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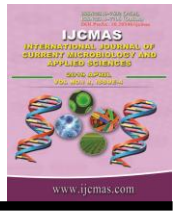

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Enhancement of Seedling Vigour through Bio-priming for Barnyard Millet Var. MDU 1

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A B S T R A C T

The experiment was conducted to determine the enhancement of seedling vigour through bio priming for barnyard millet. Seeds of barnyard millet var. MDU 1 were bioprimed with water, Azophos, *Pseudomonas fluroscens*, PPFM and the combinations of Azophos+ *Pseudomonas fluroscens* at 20% concentration for 8 h. Bio- primed seeds were evaluated for its germination, seedling length, vigour index, dehydrogenase, α-amylase and microbial count. Results revealed that seeds bioprimed with Azophos+ *Pseudomonas fluroscens* @ 20% for 8h performed positive influence on physiological quality and biochemical parameters. In addition microbial population of $107x10^4$ CFU g^{-1} of seed was observed in Azophos+ *Pseudomonas fluroscens* primed seeds compared to other priming treatments. These treatments can be utilized for enhancing seedling vigour in barnyard millet.

Introduction

Small millets are nothing but group of small millet grasses. The group comprising of finger millet, kodo millet, little millet, foxtail millet, barnyard millet and proso millet are considered as "Nutricereals" and are a source of food, feed and fodder. They are known for resilience and drought enduring capacity and are well suited for contingency crop planning, addressing the issues of climate change. Millets in general provide many essential vitamins and micronutrients that can bolster nutrition for those living in dryland areas. They are especially rich in iron, calcium and zinc, and have other dietary qualities that can help stave off anemia, celiac disease, and diabetes.

Now-a-days unpredictable and inconsistent rainfall, poor quality seeds and changing environment conditions affect the crop establishment and leading to crop failure. Among the different means of solutions, seed priming is one of the simple and low cost technology especially for dry land farmers. Seed priming is a controlled hydration process that involves exposing seeds to low water potential that restrict germination, but permits pre-germinative physiological and

biochemical changes to occur (Rink *et al.*, 2017). Different priming methods are followed by researchers. One of the best and ecofriendly priming method is biopriming. The seed biopiming is an effective seed treatment to increase the rate, uniformity of emergence and crop establishment in most of the crops especially in advanced countries it integrates the biological and physiological aspects of enhancing growth, disease control and increase in yield. Excessive and continuous use of chemical fertilizers coupled with pesticides and fungicides have damaged the soil fertility which causes deleterious effects on crop cultivation and productivity. Now-a-days, chemical fertilizers are replaced by environment friendly biofertilizers. Biofertilizers improve the root development, vegetative growth and nitrogen fixation. They liberate growth promoting substances and vitamins and help to maintain soil fertility, improve physical properties of soil, soil health in general and help in the bio-control of disease. The reports on positive and significant response of biopriming alone or combinations on physiological quality in barnyard millet is very meager therefore the present study was carried out to identify the effect of bio priming in barnyard millet.

Materials and Methods

Genetically pure and fresh barnyard millet var MDU 1 seeds were collected from Department of Seed Science and Technology, Agricultural College and Research Institute, Madurai. Bioinoculants *viz.*, *Azospirillum* (SP 7), Phosphate Solubilizing bacteria (Pb-1), Potash release bacteria (KRB 7), Pink-pigmented facultative methylotrophic bacteria (PPFMs) and *Pseudomonas fluroscens*, Silicate Solubilizing bacteria (SSB-7) were obtained from Department of Agricultural Microbiology, Agricultural College and Research Institute, Madurai, Tamil Nadu.

The strains were cultured in specific culture media for each. Liquid based bio-inoculant formulations were prepared for priming the seeds. Broth at different concentrations *viz.*, 5, 10, 20% was prepared. The seeds were soaked in respective solution with duration of 6, 8 and 12 hours with 1:1 ratio (v/w). After the priming treatments the seeds were shade dried to original moisture content of 12% and germination test was conducted (ISTA, 1999) with four replicates of 100 seeds in paper towels. The test conditions were 25±2ºC temperature, 95±5% Relative Humidity and illumination with fluorescent light (750-1250 lux). Final count of normal seedling was recorded on 7th day.

Observations on germination, seedling length and vigour index were recorded. Biochemical parameters *viz.*,dehydrogenase activity (Kittock and Law 1968) were expressed as OD value @ 480 nm and α-amylase activity expressed as mg maltose min $^{-1}$ (Paul *et al.*, 1970) respectively. Microbial population in the bioprimed seeds was assessed. All analyses were made in duplicate. The data were statistically analysed using AGRES software. Percentage data were transformed to arcsine values wherever necessary.

Results and Discussion

Based the pilot studies the best treatments were selected and taken for research. Significant differences were observed among the treatments in which the seeds bio primed with 20% Azophos + *Pseudomonas fluroscens* for 8h have recorded 100% germination, root length (15.2 cm), shoot length (8.8 cm) and vigour index (2400).

The hydroprimed seeds recorded 88%, 11.8 cm, 8.1 cm and 1751 for germination, root length, shoot length and vigour index respectively (Fig. 1–6).

Fig.1 Effect of biopriming on germination percentage and vigour index in barnyard millet

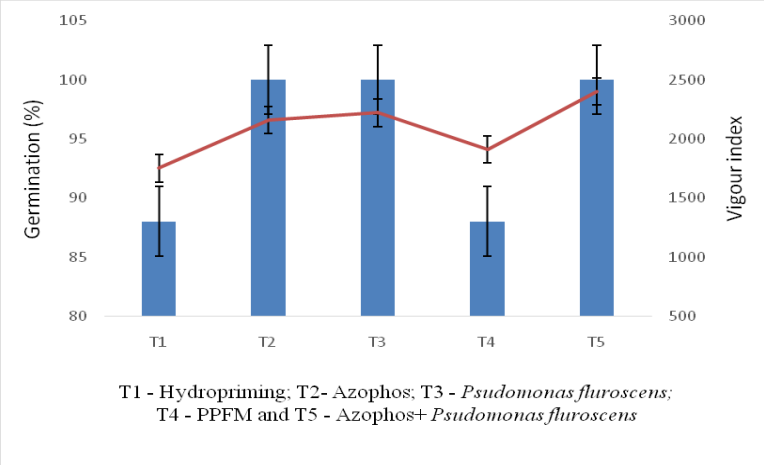


Fig.2 Effect of biopriming on root length and shoot length in barnyard millet

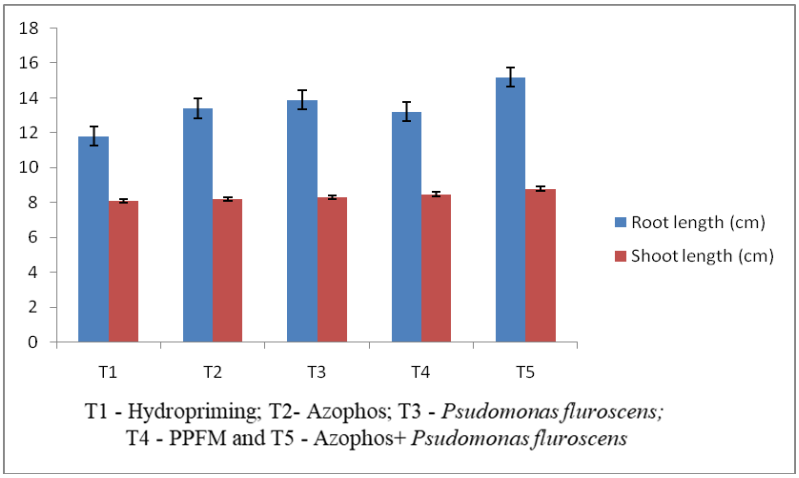


Fig.3 Effect of biopriming on microbial population in barnyard millet

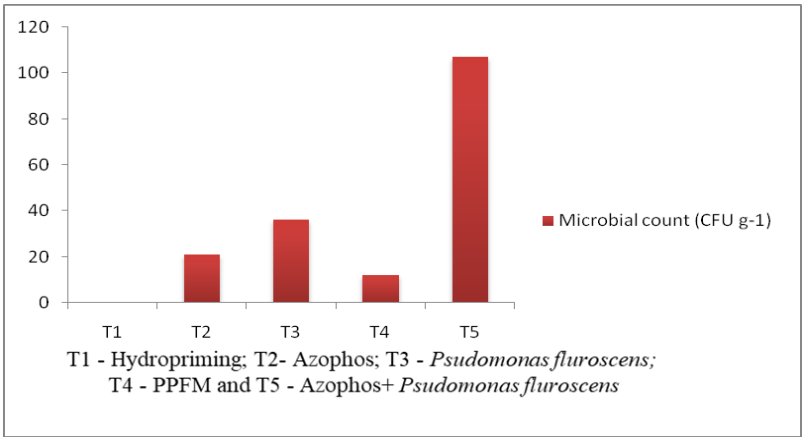


Fig.4 Effect of biopriming on dehydrogenase and α-amylase activity in barnyard millet

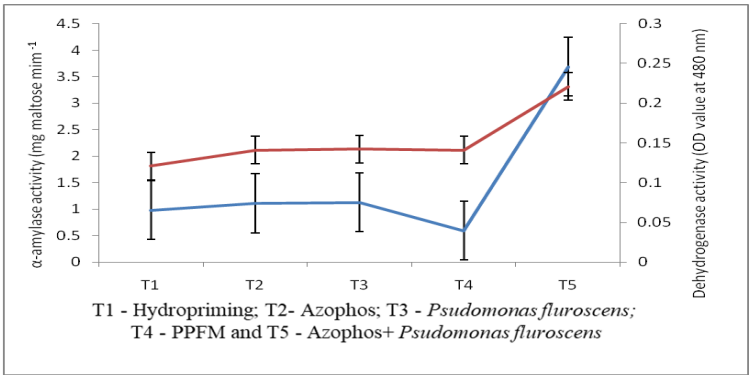
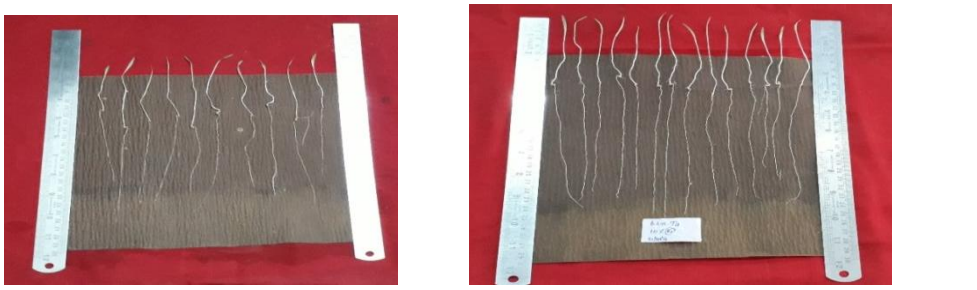


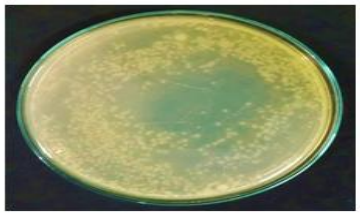
Fig.5 Seedling growth of barnyard millet – 20% at 8 h



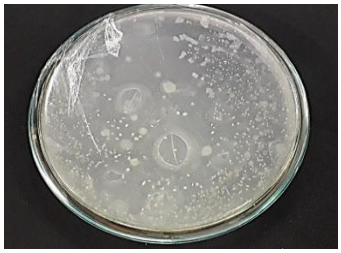
Hydroprimed

Azophos+*Psudomonas fluroscens*

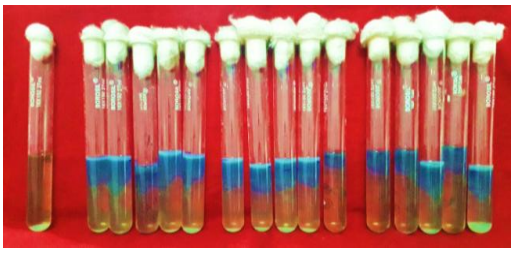
Fig.6 Microbial population of Azophos+*Pseudomonas fluroscens*



Psudomonas fluroscens



Phosphate solubilizing bacteria



Azosprilium

Bio priming using biological agents has PGPR activity that increase germination and improve seedling establishment and proliferation of PGPR on the spermosphere (Taylar and Harman, 1990).

Seed biopriming with *Azophos* + *Pseudomonas fluroscens* might have stimulated the hypocotyl and epicotyl growth and cell elongation by inducing secretion of GA_3 resulting in increased root length and shoot length. Similar findings reported by Sakthivel *et al.,* 2009 in tomato; Sivasankaridevi *et al.,* 2013 in cucumber; Sivakalai and Krishnaveni, 2017 in pumpkin; Sridevi and Manonmani, 2016 in kodo millet and barnyard millet and Madhukeshwara *et al.,* 2017 in maize.

Among the bioinoculants *Azophos* + *Pseudomonas fluroscens* showed higher microbial population compared to other bio-priming agent ($107x10^4$ CFU). Hydroprimed seeds recorded nil microbial population. Percentage increase over control (hydropriming) was by 12, 22.36, 7.95, 27.04, 45.24, 83.52 and 100 for germination, root length, shoot length, vigour index, dehydrogenase activity, α-amylase activity and microbial count respectively. The seed moisture availability might have maintained the viability of microorganisms in the seed. Similar findings were reported by (Anitha, 2010, Meena *et al.,* 2012, Raja *et al.,* 2017, Subhaswaraj *et al.,* 2017, Nithya *et al.,* 2017 and sivakalai and krishnaveni, 2017.

The enzyme activities of dehydrogenase and α-amylase were recorded higher in *Azophos* + *Pseudomonas fluroscens* primed seeds. The enhancement in the seedling growth enzyme activity and microbial count noticed in this study can be attributed to suppression of deleterious microorganisms, pathogens, production of plant growth regulators such as Gibberellic acid (GA), Cytokinin, Indole acetic acid(IAA) increased availability of minerals and other ions and also more water uptake (Ramamoorthy *et al.,* 2000). The positive effect of *Azophos* + *Pseudomonas fluroscens* bio primed seeds might be due to plant growth promoting substances or phyto hormones and also enhancing the nutrient mobilization from the seed.

It could be concluded that barnyard millet seeds soaked in equal volume of liquid microbial culture *Azophos+Pseudomonas fluroscens* @ 20% for 8h registered higher seedling vigour.

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