

## **PH.D THESIS**

### **Effect Of Exogenous Application Of Salicylic Acid And Ascorbic Acid On Activity Of Non-Enzymatic Defense System Of C<sub>3</sub> And C<sub>4</sub> Plants Under NaCl Stress**

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#### **ABSTRACT**

Two experiments were conducted in fields of agriculture college \_ University of Diyala during spring season of 2013 to study the impact of exogenous application of ascorbic acid and salicylic acid at concentration 2 and 0.2 mM respectively. Objective of this project to stimulate and induction the non- enzymatic defense system as well as to study the rates of absorption and transport of Na<sup>+</sup> and Cl<sup>-</sup> ions in sunflower (C<sub>3</sub>) and maize (C<sub>4</sub>) plants after short exposure (two weeks) to salt stress using the salt of NaCl levels: S<sub>1</sub>, S<sub>2</sub> and S<sub>3</sub>, control, 50 and 100 mM respectively. Split – split plot design was used in the experiment with three replicates based on a randomized complete block design (RCBD).

The first experiment (pot experiment)

The findings of this experiment indicated significant reduction of the dry weight of shoot and root system with increasing the levels of salt stress. The rates of absorption and transport of Na<sup>+</sup> and Cl<sup>-</sup> ions increased with increasing the salt stress from S<sub>1</sub> to S<sub>2</sub> and S<sub>3</sub> in both genotypes plant between 60 and 70 days after planting, for example the rate of absorption of Na<sup>+</sup> increased in sunflower 31.87% and 70% while in maize were 91.04% and 164.08% with irrigation by second and third levels of salt stress respectively comparison with first level, however the rates of absorption and transport of Na<sup>+</sup> and Cl<sup>-</sup> ions markedly reduced with exogenous application of

ascorbic acid and salicylic acid; this was positive reflective in increments of the dry weight of shoot and root system and the rates of  $K^+/Na^+$ , and  $Ca^{++}/Na^+$ . It thus appear that exogenous application of ascorbic acid and salicylic acid reduced the adverse effect of  $Na^+$  and  $Cl^-$  in xylem sap.

In both genotypes, particularly in control treatment the rates of absorption and transport of  $Na^+$  and  $Cl^-$  ions do not differ markedly, however these rates of absorption and transport of  $Na^+$  and  $Cl^-$  ions between  $C_3$  and  $C_4$  depend on salt stress at  $S_2$  and  $S_3$ .

The conducted experiment revealed that both genotypes  $C_3$  and  $C_4$  developed the first mechanism to reduce the rates of absorption and transport of  $Na^+$  and  $Cl^-$  ions by exogenous application of ascorbic acid and salicylic acid to avoid the oxidative stress which that clearly appear in treatment without ascorbic acid and salicylic acid application.

The second experiment (field experiment)

The results revealed that exposure of  $C_3$  and  $C_4$  plants to salt stress significantly reduced in the content of N, P,  $K^+$ ,  $Ca^{++}$  and  $Mg^{++}$  as well as the ratio of  $K^+/Na^+$  and  $Ca^{++}/Na^+$ . Moreover the relative water content (RWC), membrane stability index (MSI), photosynthesis pigments (chlorophyll a and b),  $\beta$ -carotene, leaf area and plant height were significantly reduced with increasing salt stress; this affect reflected a negative effect on weight of 100 grains and grain yield where decreased 13.45% and 61.13% in sunflower while decreased 40.76% and 68.41% in maize with irrigation by second and third levels of salt stress comparison with first level respectively, however the concentration of  $H_2O_2$  and electrolyte leakage markedly increased with increasing salt stress in fourth leaf. It thus appears that plants were under oxidative stress.

Exogenous application of ascorbic acid and salicylic acid of  $C_3$  and  $C_4$  plants which grow under salt stress induction the non-enzymatic system. The content of total phenols, poly phenols,

$\alpha$ \_tocopherol, photosynthesis pigments (chlorophyll a and b),  $\beta$ \_carotene and total soluble sugars were increased with exogenous application of ascorbic acid and salicylic acid, however the content of electrolyte leakage and  $H_2O_2$  in leaves decreased 32.49% and 15.35% in sunflower while in maize decreased 96.01% and 51.93% with exogenous application of ascorbic acid and salicylic acid respectively comparison with control.

The results of carried out experiment revealed that the second mechanism was developed by exogenous application of ascorbic acid and salicylic acid in  $C_3$  and  $C_4$  plants. Exogenous application of ascorbic acid and salicylic acid maintained the equilibrium of the relation between the formation of ROS and induction of non-enzymatic system.

The findings of carried experiment revealed that the first and second mechanisms could be worked at the same time to scavenging the ROS and induction of non-enzymatic system.