Amelioration of sodicity stress in groundnut genotypes using growth regulating substances

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Abstract: The investigation was aimed at to alleviate the adverse effects of salt stress with plant growth regulating chemicals through foliar spray. The variety CO4 and ALR3 were imposed with foliar spray of CaCl₂ 1 %, BR 0.5 ppm, BR 1 ppm, SA 50 ppm, SA 100 ppm, KNO₃ 1 %, DAP 2 % and nutrient mixture at preflowering, pegging and pod formation stages. The yield parameters like flower production per plant, pod number was improved by BR treatment. The role of BR in facilitating the partitioning of assimilates could also reveal through improved seed weight and high harvest index. The overall performance of BR, therefore, reflected on pod yield of groundnut in both the varieties. The application of BR 1 ppm through foliar spray at preflowering, pegging and pod formation stages effectively enhanced the overall physiological efficiency of the crop and improved the yield in both tolerant and sensitive varieties of groundnut grown under salt stress conditions.

I. INTRODUCTION

The role of many plant growth regulating chemicals in alleviating the adverse effects of stresses and imparting adaptation has been reviewed [1]. brassinosteroids are a novel group of plant hormones that regulate cell division, cell expansion, reproductive development, retard leaf abscission and enhance resistance to stress through stabilizing membranes and DNA [2]. salicylic acid has been shown to be essential for the plant protection against oxidative stress generated by environmental stresses. Therefore, it is directly involved in the defense mechanisms developed by the plants under stress conditions, particularly salt and osmotic stresses [3]. Several studies have shown that calcium alleviates growth inhibition by salt of glycophytic plants [4]. Development of amelioration technology may pave the way for improving growth and yield of crop plants, particularly sensitive species, growing under the hostile environments. Based on these backgrounds, the present study was formulated with the objective to evaluate the efficacy of various growth regulating chemicals on mitigating the stress effects and to select the cost effective ameliorant for higher productivity.

II. MATERIALS AND METHODS

A field experiment was carried out to study the effect of various plant growth regulating chemicals on alleviating the adverse effects of sodicity stress in groundnut. The two varieties CO4 (M₁) and ALR3 (M₂) imposed with foliar spray of Water (S₀), CaCl₂ 1 % (S₁), BR 0.5 ppm (S₁), BR 1 ppm (S₂), SA 50 ppm (S₃), SA 100 ppm (S₄), KNO₃ 1 % (S₅), DAP 2 % (S₆), and Nutrient mixture (S₇) : DAP (1 %) + KNO₃ (0.5 %) + FeSO₄ (0.5 %) + Borax (0.2 %) + NAA (20 ppm) + SA (50 ppm) + BR (1 ppm). These treatments were imposed as foliar sprays on 25th, 55th, and 85th DAS coinciding with preflowering, pegging and pod formation stages. The soil Exchangeable Sodium Percentage Was 16 %, yield components such as number of flowers per plant, number of pegs per plant, number of pods per plant, fertility coefficient, shelling percentage, 100 seed weight and harvest index were recorded at the time of harvest, besides pod yield.

III. RESULT & DISCUSSION

Number of flowers per plant differed significantly among main plot and sub plot treatments. Comparing the two main plots, M₁ recorded more number of flowers (64) than M₂ (56). The sub plot treatment S₀ registered a maximum number of 63 flowers per plant followed by S₁ (62) and S₂ (61), which were significantly higher than control. The effect of other treatments on flower production was also significantly higher than control. The highly positive correlation between the number of flowers produced during the early reproductive phase and productivity was reported in groundnut and plant growth regulators were found to induce more number of flowers in lesser number of days leading to increased pod weight and yield [5].

The two main plot treatments differed significantly with respect to number of pegs per plant. M₁ produced more number of pegs (33) than M₂ (32). All the subplot treatments showed their significant effects on number of pegs per plant over control. S₁ was the most effective one with the peg number of 36.6 followed by S₃ (34.9). Under unsprayed control the number of pegs produced per plant was 29.6.
Number of pods per plant varied significantly between the two main plot treatments. M1 recorded 26 numbers of pods per plant, whereas M2 recorded around 22 pods per plant. All the subplot treatments were effective in improving the pod number significantly over control. Among them S4 recorded the highest value of 26.8 followed by S5 (25.5) and S8 (25.1). All these treatments were significantly differed from each other. As the number of pods per plant is one of the important yield determining factors in groundnut, the reduction in pod number would have a direct reflection on total pod yield [6].

The fertility coefficient differed significantly between the two main plot treatments and M1 recorded significantly higher value of 40.1 per cent, which was significantly higher than M2. All the sub plot treatments were significantly more effective than control in improving the fertility coefficient. Among them, S4 recorded the highest fertility coefficient of 42.5 per cent. All the other treatments, except S6 and S9 were on par with each, but showed significantly higher value than control. The study conducted by [7] also indicated that Arabidopsis mutant that accumulated reduced amount of endogenous BR grown as dwarfs and their fertility was greatly impaired. Two main plot treatments significantly differed with respect to 100 seed weight. M1 being the best main plot treatment, registered a considerably higher 100 seed weight of 51, whereas M2 had a weight of 42. All the subplot treatments except S5 influenced the 100 seed weight in both the main plots. S4 being an effective treatment, registered the highest value of 49 with an 11 per cent increase over control. This treatment was followed by S5 (48.38), S7 (47.9) and S8 (47.2), which influenced the 100 seed weight with 9, 8 and 6 per cent increase over control.

Pod yield varied significantly among main plot and sub plot treatments. M1 recorded significantly higher mean pod yield of 1702.4 kg ha⁻¹, whereas M2 recorded a mean yield of 1590.1kg ha⁻¹. All the subplot treatments significantly influenced thepod yield of the two varieties. Among them, S4 registered the highest mean yield of 1754.2 kg ha⁻¹, followed by S8 with the mean yield of 1725.2 kg ha⁻¹. These two elite treatments were followed by S3 (1678.9), S6 (1657.6), S9 (1640.3), S5 (1621.6) and S2 (1608.3). The influence of S4 (1592.6) was found to be less, though significantly higher than S1, which recorded the lowest yield of 1537.7 kg ha⁻¹. Reference [8] shows revealed a pod yield reduction of 18, 51, 60 and 70 per cent at EC 3.75, 5.0, 6.25 and 7.5 dSm⁻¹ respectively. As reported by [9] 50% reduction in grain yield of groundnut took place at an ESP of about 20, which indicates that groundnut is relatively a sensitive crop for sodic soils. This reduction in yield was attributed to the marked decrease in all the yield components resulting from higher ESP level [10].
IV. CONCLUSION

From the studies, it is concluded that the groundnut variety CO4 was identified as the most tolerant variety to salt stress and ALR3, the most sensitive one. Maintenance of optimum leaf area with high proline, soluble protein and chlorophyll contents and high TDMP were the physiological basis for tolerance to both salinity and sodicity stresses. Brassinolide 1 ppm sprayed at preflowering, pegging and pod formation stages was highly effective in overcoming the adverse effects of salt stress through enhancing the overall physiological efficiency of the crop and in improving the pod yield even in the varieties sensitive to salt stress.

REFERENCES


