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Effect of foliar application of organic liquids on yield and quality of garlic (*Allium sativum*)

Sowmya, K; Bhalerao P P* and Patil, S J

ASPEE College of Horticulture and Forestry Navsari Agricultural University Navsari (Gujarat), India

Abstract

The effect of foliar application of organic liquids on growth, yield and quality of garlic (*Allium sativum* L.) cv. Yamuna Safed-3" was studied at Regional Horticultural Research Station, ASPEE College of Horticulture and Forestry, Navsari Agricultural University, Navsari, Gujarat during *rabi* season (2019-20). The experiment was laid out in randomized block design with three replications and nine treatments, *viz. Panchagavya,* novel plus, *Jeevamrut* and cow urine at each of 1% and 2% concentration and the control (no spray). The foliar application of *Panchagavya* @ 2 % (T_2) gave significantly maximum plant height (55.05 and 60.61 cm at 75 and 90 DAP, respectively), whereas maximum number of leaves/plant (7.0 and 8.13 at 75 and 90 DAP, respectively) and minimum days to maturity (127.37 days) were also reported in novel plus @ 2 % (T_4). The novel plus @ 2 % (T_4) recorded significantly maximum fresh weight of bulbs (24.79 g), dry weight of bulbs (16.73 g), diameter of bulb (3.75 cm), number of cloves/ bulb (18.60), weight of clove (2.16 g), length of clove (3.48 cm) and yield of bulbs (3.97 kg/plot and 7.87 t/ha). The plants sprayed with novel plus @ 2 % (T_4) recorded higher total soluble solids (16.87 and 22.43 ^{0}Brix at 2 and 4 MAH, respectively), ascorbic acid content (20.30, 18.30 and 15.97 mg at 2, 4 and 6 MAH, respectively) with maximum storage life of 219.67 days at room temperature. However, maximum net income of ₹2,36,012/ha with a benefit: cost ratio of 3.00 was recorded in foliar spray of Novel plus @ 2 % (T_4) as compared to rest of the treatments.

Key words: Garlic, *Panchagavya,* Novel plus, *Jeevamrut,* Cow urine and Foliar application

Garlic (*Allium sativum* L.) belongs to the family Amaryllidaceae. In Gujarat. it is cultivated in an area of 13,320 hectares with production of 105,160 tonnes (DAC&FW, 2020). Foliar fertilization or foliar feeding entails the supply of nutrients, plant hormones, stimulants and other beneficial substances in liquid form to plant through leaves and stems and other sites to realize enhanced yield. The advantage of organic liquid manure is that they disperse in water and it is rapidly taken by plants compared to solid organic fertilizers, helping in overcoming temporary, acute nutrient shortages in crops (Dhanoji *et al.*, 2018). *Panchagavya* and *Jeevamrut* are the organic inputs, which can act as a growth stimulant and immunity booster. Novel plus is a banana pseudostem based organic liquid nutrients. Therefore, the experiment was conducted to study the effect of foliar application of organic liquid sources on growth, yield and quality of garlic cv. Yamuna Safed-3".

***Corresponding author:** pankaj5bhalerao@nau.in

Materials and methods

The field experiment was conducted at Regional Horticultural Research Station, ASPEE College of Horticulture and Forestry, Navsari Agricultural University, Navsari (Gujarat), during *rabi* season (2019-20) to evaluate the effect of foliar application of organic liquids on, yield and quality of garlic cv. Yamuna Safed-3". The soil of experimental plot was clay with pH of 7.9 and 8.1 at 0-15 cm and 15-30 cm depths, respectively. The fertility of soil was relatively low in available N (220-240 kg/ha) and medium in available P_2O_5 (95-101 kg/ha) and rich in K_2O (270-280 kg/ha). The Randomized Block Design with three replications and nine treatments comprising *Panchagavya* @ 1% (T_1) and 2% (T_2), novel plus @ 1% (T_3) and 2% (T_4), *Jeevamrut* @ 1% (T_5) and 2% (T_6), cow urine @ 1% (T_7) and 2% (T_8) and control (T_9) was used.

The experimental plots were prepared by one deep ploughing, followed by one harrowing. Healthy bulbs of cv. Yamuna Safed-3 were collected from NHRDF, Rajkot, Gujarat and cloves were planted on raised beds of 110cm at a spacing of 20cm × 10cm during second

week of December 2019. The above said solutions were given as foliar spray at 30 and 60 DAP to the respective treatments. The observations on growth and yield attributes were recorded at 45, 75 and 90 DAP from ten selected plants per plot which were tagged with labels, whereas, quality parameters were recorded 2, 4 and 6 months after harvesting of bulbs.

Results and Discussion

Foliar application of organic liquid sources gave significant growth attributes of (Table 1). The plant height at 45 days after planting was found to be non-significant. However, plant height was significantly affected at 75 and 90 DAP. The maximum plant height was reported with *Panchagavya* 2% (T_2) treatment, *i.e.* 55.05 cm at 75 DAP and 60.61 cm at 90 DAP. The plant height might be increased due to application of *Panchagavya* which contains nitrogen, phosphorus, potassium, micro nutrients and growth hormones. The biofertilizers in liquid formulation which might have favored rapid cell division and elongation resulted in enhanced growth rate of plants (Ranpariya *et al.,* 2020).

Besides Indole Acetic Acid and gibberellic acid have also been reported in *Panchagavya* (Perumal *et al.,* 2006) which might have accelerated the mobility of photosynthates. The number of leaves/plant was not influenced significantly at 45 DAP. However, it was maximum in T_4 *i.e.* novel plus @ 2% (7.0 at 75 DAP and 8.13 at 90 DAP). This might be due to nitrogen content of novel plus which proliferated rate of vegetative development, resulted in maximum number of leaves. Moreover, nitrogen increases the cation exchange capacity of plant roots and makes them potent in absorbing other nutrients. To add on, nitrogen present in novel plus is responsible for formation, growth and development of cells and accelerating the formation of meristematic tissues. The plants sprayed with novel plus @ 2 % matured early (127.37 days). This might be due to hormones and nutrients which are present in novel plus may enhanced early maturity of bulbs. Another reason might be attributed to nitrogen availability which is one of the major and indispensable constituents of proteins and nucleic acid molecules, which ultimately trigger rate of photosynthesis (Pooja Rani *et al.*, 2015) results in early completion of vegetative growth.

The maximum fresh weight and dry weight of bulbs was noticed in T_4 (novel plus @ 2%), *i.e.,* 24.79 g and 16.73 g, respectively (Table 1). This is due to the nutrients which are present in novel plus might

Table 1: Effect of organic liquid sources on growth and yield attributes of garlic cv. Yamuna Safed-3

Treatment	Plant height (cm)			Number of leaves/ plant			Days to maturity	Fresh weight (g)	Dry weight (g)	Bulb diameter (cm)	No. of cloves per bulb	Weight of clove (g)	Length of cloves (cm)	Yield (t/ha)
	45 DAP	75 DAP	90 DAP	45 DAP	75 DAP	90 DAP								
T_1: *Panchagavya* @ 1%	39.67	51.17	58.08	4.23	5.20	6.53	131.23	20.46	14.64	3.34	15.30	1.63	2.86	6.59
T_2: *Panchagavya* @ 2%	40.53	55.05	60.61	4.33	6.00	7.03	129.40	21.61	15.44	3.53	16.00	1.91	3.20	7.24
T_3: Novel plus @ 1%	39.07	50.04	54.80	4.30	5.43	7.00	130.30	21.52	14.98	3.43	15.60	1.74	3.16	6.98
T_4: Novel plus @ 2%	40.08	53.13	58.83	4.43	7.00	8.13	127.37	24.79	16.73	3.75	18.60	2.16	3.48	7.87
T_5: *Jeevamrut* @ 1%	38.83	50.10	53.02	4.00	4.83	6.10	133.33	19.33	13.29	3.06	14.00	1.45	2.42	6.18
T_6: *Jeevamrut* @ 2%	39.03	50.83	56.47	4.20	5.03	6.57	132.67	20.37	14.61	3.29	14.57	1.51	2.61	6.53
T_7: Cow urine @ 1%	38.73	45.11	52.37	3.87	4.50	6.00	135.40	18.50	12.41	2.81	13.33	1.18	2.32	6.40
T_8: Cow urine @ 2%	38.83	48.27	53.02	4.13	4.63	6.07	134.40	19.60	13.23	3.15	14.40	1.23	2.35	6.04
T_9: Control (No spray)	36.83	44.00	48.03	3.87	4.20	5.47	136.37	17.50	12.15	2.70	13.03	0.90	2.26	5.90
S.Em.±	1.68	1.53	2.09	0.17	0.20	0.28	1.11	1.07	0.72	0.12	0.62	0.09	0.13	0.28
CD (5%)	NS	4.63	6.33	NS	0.60	0.85	3.36	3.23	2.19	0.34	1.88	0.26	0.41	0.83
CV (%)	7.45	5.33	6.60	7.14	6.51	7.47	1.46	9.07	8.84	6.01	7.22	9.86	8.50	7.24

have increased the growth character by cell division, cell elongation and cell enlargement coupled with increase in photosynthesis rate which leads to better accumulation of food material in plants that might have ultimately increased the weight of bulbs (fresh and dry) and cloves (Govind *et al.*, 2015).

It might be due to increased number of leaves with spray of novel plus which helps in accumulation of photosynthates and their utilization for build-up of new cells, resulting in increased dry matter production (Singh *et al.*, 2013 and Umamaheswarappa *et al.*, 2014). The maximum diameter of bulb (3.75 cm), number of cloves/bulb (18.60), clove weight (2.16 g), clove length (3.48 cm) and yield (3.97 kg/plot) were recorded in T_4, *i.e.*, novel plus @ 2%. This might be due to novel plus consisting of lavish amount of macro and micronutrients which ameliorate photosynthetic activity leads to augment in production and allocation of carbohydrates and photosynthesis which ultimately increases the yield and yield attributing characters (Singhal *et al.*, 2015).

The nutrients N and K at higher rate exerted a significant positive influence on yield attributes. The other bio-parameters which could have helped in increase of yield were synthesis of carbohydrates and their translocation to the potential storage organs (Kalariya *et al.*, 2018). Moreover, maximum number of leaves and leaf length might have influenced yield attributes as they have physiological capacity to mobilize and translocation of photosynthates to organ of economic value which in turn might have increased bulb yield (Nandini *et al.*, 2018).

There were significant difference in total soluble solids content of bulbs at 2 and 4 MAH. Whereas, it was found non-significant at 6 MAH. The maximum TSS value (16.87°Brix, 22.43°Brix at 2 and 4 MAH, respectively) with ascorbic acid content (20.30 mg, 18.30 mg, 15.97 mg at 2, 4 and 6 MAH respectively) and storage life of bulbs (219.67 days) at room temperature was reported in T_4 (novel plus @ 2%). The spray of organic liquid nutrients has no significant effect on physiological loss in weight after 2, 4 and 6 months of storage. However, minimum physiological loss in weight was observed in T_4 (novel plus @ 2%) *i.e.* 12.32, 22.17 and 29.67 % at 2, 4 and 6 MAH, respectively.

The results showed that plants sprayed with novel plus @ 2% (T_4) have significantly maximum TSS, ascorbic acid content with storage life of bulbs. This might be due to the nutrients present in novel plus which

Table 2: Effect of organic liquid sources on quality and economics of garlic cv. Yamuna Safed-3

Treatment	TSS (°Brix)			Ascorbic acid (mg/100g)			PLW (%)			Marketable yield (t/ha)	Cost of cultivation (₹/ha)	Treatment cost (₹/ha)	Fixed cost (₹/ha)	Gross income (₹/ha)	Net income (₹/ha)	BCR
	2 MAH	4 MAH	6 MAH	2 MAH	4 MAH	6 MAH	2 MAH	4 MAH	6 MAH							
T_1	16.10	21.07	31.63	19.37	17.70	14.83	14.83	24.87	33.33	6.59	55,273	2,740	16,475	2,63,600	1,89,112	2.54
T_2	16.43	22.23	32.10	19.90	18.23	15.80	13.83	24.41	32.60	7.24	55,273	4,240	18,100	2,89,600	2,11,987	2.73
T_3	16.30	21.57	31.83	19.63	18.20	15.23	14.30	24.83	33.18	6.98	55,273	2,540	17,450	2,79,200	2,03,937	2.71
T_4	16.87	22.43	33.97	20.30	18.30	15.97	12.32	22.17	29.67	7.87	55,273	3,840	19,675	3,14,800	2,36,012	3.00
T_5	14.10	20.50	31.17	18.63	16.27	13.63	17.33	27.00	34.00	6.18	55,273	2,040	15,450	2,47,200	1,74,437	2.40
T_6	14.43	20.53	31.20	19.03	17.20	14.10	16.98	26.27	36.27	6.53	55,273	2,840	16,325	2,61,200	1,86,762	2.51
T_7	16.07	21.00	31.33	18.30	16.07	13.23	16.33	26.67	34.80	6.40	55,273	1,640	16,000	2,56,000	1,83,087	2.51
T_8	14.17	20.77	26.20	18.43	16.63	13.87	17.10	25.17	33.83	6.04	55,273	2,040	15,100	2,41,600	1,69,187	2.34
T_9	12.07	20.10	28.53	18.20	15.83	13.17	20.27	30.00	43.00	5.90	55,273	0	14,750	2,36,000	1,65,977	2.37
S. Em.±	0.18	0.28	1.98	0.20	0.14	0.16	1.56	1.87	2.27	6.59	55,273	2,740	16,475	2,63,600	1,89,112	2.54
C.D. at 5%	0.53	0.84	NS	0.60	0.42	0.49	NS	NS	NS	7.24	55,273	4,240	18,100	2,89,600	2,11,987	2.73
C.V. %	2.02	2.31	11.12	1.80	1.41	1.96	16.97	12.62	11.38	6.98	55,273	2,540	17,450	2,79,200	2,03,937	2.71

Selling price of garlic: ₹ 40/kg

are involved in carbohydrate synthesis, breakdown and translocation of starch, synthesis of protein and neutralization of physiologically important organic acids (Gajjela and Chatterjee, 2019). The increase in total sugars may also be attributed to adequate supply of macro and micro nutrients with 2 sprays of 2% novel plus that might synthesize and accumulate total sugars in bulbs (Shah *et al*., 2019).

The cost of cultivation, gross return, net return and B:C ratios were worked out for different treatments (Table 2). The higher net realization and maximum benefit cost ratio *i.e.* ₹2,36,012/hectare and 3.00, respectively was recorded under 2% novel plus (T_4). This might be due to the investment cost was less and yield was higher in this treatment which gives higher benefit cost ratio. This finding is in agreement with Parikh *et al.* (2020).

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