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Effect of foliar application of chemicals on growth and yield of garlic (*Allium sativum* L.) var. GG-4

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Abstract
An experiment was conducted on the effect of foliar application of chemicals on growth and yield of garlic (*Allium sativum* L.) var. GG-4 during the year 2015-16 at Regional Horticultural Research Station, Navsari Agricultural University, Navsari (Gujarat). The experiment was laid out in a Randomized Block Design with three replications and nine treatments. Among the all treatments, the foliar application of 100 ppm citric acid + 300 ppm thiourea (T_8) at 30 and 60 DAS obtained the maximum plant height at 60 and 90 DAS (43.02 cm and 59.10 cm), maximum number of leaves at 60 and 90 DAS (8.03 and 11.20) with earliest in maturity (127.28 days). However, the bulb characters like fresh weight (24.88 g) and dry or cured weight (20.19 g) of bulb, diameter of bulb (35.92 mm), number of cloves per bulb (19.67), clove weight (2.00 g), clove length (2.73 cm), yield per plot (3.52 kg/plot) and yield per ha (7.04 t/ha) was significantly influence by the foliar application of 100 ppm citric acid + 300 ppm thiourea (T_8) in garlic var. GG-4.

Keywords: Chemicals, foliar spray, garlic, growth and yield

Introduction
Garlic (*Allium sativum* L.) commonly termed as "*Lahsun*", is one of the most important spices belonging to the family Amaryllidaceae with chromosome number 2n=16 and is second most widely used, cultivated Allium after onion. It is rich in protein, phosphorus, calcium, magnesium, carbohydrates and vitamin C. Garlic is grown all over India on an area of 2.48 lakh hectares with total production of 12.59 lakh metric tonnes having productivity of 5.1 MT/ha. In Gujarat, it occupies an area of 39.20 thousand hectare with total production 277.46 thousand MT. The productivity of garlic in Gujarat is 7.07 tons per ha (Anon., 2014) [2]. Particularly in Gujarat, it is cultivated at Bhavnagar, Junagadh, Rajkot, Jamnagar and Amreli districts. However, it is grown on small scale in South Gujarat region. Garlic cultivation has assured interest among the farmers of Gujarat and other parts of the country because of its steadily increasing demand in the market at an attractive rate. Increase in demand of garlic obviated the necessity to increase its production, for which maximization of the bulb yield per unit area is rather a more desirable proposition than increasing the area under cultivation. At present, adoption of non scientific and mono cropping cultivation techniques of paddy, sugarcane and other horticultural crop required excessive amount of fertilizer and irrigation which have resulted into twin problem of water logging and secondary salinization which leads to drastic reduction in yield of crops under South Gujarat condition (Anon., 2003) [1]. Under this situation, garlic being a more remunerative crop requires less irrigation water (45 to 50%) as compared to summer paddy and sugarcane can fit in prevailing multi-cropping system in South Gujarat. So, there is a need to conduct the research on garlic by using different chemicals such as urea, thiourea, citric acid etc. under South Gujarat condition.

Material and methods
The present investigation was carried out at RHRS farm, ASPEE Collage of Horticulture and Forestry, Navsari Agricultural University, Navsari, Gujarat during the year 2015-16. The experiment was laid out in Randomized Block Design with three replication and nine treatments *viz.*, 1% urea (T_1), 2% urea (T_2), 50 ppm citric acid (T_3), 100 ppm citric acid (T_4), 200 ppm thiourea (T_5), 300 ppm thiourea (T_6), 50 ppm citric acid + 200 ppm thiourea (T_7), 100 ppm citric acid + 300 ppm thiourea (T_8) and control (T_9). The experiment plot was thoroughly prepared by ploughing and harrowing before sowing of garlic cloves and applied required quantity of FYM (20 t/ha) as well as inorganic fertilizers (50-50-50 kg NPK/ha).

The required quantity of clove (500 kg/ha) for experimental area was worked out and sowing of cloves at 20cm x15cm was carried out in the first week of December-2015. The first foliar spray of chemicals was applied at 30 DASand second was applied at 60 DAS. For recording different observations like growth and yield, ten plants of garlic from each net plot area were selected randomly in the beginning and tagged with the labels.

Results and discussion

Effect on vegetative parameters

The data presented in Table 1 showed that the vegetative parameters affected by foliar application of different chemicals on garlic. Significantly maximum plant height at 60 and 90 DAS (43.02 cm and 59.10 cm), maximum number of leaves at 60 and 90 DAS (8.03 and 11.20) and minimum days to maturity (127.28 days) were noted in by 100 ppm citric acid + 300 ppm thiourea (T_8). This may be due to the effect of chemicals on cell division and cell elongation during plant growth stage (Haldar *et al.,* 2012) [5]. In addition, thiourea is good source of nitrogen and sulfur which promote vegetative growth of the plant. The favourable effect of thiourea on plant growth might be due to improved photosynthetic efficiency and bioregulatory role in plants (Meena *et al*., 2015) [9]. Nitrogen increases chlorophyll content in leaves thus, resulting in higher photosynthetic rate and higher vegetative growth of the plant (Pooja Rani *et al.,* 2015) [11]. Citric acid alters the hydrocarbon partitioning towards pathways that are more related to resistance to unfavourable conditions and secondary metabolism in Dill (Jaafari and Hadavi, 2012b) [7]. Similar findings were also found by Jaafari and Hadavi (2012a) [6] in Basil and Maleki *et al*. (2013) [8] in Sweet Basil.

Effect on yield and yield parameters

All the important attributes related to bulb characteristics and bulb yield were significantly influenced by the foliar application of chemicals (Table 2). Significantly maximum fresh weight (24.88 g) and dry weight (20.19 g) of bulb, bulb diameter (35.92 mm), number of cloves per bulb (19.67), clove length (2.73 cm) and clove weight (2.00 g) were recorded when the garlic crop treated with 100 ppm citric acid + 300 ppm thiourea (T_8). The increase in yield attributing characters only due to the foliar application of thiourea and citric acid. Thiourea induce large number of reproductive sinks leading to greater activity of carboxylating enzymes thus resulting in higher photosynthetic rates with greater translocation and accumulation of metabolites in sink and ultimately higher yield (Nehra *et al.,* 2006) [10]. Similar response with foliar spray of thiourea was also recorded by Balai and Keshwa (2011) [3], Shanu *et al*. (2013) [12] in coriander and Gupta and Yadav (2009) [4] in fenugreek. Foliar spray of citric acid could result in stimulation or increase in proton pump activity in roots. This stimulatory effect may be also occurring with foliar application and transferred to root and resulting an increase in organic acid and protons efflux. This can increase the uptake of ions such as nitrogen and phosphorus by plants, which ultimately enhance yield and yield attributes (Maleki *et al.,* 2013) [8]. The obtained result is good agreement with the result of Jaafari and Hadavi (2012a) [6] and Jaafari and Hadavi (2012b) [7].

The maximum yield (3.52 kg/plot) and total yield (7.04 t/ha) of garlic were significantly influenced by the foliar application of 100 ppm citric acid + 300 ppm thiourea (T_8). This is might be due to the production of taller plants with higher number of leaves, leading to increased formation of vegetative structure for nutrient absorption, photosynthesis and production of assimilates to fill the sink which result in higher yield. Similar finding were also noticed by Haldar *et al*. (2012) [5].

Table 1: Effect of foliar application of chemicals on growth parameters of garlic var. GG-4

Treatments	Plant height (cm)		No. of leaves per plant		Maturity days
	60 DAS	90 DAS	60 DAS	90 DAS	
T_1: Urea 1%	35.53	50.20	6.80	9.57	131.28
T_2: Urea 2%	34.58	51.69	6.87	9.73	130.16
T_3: Citric acid 50 ppm	30.09	46.27	6.37	8.97	132.29
T_4: Citric acid 100 ppm	32.72	49.79	6.50	9.43	131.24
T_5: Thiourea 200 ppm	34.74	50.42	6.87	9.53	129.00
T_6: Thiourea 300 ppm	36.44	51.78	7.13	10.00	128.35
T_7: Citric acid 50 ppm + Thiourea 200 ppm	41.80	57.55	7.70	10.80	127.99
T_8: Citric acid 100 ppm + Thiourea 300 ppm	43.02	59.10	8.03	11.20	127.28
T_9: Control	27.58	38.33	5.67	7.90	136.29
S.E.M±	1.65	2.36	0.32	0.46	1.01
C.D. at 5%	4.95	7.08	0.96	1.39	3.04
C.V.%	8.14	8.10	8.12	8.34	1.35

Table 2: Effect of foliar application of chemicals on yield parameter of garlic var. GG-4.

Treatments	Fresh weight (g)	Dry (cured) weight (g)	Diameter of bulb (mm)	Number of cloves per bulb	Clove weight (g)	Clove length (cm)	Yield (kg/plot)	Yield (t/ha)
T_1: Urea 1%	20.21	15.90	30.94	16.33	1.49	2.13	2.54	5.08
T_2: Urea 2%	21.48	16.37	32.94	16.33	1.56	2.37	2.80	5.60
T_3: Citric acid 50 ppm	19.04	14.78	28.24	14.67	1.43	1.93	2.24	4.48
T_4: Citric acid 100 ppm	19.76	15.34	29.90	15.00	1.49	2.17	2.51	5.02
T_5: Thiourea 200 ppm	20.18	16.28	31.25	16.00	1.63	2.30	2.77	5.54
T_6: Thiourea 300 ppm	22.21	18.19	33.57	18.00	1.79	2.37	2.88	5.75
T_7: Citric acid 50 ppm + Thiourea 200 ppm	23.27	19.26	34.79	19.33	1.95	2.60	3.16	6.32
T_8: Citric acid 100 ppm + Thiourea 300 ppm	24.88	20.19	35.92	19.67	2.00	2.73	3.52	7.04
T_9: Control	16.17	12.49	24.52	12.33	1.31	1.67	1.73	3.47
S.E.M±	1.06	0.82	1.47	1.11	0.09	0.15	0.17	0.35
C.D. at 5%	3.20	2.47	4.42	3.35	0.28	0.45	0.52	1.05
C.V.%	8.90	8.66	8.16	11.82	9.96	11.73	11.41	11.41

Conclusion

Due to low production of garlic in South Gujarat an attempt was made to increase the production by supplementing recommended dose of NPK with foliar application of different chemicals. In the present study foliar application of 100 ppm citric acid + 300 ppm thiourea increase growth and yield parameters and proved as a better treatment for garlic var. GG-4.

References

1. Anonymous. Project completion report in Indo-Dutch network programme for operational research on the control of water logging and salinization in irrigated agricultural lands. Soil and Water Management Research Unit, Navsari Agricultural University, Navsari, 2003.
2. Anonymous. Indian Horticultural Database, NHB, Ministry of Agriculture, Gurgaon, India, 2014.
3. Balai LR, Keshwa GL. Effect of thiourea on yield and nutrient uptake of coriander (*Coriandrum sativum* L.) varieties under normal and late shown conditions. Journal of Spices and Aromatic Crops. 2015; 20(1):34-37.
4. Gupta DK, Yadav SS. Response of fenugreek to varying levels of sulphur and bio-regulators. Published by S.K.N. College of Agriculture in National seminar on Spices and Aromatic plants in 21th century India. 2009, 67.
5. Haldar A, Naruka IS, Singh PP, Rathore SS. Effect of antioxidants on growth, yield and quality of garlic (*Allium sativum* L.). Medicinal Plants, 2012; 4(4):206-211.
6. Jaafari N, Hadavi E. Growth and essential oil yield of Basil (*Ocimum basilicum* L.) as affected by foliar spray of citric acid and salicylic acid. Journal of Medicinal and Spices Plants. 2012a; 17(2):80-83.
7. Jaafari N, Hadavi E. Growth and essential oil yield of Dill (*Anethum graveolens*) as affected by foliar sprays of citric acid and malic acid. Acta Horticulture. 2012b; 9(55):287-290.
8. Maleki V, Ardakani MR, Rejali F, Taherpour AA. Physiological response of Sweet basil to triple inoculation with azotobacter, azospirillum, glomus interaradices and foliar application of citric acid. Annals of Biological Research. 2013; 4(1):62-71.
9. Meena SK, Jat NL, Sharma B, Meena VS. Effect of plant growth regulators and sulfur on productivity and nutrient concentration of coriander (*Coriandrum sativum* L). Environment & Ecoloy, 2015; 33(3A):1249-1253.
10. Nehra KC, Kumat PD, Singh BP. Response of fenugreek (*Trigonella foenum-graecum*) to phosphorus, sulphur and plant growth regulators under semi arid plains zone of Rajasthan. Indian Journal of Agronomy. 2006; 51(1):73-76.
11. Pooja Rani, Panghal VPS, Rana MK, Dushan DS. Response of garlic to foliar application of urea and micronutrients. International Journal of Tropical Agriculture. 2015; 33(4):2845-2849.
12. Shanu, Naruka IS, Singh PP, Shaktawat RPS, Verma KS. Effect of seed treatment and foliar spray of thiourea on growth, yield and quality of coriander (*Coriandrum sativum* L.) under different irrigation levels. International Journal of Seed Spices, 2013; 3(1):20-25.