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MORPHOLOGICAL AND PHYSIOLOGICAL CHANGES OF GROUNDNUT PLANTS BY FOLIAR APPLICATION WITH SALICYLIC ACID

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ABSTRACT
To study the response of groundnut plant to foliar application of Salicylic acid (100,200 and 400 mg/L) as well as their interaction on vegetative growth, photosynthetic pigments content, yield and some biochemical constituents of groundnut grains. The data indicated that, an enhancement effect of growth characters of plants and yield. The total carbohydrate, fats and proteins in groundnut grains was also increased by 100 or 200 mg/L of Salicylic acid (SA) application. SA at 400 mg/L recorded the lowest values of yield and above components compared to their corresponding controls.

INTRODUCTION

Groundnut, an important cash crop, is an annual legume. It is a major oil seed crop and India is the largest producer of groundnut in the world. About two thirds of world production is crushed for oil and the remaining one third is consumed as food. Its cake is used as feed or for making other food products and haulms provide quality fodder. A possible approach to induce crop losses is the foliar application with chemical desiccant on wheat plants (Gaballah and Mandour, 2003; Nicolas and Turner, 1993). Salicylic acid (SA) naturally occurs in plants in very low amounts and participates in the regulation of physiological processes in plant such as stomatal closure, nutrient uptake chlorophyll synthesis, and protein synthesis, inhibition of ethylene biosynthesis, transpiration and photosynthesis (Raskin, 1992; Khan *et al.,* 2003; Shakirova *et al.,* 2003). It has been identified as an important signaling element involved in establishing the local and systemic disease resistance response to plants after pathogen attack (Alvarez, 2000).Salicylic acid, Jasmonic acid and Ethylene – dependent signaling pathways regulates plants responses to both abiotic and biotic stress factors (Mulpuri *et al.,* 2000). SA treatments at 0.5 mM strongly or completely suppressed the Cadmium – induced up regulation of the anti accident enzyme activities of barley (Metwally *et al.,* 2003).

The patent impact of SA on various areas of plant structure and function prompt many investigators to apply them in several crop plants aiming is control pattern of growth and development coupled with enhancement of systematic resistance against various hurtful agents which may appear in the surrounding environments. SA promotes some physiological processes and inhibiting others depending on its concentration, plant species, development stages and environmental conditions (Ding and Want, 2003; Mateo *et al.,* 2006). SA increased the number of flowers, pods of plant and yield of soybean (Gutierrez- Coronado *et al.,* 1998), enhanced wheat growth (Shakirova *et al.,* 2003) and maize growth (Shehata *et al.,* 2001; Abdel- Wahed *et al.,* 2006; El-mergawi and Abdel-Wahed, 2007). On the contrary, salicylic acid at relatively high doses inhibited plant growth and chlorophyll contents of the tomato (Kord and Hathout, 1992. Lupine (Haroun *et al.,* 1998) and wheat plants (Singh and Usha, 2003; Iqbal and ashraf, 2006). Thus SA could be expected to influence the growth and yield of groundnut plants.

Therefore, the present investigation was undertaken to study the impact of spraying SA individually on some morphological criteria, yield as well as some biochemical constituents of groundnut to improve growth, yield, grain quality and nutritional value.

MATERIALS AND METHODS

Sowing of groundnut seeds

In seedling, groundnut seeds were surface sterilized with aqueous mercuric chloride (0.1%) for 15 min, and then with 70% alcohol for 1 min. After each sterilization, seeds were washed thoroughly with sterile distilled water in a laminar airflow bench. The surface sterilized seeds were sown in pots of 15 cm diameter.

Salicylic acid treatment

About 30 day old plants were inoculated by spraying the

leaves uniformly with the Salicylic acid using hand held sprayer. Leaves were sprayed until their surface was completely covered with solution. Spray solution contained 20 mM of SA in distilled water and 0.05% Tween 80. Control spray solution contained 0.05% Tween 80 in distilled water.

Work design

The plants were grouped into 2 sets. 1st set was control without SA treatment, 2nd set was SA treated. The SA was treated as 3 concentrations (100, 200 and 400 mg/L) at 3 different periods. Observations were recorded at the time of harvest about 110 days after sowing.

Growth characters

After SA treatments growth characters were measured in terms of plant height, dry weight of plant (g) (Bremmer and Taha, 1966).

Estimation of Chlorophyll content in leaves

Chlorophyll content of the leaves was determined (Arnon, 1949).

Estimation of nutritional value in grains

Total carbohydrate was determined in the dried grains, using phenol sulphuric method (Dubois *et al.*, 1956). Proteins were estimated (Lowry *et al.,* 1951). Fat content in grain also estimated.

RESULTS AND DISCUSSION

Growth criteria

Data presented in Table 1 show that foliar application of Salicylic acid at 100 and 200 mgL^{-1} promoted growth criteria of groundnut plants compared to corresponding untreated plants. Salicylic acid at 100 mg L^{-1} was most effective treatment in increasing growth parameters. Whereas, growth characters of groundnut plants significantly decreased by increasing Salicylic acid concentration up to 400 mg L^{-1}. In this respect, many investigators found that low concentrations of Salicylic acid enhanced growth of soybean (Gutierrez-Coronado *et al.,* 1998) maize(Shehata *et al.,* 2001; El-Mergawi and Abdel Wahed, 2007) and wheat plants (Shakirova *et al.,* 2003; Iqbal and Ashraf, 2006), whereas high concentrations caused an inhibitory effect on growth of tomato, lupine wheat and maize plants(Kord and Hathout 1992; Haroun *et al.,* 1998; Singh and Usha 2003; Abdel-Wahed *et al.,* 2006).

Moreover El-Bahay (2002), reported that Salicylic acid has the potentiality to exert a suppressive or stimulative impact on various growth aspects of Lupine seedlings through their direct interference with the enzymatic activities responsible for biosynthesis and /or catabolism of growth promoting and inhibiting substances.

Photosynthetic pigments

The effect of foliar spray with Salicylic acid on the photosynthetic pigments in the leaves of groundnut plants are shown in Table 2. Salicylic acid significantly increased chlorophyll a, chl b and carotenoids recording maximum values at 100 mg/L. on the contrary, the content of such pigments were reversely changed using higher concentration of salicylic acid. These results are in agreement with those obtained by Gharib (2006) who found that in sweet basil and marjoram plants salicylic acid at 10^{-5} M stimulated total chlorophyll synthesis whereas 10^{-3} M has a reverse effect.

Yield and its components

Data presented in Table 3 show that foliar application of salicylic acid, especially at 100 mg L^{-1} resulted in the highest increase in yield and nutritional value of the grain. On the other hand, SA at 400 mg L^{-1} recorded lowest values of yield and its components compared to their corresponding controls. In this connection, foliar application of salicylic acid significantly increased yield and its components of maize (Shehata *et al.,* 2001; Abdel- wahed *et al.,* 2006) and wheat plants (Shakirova *et al.,* 2003; Iqbal and Ashraf, 2006).

Table 1: Growth criteria of groundnut after foliar application of SA

SA treatments mg L^{-1}	After 50 days from sowing		After 100 days from sowing		After 150 days from sowing	
	Plant height (cm)	Dry weight (g)	Plant height (cm)	Dry weight (g)	Plant height (cm)	Dry weight (g)
Control	35	19.98	45	20.78	46	20.98
100	40	20.87	50	21.00	52	21.54
200	46	21.65	56	22.65	58	23.78
400	36	19.34	46	20.34	48	20.21

Table 2: Effect of foliar spray with Salicylic acid on the photosynthetic pigments of groundnut leaves

SA treatment mgL^{-1}	After 50 days from sowing			After 100 days from sowing			After 150 days from sowing		
	Chl a (mg/g)	Chl b (mg/g)	Carotenoid (mg/g)	Chl a (mg/g)	Chl b (mg/g)	Carotenoid (mg/g)	Chl a (mg/g)	Chl b (mg/g)	Carotenoid (mg/g)
Control	0.67	0.43	2.889	0. 68	0.47	2.888	0.69	0.48	2.889
100	0.89	0.66	4.075	0.94	0.86	4.079	0.95	0.92	4.082
200	0.78	0.58	5.312	0.81	0.63	5.318	0.81	0.67	5.316
400	0.61	0.46	3.498	0.65	0.48	3.406	0.67	0.49	3.397

Table 3: Nutritional values of groundnut grain after foliar application of SA

SA treatment mg L^{-1}	Carbohydrates (g)	Fat (g)	Protein (g)
Control	21	48	25
100	28	56	31
200	25	54	30
400	20	49	27

REFERENCES

Abdel-Wahed, M. S. A., Amin, A. A. and El-Rashad, S. M. 2006. Physiological effect of some bioregulators on vegetative growth, yield and chemical constituents of yellow maize plants. *World J. Agric. Sci.*

2(2): 149-155.

Alvarez, M. E. 2000. Salicylic acid in the machinery of hypersensitive cell death and disease resistence. *Plant Mol. Biol.* **44:** 429-442

Arnon, D. I. 1949 Copper enzymes in isolated chloroplasts – polyphenol oxidase in *Beta Vulgaris*. *Plant Physiology*. **24:** 1-15.

Bremmer, P. M. and Taha, M. A. 1966. Studies on potato agronomy the effect of variety, seed size and spacing on growth development and yield. *J. Agric. Sci.* **66:** 241-252.

Ding, C. and Want, C. Y. 2003. The dual effects of methyl salicylate on ripening and expression for ethylene biosynthesis genes in tomato fruits. *Plant Sci.* **164:** 589.

Dubois, M., Gilles, A., Hamilton, R., Robers, J. and Smith, F. 1956. Colorimetric method for determination of sugar and related substance. *Anal. Chem.* **28:** 350-356.

El-Bahay, M. M. 2002. Metabolic changes, phytohormonal level and activities of certain related enzymes associated with growth of presoaked lupine seeds in salicylic acid and gallic acid *Bull. Fac. Sci., Assiut Univ.* **31:** 259-270.

El-Mergawi, R. and Abdel-Wahed, M. 2007. Diversity in salicylic acid effects on growth criteria and different indole acetic acid forms among faba bean and maize International Plant Growth substances Association. 19th Annual meeting. Puerto Vallarta, Mexico, July 21-**25:** 2007.

Gaballah, M. S. and Mandour, M. S. 2000. Increasing drought resistance of wheat plants during grain filling by using chemical desiccants. *J. Sci. Mansoura Univ.* **25(2):** 833-841.

Gharib, F. A. 2006. Effect of salicylic acid on the growth, metabolic activities and oil content of basil and marjoram. *International J. Agric. Biology.* **4:** 485-492.

Gutierrez-Coronado, M. A., Trejo-Lopez, C. and SKarque-Saavedra, A. 1998. Effect of salicylic acid on the growth of roots and shoots in soybean. *Plant physiol. Biochem.* **36(8):** 563.

Haroun, S. A., Aldesuqy, H. S., Shukry, W. M. and Gaber, A. M. 1998. Regulation of growth and metabolism and productivity. *Egypt J. Physiol. Sci.* **22:** 75.

Iqbal, M. and Ashraf, M. 2006. Wheat seed priming in relation to salt tolerance, growth, yield and level of free salicylic acid and polyamines. *Ann. Bot. Fennici.* **43(4):** 250-259.

Khan, W., Prithiviraj, B. and Smith, D. L. 2003. Photosynthetic response of corn an soybean to foliar application of salicylates. *J. Plant Physiol.* **160:** 485.

Kord, M. and Hathout, T. 1992. Changes on some growth criteria, metabolic activities and endogenous hormones in tomato plants consequent to spraying with different concentrations of salicyladhyde. *Egypt. J. Physiol. Sci.* **16:** 117.

Lowry, O. H., Rosebrough, N. J., Farr, A. L. and Randall, R. J. 1951. Protein measurement with the Folin phenol reagent. *J. Biol. Chemistry*. **193:** 263-275.

Mateo, A. F. D., Muhlenbock, P., Kular, B., Mullineaux, P. M. and Karpinski, S. 2006. Controlledlevels of salicylic acid are required for optimal photosynthesis and redox homeostasis. *J. Exp. Botany*. **57(8):** 1795-1807.

Metwally, A., Finkemeir, I., Georgi, M. and Dietz, K. 2003. Salicylic acid alleviates the cadmium toxicity in barley seedlings. *Plant Physiol*. **132:** 272-281.

Mulpuri, V. R., Hyung-il, L., Creelman, R. A., Mullet, J. E. and Davis, K. R. 2000. Jasmonic acid signaling modulates ozone-induced hypersensitive cell death *Plant Cell.* **12:** 1633-1646.

Nicolas, M. E. and Turner, N. C. 1993. Use of chemical desiccant and senescing agents to select wheat lines maintaining grain size during postanthesis drought. *Field crops. Res*. **31:** 155-171.

Raskin, I. 1992. Role of salicylic acid in plants. *Ann Rev Plant Physiol Plant Mol. Biol.* **43:** 439-63.

Shakirova, F. M., Sakhabutdinova, A. R., Bezrukova, M. V., Fathkutdinova, R. A. and Fathkutdinova, D. R. 2003. Changes in the hormonal status of wheat seedlings induced by salicylic acid and salinity. *Plant Sci.* **164:** 317.

Shehata, S. A. M., Ibrahim, S. I. and Zaghlool, S. A. M. 2001. Physiological response of flag leaf and ears of maize plant induced by foliar application of kinetin (kin) and acetyl salicylic acid (ASA). *Ann. Agric. Sci. Ain. Shams. Univ. Cario*. **46(2):** 435-449.

Singh, B. and Usha, K. 2003. Salicylic acid induced physiological and biochemical in wheat seedling under water stress. *Plant Growth Regul*. **39:** 137-141.

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