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Alleviating effect of IAA on salt stressed *Phaseolus mungo* (L.) with reference to growth and biochemical characteristics

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Abstract
Sodium Chloride (i.e., 25mM, 50mM, 100mM and 200mM) induced salinity effect in black gram caused significant reduction in germination, seedling growth, root and shoot length, fresh weight and leaf area. A reduction in protein content, and nitrate reductase activity was observed in all the concentrations of sodium chloride treated plants. However, the proline level, free amino acid, peroxidase and catalase activities were increased with the increase in the concentration of sodium chloride. Foliar application of 15 ppm IAA to the sodium chloride stressed plants caused an alleviating effect on the salt stressed plants and increased crop yield.

Keywords: *Phaseolus mungo*, Sodium chloride, IAA, Stress.

INTRODUCTION

Phaseolus mungo (L.) is one of the most important leguminous crops belonging to the family Fabaceae. The concentration of salinity which is high enough to lower water potential is called salt stress. In India, approximately 20% of the cultivated land and almost 50% irrigated land on the earth is salt affected [1]. Soil salinity is an enormous problem adversely affecting growth and development of crop plants and results into low agricultural production [2]. Salt stress inducing accumulation of compatible solutes such as proline, glycinebetaine in the cytoplasm are well known mechanism of salt tolerance in the cells [3]. Attempts are being made to ameliorate salt stress by using phytohormones [4]. Though we adopt different techniques to overcome this problem we have made an attempt by using of IAA. If any fruitful and noteworthy results are obtained, it may be brought to the notice of the agricultural department authorities, who on the other hand will ask the farmers to make use of these phytohormones for better growth and yield of pulses and ultimately improve their standard of living. Therefore, the present study is designed to study the alleviating effect of IAA on growth and biochemical characteristics of salt stressed *Phaseolus mungo.*

MATERIAL AND METHODS

Seeds of *P. mungo*, used for the present study were procured from the local seed centre, Sivakasi. The seeds soaked in respective concentrations of sodium chloride (25, 50,100 & 200 mM) for 2 hours were kept as experimental sets. Both the control and experimental seeds were allowed to germinate in plastic trough containing a mixture of red and black soil in the ratio of 1:1.The experimental troughs treated every day with respective concentrations of sodium chloride whereas control is supplied with distilled water (60 – 100ml/day upto 10 days on the soil surface). Replicates were maintained for each concentration of sodium chloride. 15ppm IAA is applied on the salt stressed plants as foliar spray on both dorsal and ventral surface of the leaves upto 10 days. Growth parameters such as root length, shoot length were measured with meter scale. The leaf area was measured in randomly selected experimental and control plants by using graph sheets and expressed in cm^2. Biochemical parameters such as photosynthetic pigments [5], total soluble suger [6], soluble protein [7], Proline[8] were analysed. The enzymatic activities such as nitrate reductase activity [9], peroxidase and catalase activity [10] were analyzed.

RESULTS AND DISCUSSION

In the 50mM, 100mM and 200mM concentrations of NaCl treatment, there were 70%, 50% and 40% germination of seeds respectively. The same was observed by [11] Germination percentage significantly decreased as the level of salinity increased (Table 1). There was a reduction of shoot length, root length fresh weight in 25, 50,100 and 200mM concentrations over control. (Table1). The results obtained for both root and shoot, the fresh weight and dry weight showed that dry weight accumulation was significantly reduced with the increase of sodium chloride stress. Results obtained indicate that salinity caused significant reduction in chlorophyll content, protein content, sugar content and nitrate reductase activity. [12] reported a decrease in protein content in horse gram which is in coincidence with our present report. Free aminoacid content, proline content, catalase and peroxidase activities increase with increased in the concentration of sodium chloride (Table 3). An increase in proline content in tomato in salt stress condition reported [13]. In the present study, it has been found that there is an increase of catalase activity with an increase of salt concentrations and observed in earlier reports [14].

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Table 1. Effect of NaCl on growth parameters of *Phaseolus mungo* (L.).

Sl. No.	Growth Parameters	Control	25mM	50mM	100mM	200mM
1	Shoot length (cm)	10.2±0.12 (100%)	9.8±0.01 (96%)	9.5±0.11 (93%)	9.1±0.02 (89%)	8.9±0.12 (87%)
2	Root length (cm)	2.4±0.01 (100%)	2.1±0.11 (87%)	1.8±0.12 (75%)	1.5±0.1 (62%)	1.2±0.011 (50%)
3	Fresh weight (mg)	0.81±0.15 (100%)	0.79±0.1 (97%)	0.76±0.13 (93%)	0.71±0.11 (87%)	0.69±0.10 (85%)
4	Dry weight (mg)	0.40±0.12 (100%)	0.035±0.02 (87%)	0.029±0.01 (72%)	0.025±.11 (62%)	0.018±0.13 (45%)
5	Leaf area (cm^2)	5.32±0.19 (100%)	5.20±0.01 (97%)	4.82±0.13 (90%)	4.65±0.1 (87%)	4.48±0.15 (84%)

Values are the mean of four replicates. Mean ± SD, N: 5, values in parenthesis indicate percent activity

Table 2. Effect of IAA on growth parameters of salt stressed *Phaseolus mungo (L.)*

Sl. No.	Parameters	Control	25mM	50mM	100mM	200mM
1	Shoot length (cm)	10.2±0.12 (100%)	10.0±0.21 (98%)	9.8±0.09 (96%)	9.7±0.21 (95%)	9.3±0.31 (91%)
2	Root length (cm)	2.4±0.01 (100%)	2.3±0.15 (95%)	2.2±0.16 (91%)	1.8±0.025 (75%)	1.6±0.02 (66%)
3	Fresh weight (mg)	0.81±0.15 (100%)	0.85±0.1 (104%)	0.81±0.02 (100%)	0.76±0.11 (93%)	0.75±0.1 (92%)
4	Dry weight (mg)	0.40±0.12 (100%)	0.042±0.25 (105%)	0.032±0.15 (80%)	0.028±0.21 (70%)	0.024±0.02 (60%)
5	Leaf area (cm^2)	5.32±0.19 (100%)	5.31±0.11 (99%)	5.16±0.12 (96%)	4.76±0.15 (89%)	4.63±0.01 (87%)

Values are the mean of four replicates. Mean ± SD, N: 5, values in parenthesis indicate percent activity

Table 3. Effect of IAA on biochemical parameters of salt stressed *Phaseolus mungo (L.)*

S.No	Parameters	Treatment	Control	25mM	50mM	100mM	200mM
1	Total Chlorophyll (mg/g LFW)	NaCl	0.722±0.03 (100)	0.684±0.11 (94)	0.583±0.02 (80)	0.538±0.12 (74)	0.460±0.46 (63)
		IAA	0.722±0.03 (100)	0.718±0.15 (99)	0.680±0.01 (94)	0.596±0.12 (82)	0.569±0.13 (78)
2	Total soluble sugar (mg/g LFW)	NaCl	31.12±0.13 (100)	29.06±0.34 (93)	27.61±0.15 (88)	25.43±0.14 (81)	22.46±0.01 (72)
		IAA	31.12±0.13 (100)	30.12±0.02 (96)	28.52±0.1 (91)	27.31±0.14 (87)	24.52±0.15 (78)
3	Proline (µmole/g LFW)	NaCl	25.31±0.15 (100)	28.46±0.31 (112)	30.12±0.13 (119)	32.12±0.12 (126)	34.15±0.14 (134)
		IAA	25.31±0.15 (100)	27.12±0.1 (107)	28.32±0.1 (111)	30.10±0.12 (118)	32.12±0.11 (126)
4	NRA (µ moles NO_2 formed/g/h)	NaCl	18.11±0.15 (100)	17.12±0.1 (94)	16.31±0.9 (90)	15.12±0.02 (83)	14.3±0.13 (78)
		IAA	18.11±0.15 (100)	18.02±0.1 (99)	17.62±0.01 (97)	16.32±0.12 (90)	15.42±0.13 (85)
5	Catalase activity (µmole H_2O_2 /mg protein /min)	NaCl	0.0012±0.1 (100)	0.0014±0.27 (116)	0.0015±0.15 (125)	0.0017±0.10 (141)	0.0019±0.10 (158)
		IAA	0.0012±0.1 (100)	0.0013±0.11 (108)	0.0014±0.4 (116)	0.0016±0.02 (133)	0.0017±0.12 (141)

Values are the mean of four replicates. Mean ± SD, N: 5, values in parenthesis indicate percent activity.

Foliar application of IAA (15ppm) increases the percentage of germination, shoot and root length, fresh weight, dry weight and (Table 2). A conspicuous increase in fresh and dry matter accumulation of shoot of the treated plants is attributed, due to the application of the growth regulators [15]. Regarding restoration of chlorophyll protein and sugar level by IAA after treatment with it, the following developments namely onset of chlorophyll repairing mechanism, prevention of chlorophyll degradation, stability of pigment, protein complex may be responsible besides regulation of plastid differentiation by phytohormones in plants exposed to stress. Similar increase in sugar content on the application of IAA increased the content of chlorophyll, soluble protein, nitrate reductase activity and total sugar content in pearl millet [16]. There is a decrease in proline content and free amino acids after the foliar application of 15ppm IAA on Sodium chloride stressed *P.mungo* (Table 3).The same drastic reduction was observed [1].They are of the opinion that the decline in the proline level after phytohormone treatment may be due to arrest of breakdown of protein, unknown shift in protein metabolism and maintenance of osmotic balance between cytoplasm and vacuole by constituent of phytohormones. Peroxidase and catalase are the enzymes which are responsible for the super oxide scavenging activities. Spraying of bioregulators on salinity stressed plants, will reduce the enzyme activities. Similar decrease was already reported [17].It is observed that IAA has an alleviating effect

on salinity stressed plants and increase crop yield in terms of growth and biochemical parameters.

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REFERENCES

[1] Saha, K. and K. Gupta, 1998. Effects of triazoles and CCC on growth yield and metabolism of mungbean plants under salinity stress. Indian J. Plant Physiol., 3(2): 107-111.

[2] Garg, B.K. and Gupta, I.C. 1997. Plant relations to salinity. In: Saline wastelands environment and plant growth., pp. 79-121. Scientific Publishers, Jodhpur.

[3] Girija, C., Smith, B.N. and Swamy, P.M. 2002. Interactive effects of sodium chloride and calcium chloride on the accumulation of proline and glycinebetaine in peanut (*Arachis hypogaea L*.) *Environ. Exp. Bot*. 47: 1-10.

[4] Rao, S.S.R., B.V. Vardhini, E. Sujatha and S. Anuradha, 2002. Brassinosteriods. A new class of phytohormones. Curr. Sci., 82: 1239-1245.

[5] Wellburn, A.R. and Lichtenthaler, H. 1984. Advances in Photosynthetic research (Sybesma eds) Martinus Nijhoff / Dr.W.Junk. The Hague. Vol.II: 9 – 12.

[6] Jayaraman, J. 1981. *Laboratory manual in Biochemistry*. Willey Eastern Ltd., Madras

[7] Lowry, O.H., Roseburg, N., Farr, A.L. and Randall, R. 1991. Protein measurement with the phenol reagent. J. Biol. Chem 193, 265–275.

[8] Bates, et al, 1973 L.S. Bates, R.P. Waldren and I.D. Teare, 1973. Rapid determination of free proline for water stress studies. *Plant and Soil*, 39, pp. 205–207

[9] Jaworski EG. 1971. Nitrate reductase assay in intact plant tissues. Biochem Biophys Res Commun. 18;43(6):1274–1279

[10] Addy, S.K., Goodman, R.N. 1972 "Polyphenol oxidase and peroxidase in apple leaves inoculated with a virulent or an avirulent strain of Ervinia amylovora," Ind. Phytopath., 25, pp.575-579.

[11] Mauromicale, G. and Licandro, P.2002. Agronomie.22:443 – 450.

[12] Sudhakar, C., Reddy, P.S., Veeranjaneyulu, K., 1991. Changes in respiration its allied enzymes, pigment composition, chlorophyllase and hill reaction activity of horsegram seedlings under salt stress. Indian J. Plant Physiol. 34, 171-177.

[13] Heuer B. 2003. *Influence of exogenous application of proline and glycinebetaine on growth of salt-stressed tomato plants. Plant Science. 165:693-699.*

[14] V.J. Nashikkar and T. Chakrabarti, 1994. Catalase and peroxidase activity in plants- an indicator of heavy metal toxicity. *Ind. J. Exp. Biol.*, 32**,** pp. 520–521

[15] Ries SK, Wert VF, 1992. Response of maize and rice to 9-/3-L(+) adenosine applied under different environmental conditions. Plant Growth Regul 11: 69-74

[16] Sivakumar, R., Pathmanaban, G., Kalarani, M.K., Mallika vanangamudi, Srinivasan, P.S., Vanangamudi, M., 2002, Effect of Foliar application of growth regulators on Biochemical attribute and grain yield in pearl millet. *Indian Journal of Plant Physiology,* 7(1): 79-82.

[17] Sangeeta K, Varshney KA, 1991. Effect of Gibberellic Acid Maleic Hydrazide and Cycocel on Early Growth and Activities of Some Oxidoreductases in Avena-Sativa L. Indian Journal of Experimental Biology 29, 80-2