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Short Communication

The Effect of Different Concentrations of Salicylic Acid on Yield and Yield Components of Four Varieties of Wheat in the Sistan Region

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ABSTRACT

Salicylic acid (SA) is a signaling or messenger molecule in plants and induces plant tolerance against various biotic and abiotic stresses. SA also plays an important role in the regulation of some physiological processes in plants such as effects on growth and development, ion uptake and transport and membrane permeability. Flowering is another important parameter that is directly related to yield and productivity of plants. Salicylic acid has been reported to induce flowering in a number of plants. The field experiment was laid out factorial with randomized complete block design with three replications. Treatments included varieties (a1: Bam, a2: Sistan, a3: Hirmand, a4: Hamun) as factor a and factor b consisted of salicylic acid (b1: 0 µM, b2: 900 µM, b3: 1800 µM, b4: 2700 µM). Analysis of variance showed that the effect of varieties on all characteristics was significant (Expected grain yield). Effect of salicylic acid on all characteristics was not significant (Expected spike length).

Key words: Plant height, Spike length, Harvest Index, Grain yield

INTRODUCTION

Salicylic acid (SA) is a signaling or messenger molecule in plants and induces plant tolerance against various biotic and abiotic stresses (Horvath *et al*., 2007). SA also plays an important role in the regulation of some physiological processes in plants such as effects on growth and development, ion uptake and transport and membrane permeability (Simaei *et al.,* 2012). Salicylic acid (SA) or ortho-hydroxy benzoic acid and other salicylates are known to affect various physiological and biochemical activities of plants and may play a key role in regulating their growth and productivity (Hayat *et al.,* 2010). Salicylic acid is considered to be an endogenous growth regulator of phenolic nature that enhanced the leaf area and dry mass production in corn and soybean (Khan *et al*., 2003). Enhanced germination and seedling growth were recorded in wheat, when the grains were subjected to pre-sowing seed-soaking treatment in salicylic acid (Shakirova, 2007). Fariduddin et al. (2003) reported that the dry matter accumulation was significantly increased in Brassica juncea, when lower concentrations of salicylic acid were sprayed. However, higher concentrations of salicylic acid had an inhibitory effect. Khodary (2004) observed a significant increase in growth characteristic, pigment contents and photosynthetic rate in maize, sprayed with salicylic acid. Eraslan *et al*. (2007) also reported that exogenous application of salicylic acid, enhanced growth, physiological process and antioxidant activity of carrot plants grown under salinity stress. Flowering is another important parameter that is directly related to yield and productivity of plants. Salicylic acid has been reported to induce flowering in a number of plants. Different plant species including ornamental plant *Sinningia speciosa* flowered much earlier as compared to the untreated control, when they received an exogenous foliar spray of salicylic acid (Martin-Max *et al.*, 2005) In cucumber and tomato, the fruit yield enhanced significantly when the plants were sprayed with lower concentrations of salicylic acid (Larque-Saavedra and Martin-Mex, 2007). It was reported that the foliar application of salicylic acid to soybean also enhanced the flowering and pod formation (Kumar *et al.*, 1999).Exogenous SA alters the activities of antioxidant enzymes and increases plant tolerance to abiotic stress by decreasing generation of ROS. It has been found that SA has different effects on stress adaptation and damage development of plants that depend on plant species,

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Table 1: Anova analysis of the wheat affected by varieties and salicylic acid

S.O.V	df	Plant height	Spike length	Harvest Index	Grain yield
Varieties (V)	3	215.5**	1098.9**	1188.1**	4655ns
salicylic acid (SA)	3	26.2ns	403.2*	75.82ns	861ns
R	2	0.25ns	2.33ns	40.2ns	1784ns
V*SA	9	61.73**	233.7**	160.2*	2743ns
Error	30	17.2	2.06	70.47	2014
CV (%)	-	5.07	1.32	54.7	50.05

*, **, ns: significant at $p<0.05$ and $p<0.01$ and non-significant, respectively

Table 2: Anova analysis of the wheat affected by varieties and salicylic acid

S.O.V	Treatment	Plant height	Spike length	Harvest Index	Grain yield
Varieties (V)	a1	85.4a	115.5a	21.7a	77.9b
	a2	85.1a	114.4a	25.8a	119.1a
	a3	81b	110.2b	5.7b	79.3b
	a4	76.4c	94.8c	8b	82.2sb
Salicylic acid (SA)	b1	80.1a	105.3c	15.08a	100.6a
	b2	81.5a	117.4a	18.9a	90.1a
	b3	83.5a	105.5bc	13.1a	87.8a
	b4	86.3a	106.7b	14.1a	80.07a

Any two means not sharing a common letter differ significantly from each other at 5% probability

concentration, method and time of SA application (Metwally *et al*., 2003). Furthermore, SA is a potential non-enzymatic antioxidant and an important signal molecule for modifying plant responses to environmental stressors. Some earlier reports display that exogenous SA can ameliorate the impairing effects of drought stress in different species (Arfan *et al*., 2007). SA has obtained particular attention because of inducing protective effects on plants under NaCl salinity (Simaei *et al*., 2011). Several studies have shown that the effects of cytotoxicity induced by salt stress can be ameliorated by the exogenous application of SA (Simaei *et al*., 2012).

MATERIALS AND METHODS

Location of experiment

The experiment was conducted at the zabol which is situated between 30° North latitude and 61° East longitude.

Composite soil sampling

Composite soil sampling was made in the experimental area before the imposition of treatments and was analyzed for physical and chemical characteristics.

Field experiment

The field experiment was laid out factorial with randomized complete block design with three replications.

Treatments

Treatments included varieties (a1: Bam, a2: Sistan, a3: Hirmand, a4: Hamun) as factor a and factor b consisted of salicylic acid (b1: 0 µM, b2: 900 µM, b3: 1800 µM, b4: 2700 µM).

Data collect

Data collected were subjected to statistical analysis by using a computer program SAS.

RESULTS AND DISCUSSION

Plant height

Analysis of variance showed that the effect of varieties on plant height was significant (Table 1). The maximum of plant height of treatments a1 was obtained (Table 2). The minimum of plant height of treatments a4 was obtained (Table 2). Analysis of variance showed that the effect of Salicylic acid on plant height was not significant (Table 1). The maximum of plant height of treatments b4 was obtained (Table 2). The minimum of plant height of treatments b1was obtained (Table 2).

Spike length

Analysis of variance showed that the effect of varieties on spike length was significant (Table 1). The maximum of spike length of treatments a1 was obtained (Table 2). The minimum of spike length of treatments a4 was obtained (Table 2). Analysis of variance showed that the effect of Salicylic acid on spike length was significant (Table 1). The maximum of spike length of treatments b4 was obtained (Table 2). The minimum of spike length of treatments b1was obtained (Table 2).

Harvest index

Analysis of variance showed that the effect of varieties on harvest index was significant (Table 1). The maximum of harvest index of treatments a2 was obtained (Table 2). The minimum of harvest index of treatments a3was obtained (Table 2). Analysis of variance showed that the effect of Salicylic acid on harvest index was not significant (Table 1). The maximum of harvest index of treatments b2 was obtained (Table 2). The minimum of harvest index of treatments b3 was obtained (Table 2).

Grain yield

Analysis of variance showed that the effect of varieties on grain yield was not significant (Table 1). The maximum of grain yield of treatments a2 was obtained (Table 2). The minimum of grain yield of treatments a1was obtained (Table 2). Analysis of variance showed that the effect of grain yield on harvest index was not significant (Table 1). The maximum of grain yield of treatments b1 was obtained (Table 2). The minimum of grain yield of treatments b4 was obtained (Table 2).

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