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Seed quality enhancement through biopriming in common bean (*Phaseolus vulgaris.* L)

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Abstract: An experiment on seed quality enhancement of common bean (*Phaseolus vulgaris* L.) var. S 9 (local) was conducted at the department of seed science and technology, OUAT, Bhubaneswar during 2013-14 by use of three biocontrol agents viz. *Trichoderma viride*, *Trichoderma harzianum*, *Pseudomonas fluorescence*. Seeds were bi-oprimed with the biocontrol agents at 40, 50 and 60 % concentration for 4,8,12 and 16 hours of soaking. Seeds were also hydro primed for 4,8,12 and 16 hours. Unprimed dry seed resulted in germination (69 %), shoot length (27.5 cm), root length (14 cm), seedling dry weight (1.71g), SVI-I (2859.2), SVI-II (118.0) and speed of germination (5.8) while hydro primed seeds resulted in germination (72%), shoot length (31.9 cm), root length (15 cm), seedling dry weight (1.80 g), SVI-1 (3375.9) SVI-II (129.8) and speed of germination (6.7). *Trichoderma harzianum* at 40% concentration and for 4 hours of soaking resulted enhancement of above quality parameter like 13.0 % in germination, 21.1 % in shoot length, 20.7 % in root length, 31.6 % in seedling dry weight, 36 % in seedling vigour index-I, 48.1 % in seedling vigour index-II and 58.6 % in speed of germination over unprimed seeds. Bio priming with *P. fluorescence* (at 40% concentration and for 4 hour) closely followed and at par with best treatment with 11.6 %, 18.2 %, 16.4 %, 30.4 %, 30.7 % and 56.9 % enhancement of above mentioned quality parameters, respectively.

Keywords: Biopriming, *Trichoderma harzianum Trichoderma viride*, *,Pseudomonas fluorescence,* Unprimed seed

INTRODUCTION

Common bean (*Phaseolus vulgaris* L) is an important vegetable crop, which contains many nutritional benefits. The quality of seed alone is known to account for at least 10-15% increase in the productivity. However, lack of quality seed continues to be one of the greatest impediments to bridging the vast yield gap. Therefore, to approach the potentially realizable yield of a cultivar, production and distribution of quality seed is essential. Seed priming is a quality enhancement technique for rapid uniform germination of seeds and optimum plant stand in the field. This technique is often used as a seed invigoration treatment for improving germination and vigour in low vigour lots. Hence, it appears to reverse the detrimental effects of seed deterioration (Srinivasan *et al.,* 2009).Biopriming is one of seed priming technique which was found to enhance seed quality parameters in common bean. It is recently used as an alternative method for controlling many seed and soil borne pathogens. Biological seed treatments provide an alternative to chemical control with additional benefits of induced diseases resistance, eco-friendly nature and sustainable diseases management. *Trichoderma viride*, *Trichoderma harzianum*,*Pseudomonas fluorescence* are different biocontrol agents frequently used for biopriming treatment.Several researchers have investigated the use of beneficial micro-organisms in the priming medium to control disease proliferation during priming itself (Warren and Bennet, 2000). Beneficial effects of biopriming on seed quality enhancement and yield of different pulse crops have been studied (Yadav *et al.*,2013). However, such information also found very limited in common bean(Fath El-bab*et al.,*2013). Hence, an attempt has been made in this experiment to identify the most effective bio control agents and effective technique of bio priming and also to evaluate the effect of bio priming techniques on seed quality parameters in common bean which will ultimately help in enhancing its yield.

MATERIALS AND METHODS

An experiment on seed quality enhancement through biopriming in common bean (*Phaseolus vulgaris*. L) was conducted in the department of Seed science and Technology, at Orissa University of Agriculture and Technology, Bhubaneswar during 2013-14. Suspensions of three biocontrol agents viz. *Trichoderma viride*, *Trichoderma harzianum* and *Pseudomonas flu-*

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orescence were used in this experiment. These three biocontrol agents were collected from seed pathology laboratory of All India Coordinated Research Project on Seed Technology Research, OUAT, Bhubaneswar. Seeds of common bean variety S 9 were bioprimed with the three biocontrol agents at 40, 50 and 60 % concentration for 4,8,12 and 16 hours of soaking. Seeds were also hydro primed for 4,8,12 and 16 hours. The seeds were then shade dried followed by sun drying to bring down moisture content to original content. Two hundred seeds were used for each treatment in four replications (50×4).After treatments, the seeds were subjected to germination test for speed of germination, vigour index test based on seedling length and dry weight along with the control. Different treatments are T_1-Control(Dry seed), T_2-Hydropriming, T_3- *Trichoderma viride*, T_4- *Trichoderma harzianum*, T_5- *Pseudomonas fluorescence.* Standard germination test was conducted by between paper towel method as described in the ISTA rules of seed testing (ISTA, 1999).Speed of germination was calculated on the basis of no. of seed germinated on each day from total seed used for germination test, until no further germination occurred and by using formula (Sen and Ghosh, 1999).Seedling length was measured and mean seedling length was expressed in centimeter and the mean dry weight of seedlings was recorded and expressed in grams.(AOSA, 1983).Bioprimed and hydro primed seeds were compared with unprimed seeds for their quality parameters viz, germination, seedling root and shoot length, seedling dry weight, seedling vigour index –I and II and speed of germination index based on sample size of 200 seeds for each test. The seed lot showing the higher seed vigour index is considered to be more vigorous .The formula for calculating SVI-I and SVI-II as described by (Abdul-Baki and Anderson, 1973) were :

Seedling Vigor index I = Germination% × Seedling length

Seedling Vigor index II = Germination% × Seedling dry weight

Duration of soaking was fixed at four hours which was found most suitable and also 40% concentration was fixed. The seeds were soaked in double the volume of suspension of biocontrol agents for 4 hours followed by drying to original moisture content. Then the seeds are subjected to germination test, vigour test, speed of germination test. The data were analyzed individually as per the standard analysis of variance (ANOVA) technique using Completely Randomized Design CRD.

RESULTS AND DISCUSSION

The experiment conducted to determine the optimum period of soaking in water/suspensions of biocontrol agents revealed that the benefit of priming was highest at four hours of soaking and seed quality parameters like germination, shoot length, root length, vigour index, and speed of germination index got reduced with increase in soaking period. Similarly the benefit of priming was highest at 40% concentration as compared to 50% and 60% concentration. Unprimed dry seed resulted 69% germination, 27.5 cm shoot length, 14cm root length, 1.71g seedling dry weight, (2859.2) SVI-I, (118.0) SVI-II and (5.8) speed of germination (Table 1). The figures for hydro primed seeds were 72%, 31.9cm, 15cm, 1.80g, 3375.9, 129.8 and 6.7 for the

Table 1. Standardization of Hour of Soaking of bio control agents and its effect on seed quality enhancement in Common Bean.

Biocontrol Agent	Hour of soaking	Germ. (%)	Shoot Length (cm)	Root Length (cm)	Seedling Length (cm)	Dry Weight (g)	SVI-1	SVI-2	Speed of germination
Control	-	69(56.17)	27.5	14.0	41.5	1.71	2859.2	118.0	5.8
Hydropriming	4h	72(58.06)	31.9	15.0	46.9	1.80	3375.9	129.8	6.7
Hydropriming	8h	70(56.95)	31.1	13.5	44.6	1.73	3131.6	121.3	6.2
Hydropriming	12h	67(54.64)	29.8	12.5	42.3	1.68	2815.0	111.8	5.7
Hydropriming	16h	32(34.14)	25.9	11.6	37.5	1.59	1186.2	49.9	5.6
T. Viride	4h	75(59.68)	32.4	16.5	48.9	2.20	3639.2	164.0	8.5
T. Viride	8h	70(56.48)	31.0	15.8	46.8	1.89	3252.0	131.0	6.8
T. Viride	12h	65(53.45)	28.6	11.6	40.2	1.83	2593.6	117.9	6.2
T. Viride	16h	59(50.19)	28.2	12.0	40.2	1.64	2370.6	96.7	5.7
T. harzianum	4h	78(61.68)	33.3	16.9	50.2	2.25	3889.6	174.7	9.2
T. harzianum	8h	70(56.64)	30.2	13.2	43.4	1.92	3022.6	134.1	8.5
T. harzianum	12h	67(54.64)	22.7	11.5	34.2	1.64	2273.4	109.0	7.5
T. harzianum	16h	31(33.52)	18.1	11.1	29.2	1.62	893.8	49.5	6.2
P.fluorescense	4h	77(61.01)	32.5	16.3	48.8	2.23	3736.9	170.8	9.1
P.fluorescense	8h	70(56.64)	30.7	15.7	46.4	1.94	3235.7	135.1	7.3
P.fluorescense	12h	55(47.87)	30.0	14.8	44.8	1.90	2642.5	104.0	8.1
P.fluorescense	16h	38(38.20)	21.5	11.3	32.8	1.88	1244.6	74.5	6.6
SEM	-	0.50	1.46	0.89	1.18	0.12	113.52	7.18	0.26
CD	-	1.43	4.23	2.57	3.2	0.35	327.78	20.73	0.76

*Mean of four replications, **figures in parentheses are angular transformed, Values;Germ. – Germination %age, SVI-1- Seed-

Table 2. Standardization of different Concentration of bio control agents and its effect on seed quality enhancement in common bean.

Biocontrol agent	Concentration	Germ. (%)	Shoot length	Root length	Dry weight	SVI-1	SVI-2	Speed of germination
Control	-	69(56.32)	27.9	14.9	1.73	2958.3	119.9	5.8
Hydropriming	-	72(58.21)	31.3	15.0	1.78	3344.6	128.8	6.7
T. Viride	40%	75(60.00)	34.0	17.7	2.21	3880.3	165.3	7.3
T. Viride	50%	71(57.58)	29.2	15.9	2.09	3209.2	148.9	6.5
T. Viride	60%	73(58.54)	28.5	11.7	1.80	2924.9	131.2	7.0
T. harzianum	40%	79(62.73)	34.6	18.1	2.26	4160.7	178.5	9.2
T. harzianum	50%	73(58.70)	31.6	13.1	2.15	3260.1	157.0	6.7
T. harzianum	60%	72(57.90)	30.9	13.1	1.89	2910.4	135.4	6.3
P.fluorescense	40%	78(62.03)	34.3	17.9	2.23	4071.2	174.1	9.2
P.fluorescense	50%	75(59.68)	30.0	15.0	2.05	3356.1	152.9	6.5
P.fluorescense	60%	74(59.02)	28.4	13.6	1.87	3086.7	137.5	7.3
SEM		0.33	0.8	0.9	0.07	99.1	5.2	0.2
CD		0.95	2.4	2.5	0.20	286.0	14.9	0.7

*Mean of four replications, **figures in parentheses are angular transformed values ,Germ. – Germination %age, SVI-1- Seedling vigour index 1, SVI-II- Seedling vigour index 2

above parameters. *T. harzianum* 40% concentration and 4 hour soaking (Table 1,2) resulted in 13.0, 21.1, 20.7, 31.6, 36.0, 48.1 and 58.6 %age enhancement of above quality parameters over unprimed seeds. *P. fluorescence* (40%, 4hour) closely followed and was at par with best treatment with 11.6, 18.2, 16.4, 30.4, 30.7 and 56.9 % enhancement of quality parameters, respectively. Soaking of seeds more than 8 hours had negative impact on seed quality with reduced values. The seeds of pulse crops like cowpea, beans are prone to imbibitions injury; hence a safe period of soaking in priming medium is necessary. Reports of earlier workers have indicated four to eight hours soaking suitable for the bean and related crops (Golezani *et al*.,2010, Shah *et al*., 2012, Fabunmi *et al*.,2012) found maximum priming hours was four hour for one variety and six hour for another under early moisture stress condition and concluded that varieties of same crop might require varied priming hours. But Golezani *et al*. (2010) could not find significant interaction of priming duration into cultivars of pinto bean where seven hours was optimum for all cultivars. Moosavi *et al*. (2012) suggested eight hour seed hydropriming of soybean seeds optimum for achieve maximum plant height, grain yield, oil content, dry weight and germination %age.

Selection of a priming method is important in harnessing the benefits of priming; the best methodology may vary with crop species. (Nirmala and Umarani, 2008). Hydropriming for 12 hours and solid matrix priming for 24 hour was found to significantly increase seed quality and marketable yield of okra (Sharmaa *et al*., 2014) indicating that duration of soaking may vary with priming methods. Concentration of bioagents higher than 40% did not produce significantly higher results. From the study it was concluded that biopriming of bean seeds with *T. harzianum* or *P. fluorescence* 40% concentration for 4 hour can significantly enhance seed quality.

Biopriming is often found better than hydro priming and unprimed seed as it has added advantage of controlling seed and soil borne pathogens and plant growth promoting effects. Bioprimed seed showed higher germination and better plant growth as compared to control and combinations comprising *Trichoderma* with other bioagents showed better results in chickpea and rajma. (Yadav *et al*., 2013). Karthika and Vanangamudi (2013) found higher values of speed of germination, root length and shoot length, dry matter production and vigour index over control by biopriming of maize seeds with *Azosphirillum* (20%) and *Phosphobacteria* (20%) for 12 hour.

Conclusion

It can be concluded from the present investigation that farmers in the state are using low quality seeds which need to be treated before sowing for quality enhancement. Biopriming of seeds with *Trichoderma harzianum* and *Pseudomonas fluorescence* 40% concentration for 4 hours enhance the seed quality parameters. Biopriming of seeds with Trichoderma harzianum for 4 hours of soaking gave better result in terms of germination (78 %), seedling length (50.2 cm), seedling dry weight (2.25 g), SVI-I (3889.6), SVI-II (174.7) and speed of germination index (9.2). Also using 40 % % concentration of *Trichoderma harzianum* resulted germination of 79 %, shoot length of 34.6 cm, root length of 18.1 cm, seedling dry weight of 2.26 g, SVI-I of 4160.7 and SVI-II of 178.50 and speed of germination index of 9.2 in common bean variety S 9. Hence, it can be inferred that *Trichoderma harzianum* at 4 hours of soaking and at 40 % concentration was found best enhancing seed quality parameters in common bean.

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