

Seed soaking treatment with nitrate salts *vis a vis* physiology of germination and seedling vigor in rice (*Oryza sativa* L. var. Ratna)

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ABSTRACT

In a short term experiment seeds of rice were subjected to pre-sowing soaking treatment with various salts containing 15 mM nitrate for 72 h. An improvement in seed germination, seedling vigor (length of plumule and radicle) and α -amylase activity were found in nitrate treated sets in comparison to distilled water treated sets. In an other experiment (long term) seeds were sown in pots after providing 30 h soaking treatment with above mentioned salts and distilled water and observations were made for seedling emergence at 5, 7 and 9 days after sowing (DAS) and seedling vigor at 13 and 26 DAS and these were compared with non-soaked seeds (control) which directly sown to pots. The results showed an increase in seedling emergence and vigor in nitrate salt treated sets by facilitating a number of parameters like plant height, number and length of root, fresh and dry weight of shoots and roots, number of leaves and tillers as compared to plants raised from DW soaked and control seeds. Electrical conductivity and nitrate reductase activity in leaves also increased with the use of nitrate salts as seed treatment. However, KNO_3 was found more effective during germination rather than $\text{Mg}(\text{NO}_3)_2$; but reverse was noted in studies related to seedling vigor. This type of nitrate salt treatment to rice seeds prior to sowing improves seedling vigor including root number and its mass than distilled water treated one, therefore, in system of rice intensification (SRI) cultivation which has now been practiced in a number of states of India, this type of nitrate salt treatment to the seeds can be added before seed sowing.

Key words : Rice seeds, Nitrate salt, Soaking treatment, Germination and seedling vigor, SRI cultivation

INTRODUCTION

Production of any crop has significant impact with the formation of robust and healthy seedlings which comprises the foundation stone for high yield. In case of rice, yield has direct relation with sowing of seeds in well prepared nursery beds and there after the transplanting of seedlings/plant lets to properly cultivated fields. Therefore, the aim lies in the formation of healthy seedlings which have good initial vigor, certainty to utilize the input effectively and efficiently and will able to transform the nutrients towards the yield performance of crop with efficiency.

There are various reports on pre-sowing soaking seed treatment with various salts by which seed germination and seedling vigor is found to improve. Kiss (1979) reported that 1% MgSO_4 for 2-24 h enhances the germination percentage in sugar beet and maize. Bose *et al.* (1982) observed that $\text{Ca}(\text{NO}_3)_2$ in respect to NH_4NO_3 and $(\text{NH}_4)_2\text{SO}_4$ enhanced rate of germination and protease activity of maize seeds which also resulted more solubilization of nitrogen in its mobilization towards embryo. Hilhorst (1990) noticed that NO_3^- while used as soaking treatments acts as dormancy breaking agents via stimulating the pentose phosphate path way while producing NADP, which is one of the essential criteria for the relieve of dormancy in seeds of many plant species.

Soaking of rice seeds with urea (450 ppm) found to increase seedling height, dry weight of shoot and culms diameter except number of green leaves as reported by Guoxing and Wang (1998).

In present investigation an effort has been made to get an improvement in per cent germination including the physiology of seeds, primed with nitrate salts and distilled water before sowing and to get a good seedling vigor which can be used in system of rice intensification (SRI) cultivation of rice (var. RATNA).

MATERIALS AND METHODS

Treatments description:

Surface sterilized (0.1 % HgCl_2) rice seeds were given pre-sowing soaking treatment with distilled water (DW) and nitrate (15 mM conc.) salts [$\text{Mg}(\text{NO}_3)_2$ and KNO_3] either for 72 or for 30 h (this includes 6 h imbibitions in DW and nitrate salts) for short and long term experiments, respectively whereas one lot of seeds kept untreated which was used as control.

Short term experiments:

In these experiments the seeds were kept in Petri dishes (diameter 7.5 cm) in normal light condition for upto 72 h at a temperature of $30 \pm 2^\circ\text{C}$ and following observations were made;

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