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EFFECT OF SOAKING AND FOLIAR APPLICATION OF SALICYLIC ACID AND ETHREL ON GROWTH, YIELD AND BIOCHEMICAL TRAITS OF GARLIC (*ALLIUM SATIVUM* L.) CV. G -282

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ABSTRACT

A field experiment was conducted to study the effect of soaking and foliar application of salicylic acid and ethrel on various morphological growth, yield and biochemical traits of garlic during 2014-15. The experiments were consisted thirteen treatments of salicylic acid and ethrel each at three concentrations (100, 200 and 300 ppm) laid out in Randomized Block Design with thrice replication. Application of salicylic acid at 200 ppm as soaking and foliar treatment gave minimum days to emergence (3.47), maximum plant height (92.56 cm), number of leaves per plant (11.20), length of leaves (60.67cm) and chlorophyll content of leaves (0.76 mg/100g) each at 90 DAP and clove diameter (1.10cm), clove length (3.78cm), bulb yield per plot (3.57 kg), dry matter (47.22%) and pungency (67.44 μ mol/g). while, using of ethrel at 200 ppm as soaking and foliar treatment increased number of cloves per bulb (26.22), TSS (42.35°Brix), ascorbic acid (11.66mg/100g), nitrogen (45.84%) and protein(3.27%). Therefore, it was concluded that application of salicylic acid used as soaking and foliar treatment gave better response in garlic crop.

INTRODUCTION

Garlic (*Allium sativum* L) is the most widely used cultivated *Allium* species after onion belonging to the family Amaryllidaceae. It is consumed both fresh as well as in dried form as an important ingredient for flavouring various vegetarian and non-vegetarian dishes. In the Indian subcontinent people use fresh leaves of garlic as salad and a good tasty pickle is also prepared from garlic cloves. Garlic has higher nutritive value as compared to other bulbous crops. It is a rich source of carbohydrates (29%), proteins (6.3%), minerals (0.3%) and essential oils (0.1-0.4 %) and also contains fat, vitamin C and sulphur (Memane *et al.*, 2008).

India has ranks second in area and third in production of garlic in the world. The total production of garlic in India is 1259.27 thousand metric tonnes from an area of 247.52 thousand hectares with the productivity of 6.6 MT/ha which is far less than that of China and Egypt. In Rajasthan, major garlic growing districts are Baran, Kota, Bundi, Jhalawar, Chittorgarh, Jaipur and Sikar in an area of 59.45 thousand hectare with an annual production of 235.98 thousand tons (Anonymous, 2013). In recent years, scientists have given due attention to the idea of improving the plant growth, yield and quality with the application of plant growth regulators. Today, the use of natural plant phyto-hormones is in progress viz., salicylic acid and ethrel have been recently alicylic acid and its related compounds have been indicated to induce important effect in various biological aspects in crops. These compounds inhibit certain processes and enhance other. The priming by salicylic acid improves the yield of crops and retards ethylene bio-synthesis and increase chlorophyll content. It has been recognized that salicylic acid is necessary in the single transduction for diminishing systematic acquired resistance against pathogenic infection (Ding *et al.*, 2002). Ethrel, particularly have an interesting role in modern agriculture and found to improve the bulb yield and its quality. The foliar spray of ethrel increases plant height, number of leaves, and leaf weight of bulbous plant along with increases in length, diameter and weight of bulbs as well (Habba 2003). Although, the crop is commercially important and export oriented, its yield is very low in India and Rajasthan. The poor situation of the crop may be due to its unscientific cultivation, use of local cultivars with unpredictable potential and lesser care of growers to its nutritional management. The information on the effect of salicylic acid and ethrel in bulbous crop like garlic under agro-climatic conditions of Rajasthan in black cotton soils is merge. Hence, keeping in view the present study the effect of salicylic acid and ethrel on growth, yield and quality of garlic has been undertaken .

MATERIALS AND METHODS

The experiment was carried out at Protected Cultivation Unit, Department of Vegetable Science, College of Horticulture and Forestry, Jhalrapatan city, Jhalawar in open condition during October, 2014 to March, 2015. The experiment was consisting of 13 treatments having two growth regulators *i.e.* salicylic acid and ethrel @ 100, 200 and 300 ppm viz. Control (T_0), salicylic acid 100 ppm as soaking (T_1), salicylic acid 200 ppm as soaking (T_2), salicylic acid 300 ppm as soaking (T_3),

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ethrel 100 ppm as soaking (T_4), ethrel 200 ppm as soaking (T_5), ethrel 300 ppm as soaking (T_6), salicylic acid 100 ppm as soaking and foliar spray (T_7), salicylic acid 200 ppm as soaking and foliar spray (T_8), salicylic acid 300 ppm as soaking and foliar spray (T_9), ethrel 100 ppm as soaking and foliar spray (T_{10}), ethrel 200 ppm as soaking and foliar spray (T_{11}) and ethrel 300 ppm as soaking and foliar spray (T_{12}) was given as foliar spray on the leaves at 60 DAP and soaking of seed cloves before planting according to the treatment along with water spray and without soaking as control, respectively. The experiment was laid out in randomized block design with three replications. The stock solution was first prepared for each growth regulator by diluting with distilled water and acetone. The solution of required concentration was then prepared by further dilutions of the measured volume of stock solution with distilled water. The spray of growth regulators were done at 60 days after planting. Spraying was done as per treatment for each plant taking equal volume of the solution. Spraying was done in the morning with a compressed air hand sprayer. The control plant was sprayed with distilled water. The garlic seed cloves soaked with same solution of growth regulator before 12 hour of planting into buckets. Analysis of variance for individual character was done on the basis of mean values as suggested by Panse and Sukhatme (1967).

RESULTS AND DISCUSSION

Growth parameters

The result of present study clearly indicate that the plant growth parameters increased significantly due to using of the different level of salicylic acid and ethrel as compared to control. The value of growth parameters *i.e.* minimum days to emergence (3.47), maximum plant height at 90 DAP (92.56 cm), maximum number of leaves per plant at 90 DAP (11.20), maximum length of leaves at 90 DAP (60.67 cm) and maximum chlorophyll content of leaves at 90 DAP (0.76 mg/ 100 g) were recorded under treatment T8 (cloves soaking with 200 ppm + 200 ppm with foliar spray of salicylic acid) as compared to maximum days to emergence (6.47), minimum plant height at 90 DAP (81.48 cm), minimum number of leaves

per plant at 90 DAP (10.07), minimum length of leaves at 90 DAP (53.74 cm) and minimum chlorophyll content of leaves at 90 DAP (0.61 mg/100 g) under control, respectively.

Sakhabutdinova *et al.* (2003) established that SA increased the level of cell division within the apical meristem of seedlings roots which caused an increase in plant growth. We have determined that POD activity gradually decreases by the application of decreasing SA concentration in sunflower cotyledons. It would suggest that POD activity decreases during growth period. It would suggest that growth promoting effect of SA is due to the phenomenon described above. The results of this research is also exhibited SA as plant growth regulator. (Kang *et al.*, 2005; Wilson, 2007)

Yield parameter

A perusal of result given reveals that salicylic acid and ethrel had significant role in yield parameters as compared to control. The maximum value of yield parameters *i.e.* clove diameter (1.10 cm), clove length (3.78 cm) and bulb yield per plot (3.57 kg/plot), were recorded under treatment T_8 (cloves soaking with 200 ppm + 200 ppm with foliar spray of salicylic acid) as compared to minimum clove diameter (0.93 cm), clove length (2.16) and bulb yield per plot (1.97), were recorded under control. While, the maximum number of cloves per bulb (26.22) were recorded by using treatment T_{12} (cloves soaking with 300 ppm + 300 ppm with foliar spray of ethrel) and minimum number of cloves per bulb (21.59) under control, respectively.

It may be due to the increasing in number of leaves leading to increase in more accumulation of food. Moreover, the primitive effect of salicylic acid and ethrel could be attributed to their bio-regulator effects on physiological and biochemical processes in plants such as ion uptake, cell elongation, cell division, cell differentiation, cell wall plasticity and sink/source regulation. (Dat *et al.*, 1998, Hoyos and Zhang 2000, Blokhina *et al.*, 2003 and Bai *et al.*, 2006.)

Bio-chemical traits

The result of present investigation reveals that TSS, Ascorbic acid, Dry matter content, Nitrogen content, Protein content and Pungency in bulb significantly increased with increasing levels of salicylic acid as compared to control. The application of T8 (cloves soaking with 200 ppm + 200 ppm with foliar

Table 1: Effect of salicylic acid and ethrel on plant growth parameter of garlic var. G-282

Symbols	Plant height (cm) at 90 DAP	No. of leaves / plant at 90 DAP	Length of leaves at 90 DAP	Chlorophyll content of leaves (mg/g) at 90 DAP	Days to emergence
T_0	81.48	10.07	53.74	0.61	6.47
T_1	85.68	10.60	56.78	0.72	4.27
T_2	87.49	10.80	57.74	0.73	4.27
T_3	85.29	10.53	56.57	0.69	4.33
T_4	85.15	10.67	57.20	0.69	4.33
T_5	86.66	10.80	57.59	0.72	4.40
T_6	88.00	10.93	58.74	0.73	3.93
T_7	87.19	10.87	58.53	0.72	3.87
T_8	92.56	11.20	60.67	0.76	3.47
T_9	85.32	10.67	56.09	0.70	3.93
T_{10}	85.46	10.67	56.71	0.71	4.60
T_{11}	86.95	10.87	57.44	0.73	3.80
T_{12}	89.12	10.93	59.37	0.75	3.73
S.Em \pm	1.48	0.23	0.93	0.01	0.25
CD at 5%	3.06	0.49	1.92	0.03	0.52

Table 2: Effect of salicylic acid and ethrel on plant yield parameter of garlic var. G-282

Symbols	Clove length (cm)	Clove diameter (cm)	Bulb yield per plot (kg)	Number of cloves per bulb
T ₀	2.16	0.93	1.97	21.59
T ₁	3.50	1.02	2.60	25.22
T ₂	3.76	1.05	2.86	25.78
T ₃	2.97	1.01	2.52	25.11
T ₄	2.33	0.95	2.51	24.00
T ₅	2.55	0.97	2.62	25.11
T ₆	2.55	0.99	2.63	26.18
T ₇	3.62	1.05	3.14	25.77
T ₈	3.78	1.10	3.57	25.55
T ₉	3.37	1.03	2.32	25.55
T ₁₀	2.66	0.98	2.87	25.33
T ₁₁	2.87	0.99	2.89	25.92
T ₁₂	3.01	1.00	3.05	26.22
S.Em \pm	0.29	0.02	0.34	1.10
CD at 5%	0.60	0.04	0.71	2.28

Table 3: Effect of salicylic acid and ethrel on plant biochemical traits of garlic var. G-282.

Symbols	TSS ^o Brix	Vitamin C (mg/100g)	Dry matter (%)	Nitrogen (%)	Protein (%)	Pungency (imol/g)
T ₀	36.80	9.29	39.64	1.88	11.77	62.94
T ₁	39.97	10.28	44.54	2.36	14.77	66.49
T ₂	37.39	10.37	45.90	2.46	15.38	66.73
T ₃	38.33	9.59	45.01	2.26	14.13	65.01
T ₄	40.43	9.94	44.31	2.37	14.79	65.59
T ₅	41.13	11.12	44.66	2.39	14.96	65.93
T ₆	41.30	11.24	44.19	2.67	16.71	66.57
T ₇	38.93	10.78	46.78	2.44	15.27	66.83
T ₈	40.77	10.80	47.22	2.67	16.69	67.44
T ₉	38.30	11.34	46.96	2.43	15.19	64.24
T ₁₀	41.17	10.45	45.20	2.70	16.88	65.93
T ₁₁	41.73	11.60	44.27	2.84	17.75	66.45
T ₁₂	42.35	11.66	45.84	3.27	20.42	66.28
S.Em \pm	1.30	0.69	1.62	0.27	1.74	1.11
CD at 5%	2.38	1.44	3.35	0.57	3.60	2.30

spray of salicylic acid) recorded maximum, dry matter of bulb (47.22 %) and pungency (67.44 μ mol/g) and minimum dry matter of bulb (39.64 %) and pungency (62.94 μ mol/g) was recorded under control, respectively. However, total soluble solid (42.35 °Brix), vitamin C (mg/100g), nitrogen content (3.27 %) and protein content (20.42 %) was recorded maximum with 2.30 and minimum TSS (36.80 °Brix), vitamin C (mg/100g), nitrogen content (1.88 %) and protein content (11.77 %) in control, respectively.

The responses of growth are most important phenomenons of plant physiology. In growth, which is a result of accelerated anabolic reactions in the cells and consequent nitrogen, protein, chlorophyll, DNA and RNA synthesis were studied in detail. The researchers investigating physiological changes that occur in cotyledons of various plants during growth observed that bio-chemical properties were synthesized (Palavan-Ünsalet *al.*, 2002).

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