.07	0.82	3.75
Vitavax (T_7)	94.07	93.37	92.99	10.07	12.18	0.71	2.89
Carbendazim (T_8)	95.89	95.30	94.75	10.28	12.32	0.71	2.81
Tebaconazole (T_9)	79.63	78.23	77.07	2.16	6.31	0.50	2.05
Control (T_{10})	85.56	84.78	84.62	8.15	10.32	0.62	2.23
S. Em.±	2.051	1.922	1.831	0.608	0.546	0.047	0.347
C.D. at 5 %	6.094	5.711	5.441	1.806	1.623	0.140	1.032
C.V. %	0.58	0.83	1.22	3.42	4.52	3.02	6.71
Season							
S. Em.±	1.123	1.053	1.003	0.333	0.299	0.026	0.190
C.D. at 5 %	NS	NS	NS	0.989	NS	NS	0.565
S x T							
S.Em.±	0.268	0.382	0.562	0.163	0.283	0.011	0.107
C.D. at 5 %	0.754	1.074	1.581	0.458	0.797	0.032	0.301

Table 2: Contd…

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Treatment	Root Dry Weight (mg)	Shoot Dry Weight (mg)	Seedling Length (cm)	Seedling Dry Weight (mg)	Vigour Index Length	Vigour Index Mass
Hydropriming (T_1)	0.18	0.59	23.52	0.77	2233.17	73.32
Rhizobium leguminosarum (T_2)	0.18	0.76	27.97	0.94	2722.18	91.46
Pseudomonas fluorescens (T_3)	0.16	0.74	26.34	0.90	2558.56	87.68
Trichoderma viride (T_4)	0.15	0.71	24.86	0.85	2372.00	81.17
Trichoderma harzianum (T_5)	0.15	0.55	23.85	0.69	2281.09	66.47
Thirum (T_6)	0.15	0.67	21.98	0.81	2090.39	77.37
Vitavax (T_7)	0.14	0.44	22.25	0.58	2094.45	54.85
Carbendazim (T_8)	0.16	0.46	22.60	0.62	2166.59	59.62
Tebaconazole (T_9)	0.13	0.26	8.47	0.39	686.89	31.90
Control (T_{10})	0.13	0.25	18.47	0.37	1580.32	31.95
S.Em.±	0.011	0.070	1.031	0.068	105.976	6.567
C.D. at 5 %	0.032	0.208	3.064	0.202	314.883	19.514
C.V. %	9.35	3.67	2.73	3.80	2.86	3.74
Season						
S.Em.±	0.006	0.038	0.565	0.037	58.046	3.597
C.D. at 5 %	0.018	NS	1.678	NS	172.469	NS
S xT						
S.Em.±	0.007	0.010	0.301	0.013	29.742	1.227
C.D. at 5 %	0.020	0.028	23.52	0.037	83.703	3.454

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