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Challenging saline stress in aggregatum onion using plant stimulants

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Abstract
An experiment was conducted to find out the ability to challenge salinity stress in aggregatum onion (*Allium cepa var aggregatum*) using plant growth regulators. The experiment was carried out at Department of Horticulture, Faculty of Agriculture, Annamalai University. The bulbs of Gnanamedu local variety were selected to undergo the physiological performance for yield improvement under salinity. To fix the critical threshold level of salinity and to understand the mechanism of stress with the concentration of NaCl from 10 mm to 70 mm. Among the various NaCl concentration (10-70mM), concentration beyond 50mM showed more than 75% reduction in dry matter. Thus 50mM of NaCl concentration was identified as the threshold level upto which management strategies would work to restore the elastic strain. Then the seedlings were treated with plant growth regulators viz. Hexaconazole, Triadimefon, Propiconazole and Tetraconazole for mitigating the salinity stress. The data on various physiological attributes indicated that the reduction was brought out by the ionic, osmotic and secondary stresses. The activity of sodium and potassium got changed and enhanced the production of proline, increased the membrane stability and reduced electron leakage. Further increased proline content indicates the role of plant growth regulators in osmoregulation and maintenance of cell integrity. The result on various biometric traits reveals that increased yield was mainly contributed by increased number of bulbs, bulb length, bulb diameter and individual bulb weight. Thus, it is concluded that under salinity stress within the threshold limit, exogenous application of hexaconzole @ 5 ml per lit would mitigate the salinity stress to about 80 per cent.

Keywords: Saline stress, onion, plant stimulants

Introduction
Vegetables are rich source of minerals and vitamins for human diet. With increasing population there is an increasing demand of vegetables throughout the world urging a great necessity the production of vegetables. The productivity of any vegetable depends on edaphic, genetic, climatic and management factors. High soil salinity is one of the important environmental factors that limit distribution and productivity of major crops (Ashraf *et al.*, 2005 and Chandan *et al.,* 2006) [1, 4]. In the Indian context, salt affected soils occupy about 6.73m ha of area affecting production and productivity across number of states. In Tamil Nadu, the area affected by salinity is around one lakh ha with a major problem of soil belts in Chengalpattu, Cuddalore, Thanjavur, Kanyakumari covers an area of about 7425 sq.km. Onion is one of the most important bulbous vegetable crop commercially grown in India, which is an essential ingredient for food preparation as a flavouring agent. Onion is a rich source of calcium, iron and vitamin A, B and C. The cultivation of onion is handicapped by many factors. Among this, salinity is the most limiting one. A possible alternative is to induce the capability within plants to successfully face the detrimental situation by treatment with growth regulators to mitigate the adverse effects of salinity on plants.

Materials and Methods
The investigation was carried out in the Department of Horticulture, Faculty of Agriculture, Annamalai University, Annamalai Nagar in Randomized Block Design with three replications. The bulb of aggregatum cultivar Gnanamedu local was used for the experiment. It is widely cultivated in the coastal tract of Cuddalore district. In the experiment I, the stress inducing critical concentration of NaCl was identified. In the experiment II, the effect of plant growth regulators viz., Triazole compound such as triadimefon, hexaconazole, propiconazole and tetraconazole on salinity stress was studied.

Results and Discussion
Even though there appeared increased sodium uptake to increasing salinity levels, the tolerant genotype was found to have lower sodium uptake.

Proline accumulation is a universal response of plant to stress. Proline content got increased with the increasing level of salinity. It ranged from 130 to 196 per cent in leaf. Among the eight plant growth regulator treatments, the highest chlorophyll content was recorded in T4 (Hexaconazole @ 5ml l^{-1}). The highest sulphur content was recorded 1.13 mg g^{-1} in T4 (Hexaconazole @ 5ml l^{-1}). Proline seems to have diverse roles under salinity stress, such as stabilization of protein structures against denaturation; osmoregulatory function; and also stabilizing cell membranes by interacting with phospholipids, and sub-cellular structures, thereby protecting the cellular function (Kavi-Kishor *et al.*, 2005). Sodium toxicity represented the major ionic stress associated with high salinity. Potassium content decreased as soil salinity increased. This may indicate that aggregatum onion is characterized by high selectivity for Na:K ratio. Sodium exclusion at the root surface were based on a relatively low passive sodium permeability exhibited by the epidermal and cortex plasmalemma. Plants treated with triazoles had alterd membrane properties to facilitate the removal of damaged areas under stress (Paliyath and Fletcher, 1995) [7]. Loss of membrane integrity in bean was ameliorated by triazole @ 4 mg l^{-1} (Asara Boamah and Fletcher, 1986) [9]. It helped in maintaining membrane integrity and reduced ion leakage.

Treatments (ml per lit)	Sodium Content (%)	Potassium Content (%)	Sodium: Potassium Ratio
T1(control)	1.21	2.38	0.51
T2 (10mM)	1.43	2.14	0.67
T3 (20mM)	1.84	2.01	0.92
T4 (30mM)	2.12	1.87	1.13
T5 (40mM)	2.29	1.73	1.32
T6 (50mM)	2.71	1.57	1.73
T7 (60mM)	2.98	1.39	2.14
T8 (70mM)	-	-	-
S.Ed.	0.10	0.05	-
CD(p = 0.05)	0.21	0.12	-
Treatments (ml per lit)	**Proline Content (µg g^{-1})**	**Sulphur Content (mg g^{-1})**	**Chiorophyll Content (mg g^{-1})**
T1-salinised	3.04	0.28	0.44
T2-Triadimefon@3ml	10.81	0.91	2.11
T3-Triadimefon@5ml	11.22	1.06	2.33
T4-Hexaconazole@5ml	11.42	1.13	2.43
T5-Hexaconazole@3ml	11.01	0.98	2.23
T6-Propiconazole@5ml	10.63	0.84	2.01
T7-Propiconazole@3ml	10.11	0.73	1.84
T8-Tetraconazole@3ml	10.30	0.80	1.95
T9-Tetraconazole@5ml	9.91	0.68	1.78
T10-Absolute control	1.31	1.28	2.68
S.Ed.	0.08	0.02	0.04
CD(p = 0.05)	0.17	0.05	0.09

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