BIO SEED TREATMENT IN SUSTAINABLE AGRICULTURE BY INDUCING MOISTURE STRESS TOLERANCE IN RICE SEED GERMINATION

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KEYWORDS

Biopriming
Moisture stress
Pseudomonas fluorescens
INTRODUCTION

Indian agriculture mainly depends on monsoon rainfall. Generally usage of beneficial microorganism like bio control agents and bio fertilizers effectively reduces the chemical fertilizers and pesticide in rain fed agriculture (Shaguntala et al., 2012).Moisture stress is a critical environmental factor that restricts seed germination. Moisture stress during the earlier phase of seed germination affects the field emergence, seedling establishment ultimately the yield of the crop (Ceesay, 2004).

Seed priming is an efficient method for increasing seed vigour and synchronization of germination, as well as the growth of seedlings of many crops under stressful conditions and it play a positive role in the tolerance to abiotic stresses. Priming is seed invigoration treatments, which consist of a controlled imbibitions of the seeds followed by dehydration back to their initial water content (Bradford, 1986). This treatment could enable the crop to establish under initial moisture stress condition and established vigourous seedling also give higher yield under terminal moisture stress condition (Musa et al., 2001).

In addition to that many beneficial bioagents also involved in sustainable agriculture under abiotic stress condition. So this experiment was conducted for analyse the combined effect of priming and bioagent as biopriming seed treatment and to identify the perfect biopriming treatment which enhance the germination of CORH 4 rice hybrid under moisture stress condition.

MATERIALS AND METHODS

Bio priming

The bioagents viz., 4 % Pseudomonas fluorescens, 20 % liquid Azospirillum, 15 % liquid phosphobacteria and 20 % liquid Azophos were prepared and the seeds were soaked in equal volume of solutions for 12 h duration. After biopriming, the seeds were removed from the solutions and shade dried at room temperature till bring back the seed moisture to its original level.

Moisture Stress

A known quantity (weight basis) of sand was taken in an aluminium tray. Then, known quantity of water was added till the media reached saturation and weighed again. The difference in weight and the total quantity of water added to reach saturation was noted. This ratio of sand and water was taken as 100 % moisture holding capacity and accordingly, 80, 60, 40 and 20 % of water was added to sand media to create 80, 60, 40 and 20 % water holding capacities, respectively. Four replicates of 100 seeds from each treatment were sown in each of the above water holding capacity and kept in the germination room and at the end of 14 days, the following observations were made.

Germination

The germination test was conducted by following the procedure outlined in ISTA (2011) using paper medium by following between paper method. Four replicates
of 100 seeds each were germinated in a germination room maintained at 25 ± 2°C temperature and 90 ± 3 % RH. At the end of fourteenth day of sowing, the number of normal seedlings in each replication was counted and the germination was calculated and expressed in percentage.

Root length
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
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 terminal leaf and the mean values were expressed in centimetre.

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

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\text{Vigour index} = \text{Germination} \times \text{Seedling length (cm)}
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RESULTS AND DISCUSSION
The performance of bioprimed seed under different water holding capacities namely 20, 40, 60 and 80 per cent was compared with nonprimed seeds. The results revealed that the seeds bioprimed with 4 per cent *Pseudomonas fluorescens* for 12 h enhanced the germination under moisture stress conditions than other biopriming treatments (figure 1). The increase in germination over nonprimed seeds was 11, 10, 7 and 6 per cent in COMS 23A, 10, 8, 8 and 7 per cent in CB 174R and 11, 13, 7 and 7 per cent in CORH 4 under 20, 40, 60 and 80 per cent water holding capacities, respectively. All bioprimed seeds exhibited improved germination rate (figure 1), seedling length (table 1 & 2 and vigour index (plate 1 & figure 2) over nonprimed and hydroprimed seeds under different moisture stress condition.

This result agrees with Chavan et al. (2014) who reported that the primed soybean seed produced taller seedling than nonprimed seed. Seed priming has improved seed germination and seedling establishment under extreme drought conditions.
The positive role of priming on abiotic stress tolerance might be due to the improved antioxidant production (Mittler, 2002). Antioxidants are natural defensive elements in seed that scavenge excessive reactive oxygen species (ROS). In priming the excessive ROS were scavenged during early imbibition process and it play an essential role in ensuring successful germination, especially under stress conditions (Bailly et al., 2008).
With regards to PGPR strains, application of PGPR can enhance phytohormones content of seed under moisture stress condition (Ansari et al., 2012). Phytohormones plays critical role in regulating plant growth and its response to stress. *Pseudomonas fluorescens* treatment had improved phytohormonal characters under water deficit condition. The *P. fluorescens* protect plants from drought stress (Loon, 1998) and significantly promote the seedling growth under stress condition. Application of *Pseudomonas* sp. under water stress improved the antioxidant (Heidari and Golpayegani, 2012). This experiment concluded that rice seed bioprimed with 4% *Pseudomonas fluorescens* for 12h could able to withstand extreme moisture stress (20 % WHC) condition. The tolerance nature of bioprimed seeds might be due to enhanced antioxidant and phytohormone accumulation during biopriming.

**REFERENCES**


