A Novel Technique for Evaluating and Selecting Crop Cultivars for Salinity Tolerance: its Progress

Ratikanta Maiti*

Vibha Seeds, Inspire, Plot#21, Sector 1, Huda Techno Enclave, High Tech City Road, Madhapur, Hyderabad, Andhra Pradesh (500 081), India

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Correspondence to
E-mail: ratikanta.maiti@gmail.com

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Abstract

Salinity is one of potential threats in growing crops successfully. Identification of salt tolerant cultivars and its management may be an option in managing saline soils. The author has developed a novel technique by screening pipe line hybrids/parents at 0.15, 0.20 and 0.25 M NaCl concentration for evaluating and selecting salt tolerant cultivars with high yield potentials. Salt tolerant cultivars tested in laboratory condition have also proved their performance in field.

1. Introduction

Salinity affects crop productivity in two thirds of arable land of the world and its gravity is increasing day by day. Concerted research activities have been directed to understand and adopt strategy for solving the problems, but very little progress has been achieved. The degree to which growth is reduced by salinity differs greatly within crop species and to a lesser extent with genotypes/varieties within a species. Significant advances have been attained on the mechanism of tolerance on the basis of physiology, biochemistry and molecular mechanism. Identification of salt tolerant crop cultivars with high yield potential is a great necessity. Various techniques have been adopted by several researchers to develop and identify salt tolerant cultivars but with low yield capacity. A novel technique has been developed by the author at Vibha Seeds, which is efficient to distinguish and select salt tolerant various field and vegetable crop species with high yield potentials. A new approach has been adopted to screen pipe line hybrids/parents for evaluating and selecting salt tolerant cultivars with high yield potentials. This approach has not been adopted elsewhere. The technique described below has been effectively utilized in evaluating several field and vegetable crops for selection of cultivars tolerant to salinity showing consistent results.

2. Experimental Approach

Seeds were grown in plastic pots using coco peat in room temperature and artificial light was provided to maintain light up to 14 days. Room temperature was about 27°C. A novel technique has been developed for this purpose. The technique involved consists of sowing the seeds at a depth of 2 cm in a plastic pot (height 85 mm, diameter 80 mm) filled with coco peat (neutral delignified coir fibers) and then applying water or required saline concentration up to two thirds of the pot. Twenty seeds were sown in each pot in the upper coco peat layer at 2 cm depth which receive water/solution by capillarity. We apply the solution only one time, say water, or saline solution up to the termination of the experiment (18 days after sowing). To protect seeds from fungal attack, seeds were treated with thiram solution (5% p/v) for 5 minutes before sowing. Seeds were sown in each pot under control (distilled water) along with 0.15 M NaCl or at higher salinity level up to 0.25 M NaCl as per specific experiment. Each of the treatments was replicated thrice for all the genotypes. This technique simulates a semi-hydroponic system where the upper layers of coco peat medium receive water/and saline solution only by capillary movement, while the roots are immersed in saturated lower coco peat medium. During capillary movement there is free flow of oxygen owing to constant evapo-transpiration. Observations were taken by taking 15 days old seedlings. Data were taken on average emergence percentage, shoot length (cm), root length (cm), and seedling dry weight (g) on 15th day. The same procedure and the same variables are taken in all the experiments. The main objective of the study is to determine the efficacy of this new technique on different sets of Bt cotton hybrids for tolerance to NaCl-salinity.

This technique has been made to detect genotypic variability of salinity tolerance of different genotypes of different field crops at the seedling stage (using distilled water as control, 0.15 M NaCl and 0.20 M NaCl, 0.25 M NaCl as saline treatments). It is observed that increasing NaCl concentration significantly reduced germination, emergence, seedling shoot and root length, showing considerable variation between the different genotypes.

By using the above mentioned technique we screened a large number of genotypes of different field crops (cotton, sunflower, pearl millet and maize) and vegetable crops (tomato, chilli, okra, gourds) for salinity tolerance at seedling stage (Panel 1).

In general, it is observed in most of the crops that increasing salinity concentration did not decrease seedling growth in salt tolerant genotypes; on the contrary, it decreased substantially in the case of the susceptible ones. In the case of cotton and cereals, there was increase in root elongation in the salt tolerant genotypes, but it decreased drastically in the susceptible ones. Significant differences have been observed among genotypes for tolerance to salinity in different crops. It is concluded that emergence percentage, and root elongation may be consider as selection criteria for salinity tolerance in these crops.

3. Conclusion

It is recommended that this technique may be utilized in screening crop cultivars for salt tolerance with success, as documented on given references. In addition, it is confirmed that the genotypes selected for salt tolerance are found to be tolerant in saline prone areas. Selection of salt tolerant crop cultivars is a feasible strategy to maintain sustainable crop production under saline prone areas. This technique has been utilized for evaluating salt tolerant cultivars with high yielding background and reasonable results.

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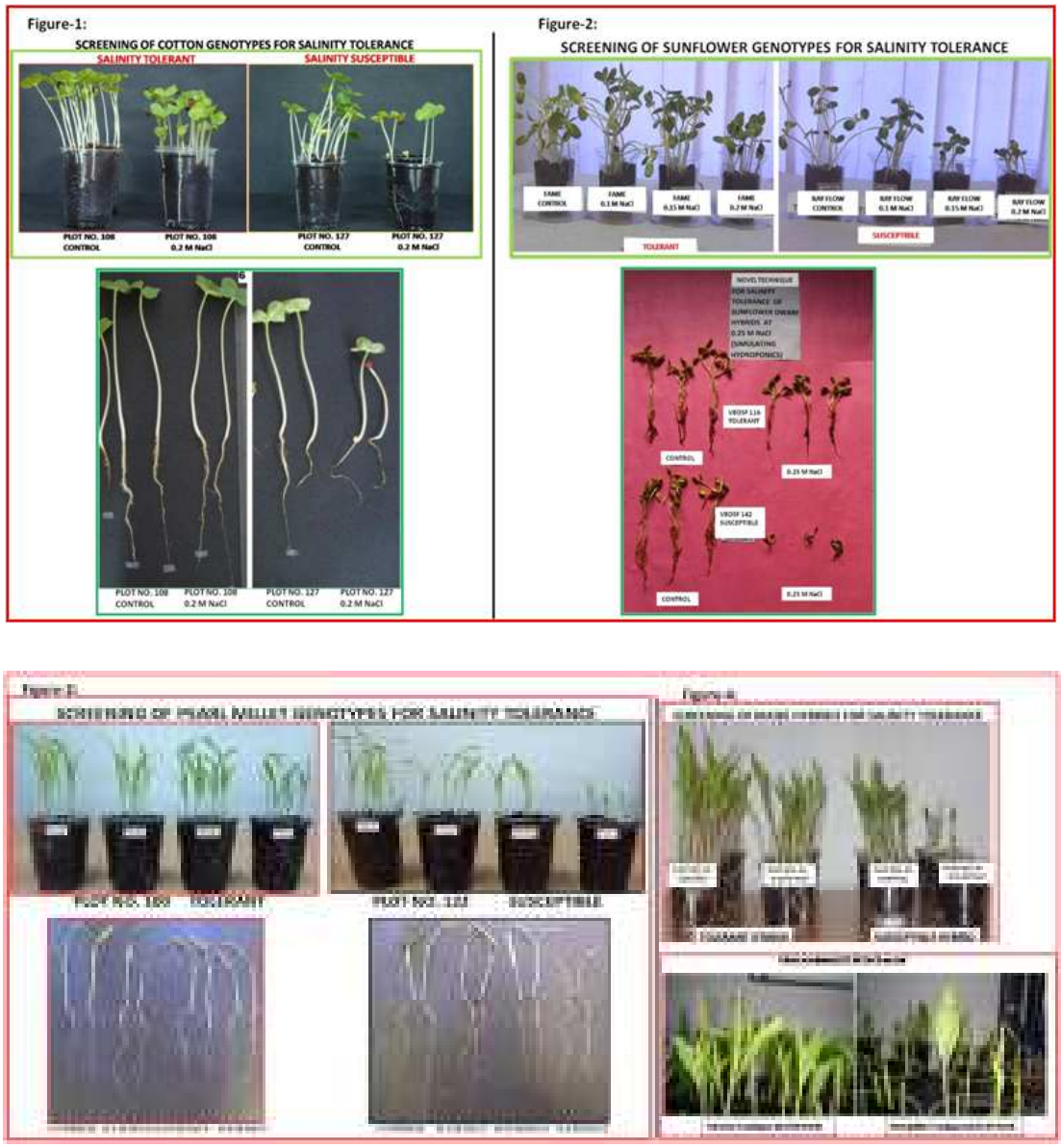

Panel 1: Effect of different salt treatments on different filed crops at seedling stage