

Effect of foliar application of organic liquids on yield and quality of turmeric (*Curcuma longa*)

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ABSTRACT

A field experiment was conducted to find out the effect of foliar application of organic liquids on growth, yield and quality of turmeric (*Curcuma longa* L.) cv. GNT-2 during 2019-20 at Regional Horticultural Research Station, ASPEE College of Horticulture and Forestry, Navsari Agricultural University, Navsari, Gujarat, India. Randomized Block Design with three replications and eleven treatments, viz. panchagavya @ 4% (T₁), panchagavya @ 5% (T₂), novel organic liquid nutrients @ 4% (T₃), novel organic liquid nutrients @ 5% (T₄), jeevamrut @ 4% (T₅), jeevamrut @ 5% (T₆), humic acid @ 0.1% (T₇), humic acid @ 0.2% (T₈), cow urine @ 4% (T₉), cow urine @ 5% (T₁₀) and the control (T₁₁) was followed. The novel organic liquid nutrients 5% (T₄) registered significantly maximum plant height (93.64 cm at 150 DAP and 120.71 cm at 210 DAP) and maximum number of leaves/plant (6.27, 6.83 and 8.33) at 90, 150 and 210 DAP, respectively. However, maximum length of leaves (60.46 cm and 73.07 cm) was recorded at 150 and 210 DAP. Application of humic acid 0.2% (T₈) gave maximum number of tillers/plant at 90, 150 and 210 DAP (1.27, 2.53 and 3.50, respectively). Substantial effect of foliar application of novel organic liquid nutrients at 5% (T₄) gave more number of mother rhizomes/plant (3.53), number of finger rhizomes/plant (18.20), weight of mother rhizome (52.73 g), weight of finger rhizomes (248.67 g) with lowest number of finger rhizomes: number of mother rhizomes ratio (5.15) as well as fresh weight of rhizome (301.40 g/plant) with fresh rhizome yield (32.29 t/ha). The curcumin content in rhizomes (3.86%) as well as essential oil of rhizomes (3.23%) was recorded in 0.2 % humic acid (T₈). The foliar application of 5% novel organic liquid nutrients was found economical, profitable and highly remunerative with maximum net returns of ₹ 6,54,732 and maximum benefit:cost ratio (4.29) as compared to rest of the treatments.

KEY WORDS: Foliar, organic, Growth, yield, Quality, Economics, Curcumin content

Turmeric (*Curcuma longa* L.) is native to South-East Asia. Gujarat occupies 4,425 ha area with 17,386 tonnes of production (MA and FW, 2020). Novel organic liquid nutrients provide essential macro and micronutrients as well as growth boosters (Jadhav *et al.*, 2014). Humic acid is one of the most important constituents of fertile soils containing S, N and P in varying amounts as well as metals such as Ca, Mg, Cu, Zn etc. which improves availability of nutrients to plants and thus influences plant growth and yield. Cow urine contains 95% water, 2.5% urea and the remaining 2.5%, a mixture of salts, hormones, enzymes and minerals. Thus, an experiment was conducted to find out the effect of foliar application of organic liquids on growth, yield and quality of turmeric cv. GNT-2.

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MATERIALS AND METHODS

The experiment was conducted on turmeric cv. GNT-2 during 2019-20 at Regional Horticultural Research Station, ASPEE College of Horticulture and Forestry, Navsari Agricultural University, Navsari, Gujarat, India, in Randomized Block Design (RBD) with three replications and eleven treatments, viz. panchagavya @ 4% (T₁), panchagavya @ 5% (T₂), novel organic liquid nutrients @ 4% (T₃), novel organic liquid nutrients @ 5% (T₄), jeevamrut @ 4% (T₅), jeevamrut @ 5% (T₆), humic acid @ 0.1% (T₇), humic acid @ 0.2% (T₈), cow urine @ 4% (T₉), cow urine @ 5% (T₁₀) and the control (T₁₁). The first spray was applied at 60 DAP, second at 120 DAP and third at 180 DAP. The soil of the experimental site was dark greyish black type having medium to poor drainage and high water-holding

capacity. The soil of the experimental plot was clay in texture. The pH values for 0-15 cm and 15-30 cm depths were 7.9 and 8.1, respectively.

The experimental plots were prepared by one deep ploughing followed by one harrowing. There were total 33 plots of 4.2 m × 4.4 m size having raised bed of 110 cm width were prepared at a spacing of 30 cm × 20 cm during the third week of May, 2019. The cultural practices and nutrient management, 20-25 t/ha and 60:60:60 kg NPK/ha) were carried out as per the recommendations. Observations on different growth parameters was recorded at three of crop periods, viz. 90, 150 and 210 days after planting from five randomly selected plants from each plots, whereas yield attributing characters were recorded after harvesting. The quality parameters, viz. curcumin content (%) of turmeric rhizomes was estimated by ASTA method (ASTA, 1968) modified by Manjunath *et al.* (1991) and expressed as percentage on moisture free basis. However, essential oil (%) was estimated by distillation methods. Statistical analysis was done as per Panse and Sukatme (1985).

RESULTS AND DISCUSSION

Effect of foliar application of organic liquids on plant height (73.73 cm) did not influence significantly at 90 DAP. However, 150 and 210 DAP treatment T₄ (novel organic liquid nutrients 5%) gave 93.64 cm and 120.71 cm and number of leaves at 90, 150 and 210

DAP showed significant results (6.27, 6.83 and 8.33, respectively). The length of leaves was significantly maximum (46.22 cm) at 90 DAP in 0.2% humic acid, whereas at 150 and 210 DAP noted significantly maximum length of leaves (60.47 cm and 73.07 cm) in 5% novel organic liquid nutrients (T₄). However, it also recorded significantly maximum breadth of leaves (12.54 cm, 13.40 cm and 13.60 cm) at 90, 150 and 210 DAP, respectively. The increase in growth of plant might be due to novel organic liquid nutrients containing plant growth regulators such as NAA, gibberellic acid, cytokinin, macronutrients (N, P, K, Ca, Mg, S) and micronutrients (Mn, Cu, Zn) which enhanced cell division and cell elongation.

A novel organic liquid nutrient increased the auxin level of tissue or enhanced the conversion of tryptophan to IAA leading to enhanced activity of cell division and cell elongation through the effect of gibberellic acid and cytokinin singly or due to combine effect of both on increase in growth characters. These findings support to those of Kalariya *et al.* (2018) and Desai Supal *et al.* (2018). Subsequently, maximum number of tillers/plant was found with foliar application of 0.2% humic acid (T₈). This might be due to humic acid contains gibberellin like substances, which may lead to increased plant growth by producing more number of primary branches as well as more number of side shoots.

The treatment T₄ (novel organic liquid nutrients

Table 1. Effect of foliar application of organic liquid sources on yield-attributing characters of turmeric cv. GNT-2

Treatment	No. of mother rhizomes /plant	No. of finger rhizomes /plant	Weight of mother rhizomes (g/plant)	Weight of finger rhizomes (g/plant)	No. of finger rhizomes: No. of mother rhizomes ratio	Rhizome yield (g/plant)	Rhizome yield (t/ha)	Curcumin content (%)	Essential oil (%)
T ₁ : Panchagavya @ 4%	2.47	14.35	43.13	221.67	5.82	264.97	28.38	3.20	2.77
T ₂ : Panchagavya @ 5%	2.07	13.40	46.67	229.33	6.50	276.00	29.57	3.19	2.60
T ₃ : Novel organic liquid nutrients @ 4%	2.07	17.07	49.13	232.67	8.29	281.80	30.19	3.33	2.57
T ₄ : Novel organic liquid nutrients @ 5%	3.53	18.20	52.73	248.67	5.15	301.40	32.29	3.61	2.83
T ₅ : Jeevamrut @ 4%	1.93	15.27	48.93	222.33	7.91	271.27	29.06	3.14	2.53
T ₆ : Jeevamrut @ 5%	2.13	13.47	48.00	221.33	6.33	269.33	28.85	3.39	2.47
T ₇ : Humic acid @ 0.1%	2.07	15.47	47.80	230.00	7.50	277.80	29.76	3.36	2.73
T ₈ : Humic acid @ 0.2%	3.10	16.00	50.20	234.33	5.16	284.53	30.48	3.87	3.23
T ₉ : Cow urine @ 4%	1.87	14.93	45.67	219.33	8.01	265.00	28.39	3.57	2.43
T ₁₀ : Cow urine @ 5%	1.93	13.53	44.33	231.00	7.00	275.33	29.50	3.33	2.50
T ₁₁ : Control (No spray)	1.73	12.47	30.40	200.33	7.21	230.73	24.72	3.13	2.40
S Em (±)	0.06	0.40	1.29	5.56	0.32	6.09	0.65	0.12	0.08
CD (5 %)	0.19	1.18	3.81	16.41	0.94	17.96	1.92	0.36	0.23
CV (%)	4.89	4.63	4.85	4.24	8.14	3.87	3.87	6.35	5.15

Table 2. Economics of different treatments

Treatment	Marketable rhizomes yield (t/ha)	Cost of cultivation (₹/ha)	Treatment cost (₹/ha)	Fixed cost (₹/ha)	Gross income (₹/ha)	Net income (₹/ha)	B:C ratio
T ₁ : Panchagavya @ 4%	28.38	93,705	7,860	44,343	7,09,500	5,63,592	3.86
T ₂ : Panchagavya @ 5%	29.57	93,705	9,360	46,203	7,39,250	5,89,982	3.95
T ₃ : Novel organic liquid nutrients @ 4%	30.19	93,705	7,060	47,045	7,52,725	6,04,915	4.00
T ₄ : Novel organic liquid nutrients @ 5%	32.29	93,705	8,360	50,453	8,07,250	6,54,732	4.29
T ₅ : Jeevamrut @ 4%	29.06	93,705	5,060	45,406	7,26,500	5,82,329	4.00
T ₆ : Jeevamrut @ 5%	28.85	93,705	5,860	45,078	7,21,250	5,76,770	3.90
T ₇ : Humic acid @ 0.1%	29.76	93,705	2,275	46,500	7,44,000	6,01,520	4.22
T ₈ : Humic acid @ 0.2%	30.48	93,705	2,690	47,625	7,62,000	6,17,980	4.20
T ₉ : Cow urine @ 4%	28.39	93,705	3,460	44,359	7,09,750	5,68,226	4.01
T ₁₀ : Cow urine @ 5%	29.50	93,705	3,860	46,093	7,37,500	5,93,842	4.13
T ₁₁ : Control (No spray)	24.72	93,705	0	38,625	6,18,000	4,85,670	3.67

5%) recorded maximum number of mother rhizomes/plant (3.53), number of finger rhizomes/plant (18.20), weight of mother rhizomes/plant (52.73 g), weight of finger rhizomes/plant (248.67 g) with lowest number of finger rhizomes: number of mother rhizome ratio (5.15) (Table 1). It also exhibited maximum fresh rhizome yield (301.40 g/plant and 32.29 t/ha). The increase in yield probably may be due to novel organic liquid nutrients consisting of lavish amount of macro and micronutrients which ameliorate photosynthetic activity ultimately increased the yield and yield attributing characters (Singhal *et al.*, 2015).

The application of nutrients accelerated an uptake of water and nutrients, commanding higher photosynthesis and greater accumulation of photosynthesis which ultimately increased the production and productivity of crop (Singhal *et al.*, 2015). The results are in accordance with Shah (2019), Patil and Kolambe (2014), Salunkhe *et al.* (2013).

The maximum curcumin contain (3.86%) and essential oil (3.23%) were recorded in T₈ treatment (humic acid 0.2%). Application of humic acid helped in availability for more nitrogen in the form of NH₄-N, which could have promoted hormonal activity of plants.

The higher net realization and maximum benefit:cost ratio, ₹ 6,54,732/ha and 4.29, respectively were recorded under 5% Novel organic liquid nutrients (T₄) (Table 2). This might be due to investment cost was less and yield was higher in this treatment which gives higher benefit:cost ratio. This finding is in agreement with Salunkhe *et al.* (2013).

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