

INFLUENCE OF FOLIAR APPLICATION OF SALICYLIC ACID AND ETHREL ON GROWTH, YIELD AND QUALITY OF GARLIC (*ALLIUM SATIVUM* L.) VAR. G-282

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ABSTRACT

A field experiment was conducted to study the effect of salicylic acid and ethrel on growth, yield and quality of garlic as a randomized block design with three replications. The phyto-hormone salicylic acid and ethrel @ 100, 200, and 300 ppm each as single and twice spray, single spray done at 45 DAP and twice spray done at 60 DAP with 13 treatments. The application of treatment T₈ (salicylic acid 200 ppm with twice spray) was found most effective in parameters *i.e.* number of leaves per plant (11.13), chlorophyll content of leaves at 90 DAS (0.76 mg/g), fresh bulb weight (57.66 g), bulb length (4.16 cm), clove diameter (1.10cm), yield of bulb per hectare (214.20q), dry matter of bulb (47.00%) and pungency (67.71 μmol/g) as compare to control. Further, the treatment T₁₂ was found at par with treatment T₈ for number of leaves per plant, chlorophyll content of leaves, dry matter content and pungency. The maximum net return (246201) and B:C ratio (3.28) were also recorded under treatment T₈ (salicylic acid @ 200 ppm with twice spray). Therefore, it may be concluded that the use of salicylic acid (200 ppm with twice spray) was found best in most of parameter and in economic feasibility.

INTRODUCTION

Garlic is second most cultivated *allium* after onion. It is belonging to *Amaryllidaceae* family grown in tropical and sub-tropical regions. Garlic has been used as spice and food ingredient in cooking all over the world because it combines well with an enormous range of food, adding its own aroma and flavour as well as enhancing the flavour of the foods with which it is mixed. 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 phytohormones is in progress. Salicylic acid and ethrel have been recently added and have shown as potential tool in enhancing growth of plant (Wang and Altman, 2003). Salicylic acid is a phenolic growth regulator, which participates in the regulation of physiological and molecular mechanism to adjust plant in adverse environmental conditions. Ethrel, particularly has an interesting role in modern agriculture. It has been found to improve the bulb yield and its quality (Tiwari *et al.*, 2003). In the same respect, Habba (2003) reported that foliar spray of ethrel increases

plant height, number of leaves and leaf weight of bulbous plant. At the same time it also increases length, diameter as well as weight of bulbs. Keeping of view the information on the effect of salicylic acid and ethrel in garlic under agro-climatic conditions of Rajasthan in black cotton soils merge.

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 was given as foliar spray on the leaves in the morning according to the treatment at 45 and 60 DAP for single and twice spray along with water spray as control, respectively. The experiment was laid out in randomized block design with three replications. 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 first spray of growth regulators were done at 45 days after planting while second spray was 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 data generated during the experimentation were subjected to statistical analysis of

variance. Data was analyzed using analysis of variance (ANOVA) according to the procedure described by Panse and Sukhatme (1985) Critical difference(CD) with in the treatment was calculated in order to compare the treatment at 5% level of significance only.

RESULTS AND DISCUSSION

Effect of salicylic acid and ethrel on growth attributes

The result of present study clearly indicate that number of leaves per plant and chlorophyll content of leaves increased significantly due to application of different levels of salicylic acid and ethrel as compared to control. The maximum value of growth parameters *i.e.* number of leaves per plant (11.13) and Chlorophyll content of leaves at 90 DAS (0.76 mg/g) was recorded under treatment T₈ (salicylic acid 200 ppm with twice spray) as compared to minimum number of leaves per plant (9.93), and Chlorophyll content of leaves at 90 DAS (0.61 mg/g) under control, respectively. Further, treatment T_{12'}, T_{8'}, T_{2'}, T₁₀ and T₁₁ for number of leaves per plant and T_{12'}, T_{11'}, T₂ and T₆ for chlorophyll content of leaves was found at

par with the treatment T₈.

This may be due to fact that salicylic acid is considered to be a potent plant hormone and plays diverse regulatory roles in plant metabolism. It potentially generates a wide array of metabolic responses in plants which enhance plant growth. It may, therefore be concluded that the sustained increase in the observed parameters expectedly culminated in maximization of the process of biomass accumulation leading to higher growth. Thus adequate supply of salicylic acid on crop resulted in increased metabolic activity at the cellular level might have increased the nutrient uptake and accumulation in the vegetative plant parts which in turn resulted in improved plant growth attributes (Yildirim *et al.*, 2008 and Jayalakshmi *et al.*, 2010). Ethrel application restricted vegetative growth of plants during early growing season and it decreased in plant height was compensated by increase in radial growth because of The 2-chlorethylphosphonic acid induced anatomical and biochemical changes of cambium and enhanced stability of bark accordingly the shoots growth slowed down. Findings are related with results of Pekason *et al.*, 1995 in cucumber and Jaiswal *et al.*, 2014 in soyabean.

Table 1 : Effect of salicylic acid and ethrel on growth and yield parameters of garlic

treatments	No of leaves per plant	Chlorophyll content in leaves at 90 DAP (mg/100g)	Weight of bulb (g)	Length of bulb (cm)	Bulb diameter (cm)	Yield of bulb per ha.
T ₀	9.93	0.61	43.46	3.05	3.86	111.6
T ₁	10.53	0.72	53.23	3.6	4.51	151.6
T ₂	10.73	0.73	54.11	3.77	4.81	160.2
T ₃	10.47	0.69	52.73	3.45	4.17	131
T ₄	10.47	0.69	48.33	3.43	4.62	150.8
T ₅	10.53	0.72	50.15	3.48	4.78	157
T ₆	10.6	0.73	51.08	3.51	4.96	157.8
T ₇	10.87	0.72	55.25	3.83	4.67	168.2
T ₈	11.13	0.76	57.7	4.16	5.17	214.2
T ₉	10.53	0.7	54	3.7	4.51	139.4
T ₁₀	10.73	0.71	50.56	3.46	4.95	172.4
T ₁₁	10.73	0.73	52.2	3.5	5.04	173.2
T ₁₂	10.87	0.75	54.23	3.66	5.67	183.4
S.Em+	0.23	0.01	1.67	0.18	0.32	11.61
CD at 5%	0.49	0.03	3.46	0.38	0.66	23.97

Table 2: Effect of salicylic acid and ethrel on quality parameters of garlic

Treatments	Dry matter content (%)	Pungency (¼mol/g)	TSS (°Brix)	Ascorbic acid (mg/100g)	B:C Ratio
T ₀	39.64	62.8	36.8	9.29	1.23
T ₁	44.54	65.57	38.43	10.28	2.03
T ₂	46.57	66.44	38.63	10.37	2.2
T ₃	43.45	64.52	37.67	9.47	1.62
T ₄	43.95	64.62	39.43	9.61	2.01
T ₅	44.43	64.87	39.5	10.12	2.14
T ₆	44.19	65.24	39.63	10.58	2.15
T ₇	45.45	66.83	39.6	10.44	2.36
T ₈	47	67.71	40.73	10.82	3.28
T ₉	43.96	64.58	38.53	9.97	1.78
T ₁₀	44.57	65.25	39.83	10.12	2.44
T ₁₁	44.27	65.78	40.07	10.26	2.46
T ₁₂	45.84	66.64	41.83	12	2.66
S.Em+	1.16	0.89	0.93	0.56	
CD at 5%	2.39	1.84	1.39	1.16	

Effect of salicylic acid and ethrel on yield attributes

Application of different levels of salicylic acid and ethrel significantly increased the weight of bulb, bulb diameter, length of bulb and bulb yield per hectare over control. The maximum weight of bulb (57.66 g), length of bulb (4.16 cm) and yield of bulb per hectare (214.20qt) was found under treatment T₈ (salicylic acid 200 ppm with twice spray) and minimum fresh weight of bulb (43.46 g), length of bulb (3.05cm) and yield of bulb per hectare (111.60 q) was recorded under control, respectively. However, the bulb diameter (5.67 cm) was found maximum under application of treatment T₁₂ (ethrel @ 300 ppm with twice spray) and minimum bulb diameter (3.86 cm) was recorded under control, respectively. Further, treatment T₇ and T₁₂ for weight of bulb, T₇ for bulb length was found at par with the treatment T₈. While, treatments T₈ and T₁₁ was found at par with treatment T₁₂ for bulb diameter. It may be due to the fact that salicylic acid and ethrel are important regulator of photosynthesis because it affects leaf and chloroplast structure, stomatal closure, chlorophyll and carotenoid contents and the activity of enzymes such as RuBisCO (ribulose-1,5bisphosphate carboxylase/oxygenase) and it may be resulting in greater transfer of photo-assimilates to the bulb and increasing in number of leaves per plant with increase in plant growth characters may be attributed in large part to the augmented effect on cell division in the sub apical meristems and cell enlargement growth regulator on cell division in the sub apical meristems and cell enlargement, photosynthetic parameters and plant water relations causing increase in yield and weight of bulb. Similar results observed by Stevens *et al.*, 2006 in tomato and Bano *et al.*, 2009 in cucumber.

Effect of salicylic acid and ethrel on qualitative attributes

The result of present investigation reveals that TSS, Ascorbic acid, Dry matter content and Pungency in bulb was significantly increased with increasing levels of salicylic acid and ethrel as compared to control. The application of T₈ (salicylic acid 200 ppm with twice spray) recorded maximum, dry matter of bulb (47.00%) and pungency (67.71 μ mol/g) and minimum dry matter of bulb (39.64%) and pungency (62.80 μ mol/g) was recorded under control, respectively. However, total soluble solid (41.83oBrix) and ascorbic acid (12.00 mg/100g of edible portion) was recorded maximum with spray of T₁₂ (ethrel 300 ppm with twice spray) and minimum TSS (36.80° Brix) and ascorbic acid (9.29 mg/100g of edible portion) in control. Further, treatment T₁₂ and T₇ for dry matter content of leaves and T₇, T₁₂ and T₂ for pungency was found at par with the treatment T₈ while and Treatment T₈ and T₁₁ for total soluble solids was found at par with T₁₂, 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, sink/source regulation, enzymatic activities and protein syntheses as well as increase the antioxidant capacity of plants and it is also increased the bulb quality by overcoming adverse effect of fungal development and ethylene production and it was presumed to be enhanced activation of some enzymes such as ascorbate peroxidase which increases

antioxidant ability and ascorbic acid amount, increase in nitrogen, proteins, total soluble solids content and it may be directly or indirectly affect in qualitative attributes of garlic bulb. These findings are in close proximity with Caprita and Caprita 2005, Kakade *et al.*, 2009 in sponge gourd and Thappa *et al.*, 2011 in cucumber.

Effect of salicylic acid and ethrel on economics of treatment

Significant increase in net returns and B: C ratio was obtained with application of salicylic acid 200 ppm, ethrel 300ppm. The treatment T₈ (salicylic acid 200 ppm with twice spray) registered maximum value of Rs. 246201 with highest B : C ratio (3.28) and significantly superior over control (Rs. 92346 and B : C ratio 1.23), respectively. Increase in net returns and B: C with application of salicylic acid might be due to higher yield and low cost inputs. Results are in accordance with Tiwari *et al.*, 2003 in onion.

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