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EFFECT OF SEED PRIMING ON SEED GERMINATION AND VIGOUR IN TURKEY BERRY (*Solanum torvum* Sw.)

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ABSTRACT
An experiment was carried out with turkey berry to standardize the seed biopriming (biocontrol agents and liquid biofertilizers) and haloprimed with KH_2PO_4 to improve the seedling vigour conducted in Department of Seed Science and Technology, Tamil Nadu Agricultural University, Coimbatore during 2014-2015. To optimize the concentration, seeds were bioprimed with liquid *Pseudomonas fluorescens* (5%, 10%, 15% and 20%), *Azospirillum* (5%, 10%, 15% and 20%) *and* halo primed with KH_2PO_4 (1%, 2%, 3% and 4%) in different concentration by adopting seed to solution ratio of 1:1 as volume by volume basis for 6h. For hydropriming, water was used for soaking and nonprimed seeds formed the control. The results revealed that seeds primed with liquid *Pseudomonas fluorescens* at 15% concentration for 6h were the best treatment for additive invigourative effect. *Pseudomonas fluorescens* at 60% concentration for 12 h also improved the speed of germination, germination (%), root length (cm), shoot length (cm), dry matter production (mg seedlings-^{10}) and vigour index. The increases over nonprimed seeds for these parameters were 38, 31, 24, 32, 113, and 68% respectively.

KEY WORDS: *Solanum torvum* seeds, *Pseudomonas fluorescens*, *Azospirillum*, KH_2PO_4.

INTRODUCTION

Turkey berry (*Solanum torvum*) is a bushy, erect and spiny perennial plant belonging to solanaceae family and is normally propagated by seeds and branch cuttings. It is popularly known as a traditional medicine as well as a vegetable. *Solanum torvum* is widely used like food and in folk medicine around the world (Yousaf *et al.,* 2013). Turkey berry has tremendous use in horticulture as it is used as the rootstock for eggplant. Grafted plants are very vigourous and tolerate diseases affecting the root system, thus allowing the crop to continue for a second year (Petran and Hoover, 2014). But the seeds didn't germinate uniformly and studies on improvement of germination are very meagre and scanty. It is important to obtain quality seeds for enhanced production and productivity. One such treatment is seed priming. Seed priming is used commercially in many horticultural crops as a tool to increase speed and uniformity of germination and to improve final stand under environmental stress conditions (Rowse, 1996). During priming, seeds are partially hydrated so that pre germinative metabolic activities proceed, while radicle protrusion is prevented and then are dried back to the original moisture level (McDonald, 2000). Priming can be practiced to assure the germination and physiological quality of turkey berry seeds for root stock production. In view of knowing the importance in horticulture crop as rootstock of egg plant, the present study was designed to treat the seeds with liquid *Pseudomonas fluorescens*, *Azospirillum and* halo primed with KH_2PO_4 in different concentration .

MATERIALS & METHODS

Seeds of turkey berry (*Solanum torvum*) collected from Orchard, Horticultural Collage and Research Institute, Tamil Nadu Agricultural University, Coimbatore formed the base material for this study . The liquid biocontrol agent *Pseudomonas fluorescens* obtained from the Department of Plant Pathology and liquid *Azospirillum* obtained from the Department of Agricultural Microbiology, Tamil Nadu Agricultural University, Coimbatore was used for this study. The seeds were bioprimed with liquid *Pseudomonas fluorescens* (5%, 10%, 15% and 20%), *Azospirillum* (5%, 10%, 15% and 20%) *and* halo primed with KH_2PO_4 (1%, 2%, 3% and 4%) in different concentration to standardize the optimum concentration by adopting seed to solution ratio of 1:1 as volume by volume basis for 6h. For hydropriming, water was used for soaking and nonprimed seeds formed the control. After the treatment, seeds were shade dried for 24h at room temperature and dried back to original moisture content. The experiment was carried out with four replications in factorial completely randomised design (FCRD).and evaluated the following seed quality parameters.

Speed of germination

Four replicates of hundred seeds each were used to test the speed of germination of seeds from different treatments in paper medium. The seeds showing radical protrusion were counted daily from fourth day after sowing until twenty days. From the number of seeds germinated on each day, the speed of germination was calculated using the following formula and the results were expressed in number (Maguire, 1962).

$$\text{Speed of germination} = \frac{X_1}{Y_1} + \frac{X_2 - X_1}{Y_2} + \ldots\ldots\ldots + \frac{X_n - X_{n-1}}{Y_n}$$

X_1- Number of seeds germinated at first day
X_2- Number of seeds germinated at second day
X_n- Number of seeds germinated on n^{th} day

Y_1- Number of days from sowing to first day
Y_2- Number of days from sowing to second day
Y_n- Number of days from sowing to n^{th} day

Germination (%)
Four replicates of 100 seeds, each were germinated by using paper (Between papers) medium under nursery condition. After the test period of 28 days, the number of normal seedlings in each replication was counted and expressed in percentage (ISTA, 2007).

Root length (cm)
At the time of germination count, ten normal seedlings were selected at random from each replication and used for measuring the root length of seedlings. Root length was measured from the point of attachment of seed to the tip of primary root. The mean values were calculated and expressed in centimetre.

Shoot length (cm)
The seedlings used for measuring root length were also used for measuring shoot length. The shoot length was measured from the point of attachment of seed to tip of the leaf and the mean values were expressed in centimetre.

Drymatter production (mg seedlings-^{10})
The ten normal seedlings were placed in a paper cover and dried in shade for 24h and then, they were kept in an oven maintained at 80°C for 48h and allowed to cool in a desiccators for 30 minutes. The dried seedlings were weighed and the mean values were expressed in mg seedlings-^{10}.

Vigour index
Vigour index values were computed using the following formula and the mean values were expressed in whole number (Abdul-Baki and Anderson, 1973).

Vigour index = Germination percentage x Total seedling length (cm).

Statistical Analysis
The data obtained from different experiments were analysed for 'F' test of significance following the methods described by Panse and Sukhatme (1985). Wherever necessary and the per cent values were transformed to angular (arc-sine) values before analysis. The critical differences (CD) were calculated at 5 per cent probability level. The data were tested for statistical signifinance (*). If F test is non-significant, it was indicated as NS

RESULTS & DISCUSSION

Seed treatments are mostly meant for seed invigouration and protection. Seed priming is a tool to exhibit an increased germination rate, greater germination, uniformity and higher total germination percentage (Basra *et al*., 2005). Seeds are partially hydrated so that pre-germinative metabolic activities proceed, while radicle protrusion is prevented and then are dried back to the original moisture level (McDonald, 2000). During the priming, several processes including activation and synthesis of a number of enzymes and nucleic acids, repair and build up, ATP synthesis, enzyme activities and the cytoplasmic membrane repair in treated seeds will start to occur (Hosseini and Koocheki, 2007).

In the present study, results revealed that germination per cent was statistically significant among the priming treatments. The seeds primed with *P. fluorescens* at 10, 15 and 20% or *Azospirillum* 15 and 20% recorded the highest germination (88%) followed by the seeds primed with *P. fluorescens* at 5% and *Azospirillum* at 10% (86%) which were on par to each other. The nonprimed seed recorded the lowest germination of 73% (Table 1).

TABLE 1. Effect of priming agent and its concentration on different seed quality parameters

Treatments	Parameters	Speed of germination	Germination (%)	Root length (cm)	Shoot length (cm)	Dry matter production (mg seedlings $^{-10}$)	Vigour index
T_1	Hydropriming for 6h	2.3	80 (63.43)	4.6	2.0	0.0020	527
T_2	*P. fluorescens* 5% for 6h	2.4	86 (68.03)	5.0	2.0	0.0021	600
T_3	*P. fluorescens* 10% for 6h	2.6	88 (69.73)	5.2	2.1	0.0026	643
T_4	*P. fluorescens* 15% for 6h	2.9	88 (69.73)	5.5	2.4	0.0031	695
T_5	*P. fluorescens* 20% for 6h	2.7	88 (69.73)	5.3	2.3	0.0024	672
T_6	*Azospirillum* 5% for 6h	2.4	85 (67.21)	4.9	2.0	0.0026	587
T_7	*Azospirillum* 10% for 6h	2.6	86 (68.03)	5.0	2.1	0.0023	610
T_8	*Azospirillum* 15% for 6h	2.5	88 (69.73)	5.2	2.3	0.0021	661
T_9	*Azospirillum* 20% for 6h	2.5	88 (69.73)	5.3	2.2	0.0026	663
T_{10}	KH_2PO_4 1% for 6h	2.6	82 (64.90)	4.8	1.9	0.0025	550
T_{11}	KH_2PO_4 2% for 6h	2.6	82 (64.90)	5.0	2.1	0.0024	579
T_{12}	KH_2PO_4 3% for 6h	2.7	84 (66.42)	5.1	2.0	0.0026	597
T_{13}	KH_2PO_4 4% for 6h	2.5	84 (66.42)	5.1	2.2	0.0023	612
T_{14}	Control	2.0	73 (58.69)	4.4	1.5	0.0019	431
	Mean	2.5	84 (66.42)	5.0	2.1	0.0024	602
	SEd	0.05	1.20	0.10	0.03	0.0001	10.47
CD (P = 0.05)		0.10	2.44	0.20	0.07	0.0002	21.44

(Figures in parentheses indicates arcsine values)

The improvement in germination noticed with optimum dose was 15 per cent higher than nonprimed seed and 6 percent over hydroprimed seed. The computed vigour index values were significant among various treatments, where the seeds primed with *P. fluorescens* at 15% has recorded the highest vigour index value of 695 followed by the seeds primed with 10% (672) and remained significantly superior to all other treatments. The improvement in seedling vigour in respect to *P. fluorescens* at 15% was 61.3 and 31.9 percent over nonprimed and hydroprimed seeds, respectively.

PLATE 1. Performance of primed seeds on vigour of seedling

Seed bioprimed with *P. fluorescens* at 15% concentration for 6h improved the seed germination and seedling vigour. Seed treatment with biocontrol agents with growth regulatory function and biofertilizers often known as biopriming is widely recommended for different crops. Biopriming integrates biological and physiological aspects of disease control and is used as an alternative method to fungicide treatment for controlling many seed and soil borne pathogens (EL-Mohamedy, 2004) but with invigourative function. The enhancement in the seedling growth noticed in this study could be attributed to the production of plant growth regulators such as gibberellins, cytokinins and indole acetic acid; increased availability of minerals and other ions; and more water uptake (Ramamoorthy *et al.,* 2001). The effectiveness of biopriming with *P. fluorescens* was also evident in improvement of seed germination and seedling vigour in sorghum (Raju *et al.,* 1999), rice (Kumar *et al.,* 2001 and Kavitha, 2011), maize (Kalaivani, 2010), bhendi (Mariselvam, 2012), brinjal (Ilakiya, 2013 and Jeyavelan, 2014),Chilli (Ananthi,2014), blackgram, sunflower and rice (Sowmiyabhanu, 2014)

CONCLUSION

In line with these views, in the present study revealed that seed bioprimed with *Pseudomonas fluorescens* at 15% concentration for 6h was the best treatment for additive invigourative effect

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