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Short communication

Effect of biostimulants on yield and quality in tomato

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ABSTRACT

An experiment was conducted to study comparative efficacy of growth regulators and *panchakavya* on growth, yield and biochemical constitution of tomato. It is well known that *panchakavya* plays a vital role in organic cultivation. Hence, the present experiment was laid out to determine the effect of this biostimulant on yield and quality in tomato. Recommended dose of fertilizers recorded highest yield. Next best results were obtained by combined spray of *panchakavya* (3%) + salicylic acid (100ppm) + nitrobenzene (150ppm); *panchakavya* (3%) alone and *panchakavya* (3%) + salicylic acid (100ppm). Results also revealed comparable performance of *panchakavya* over salicylic acid and nitrobenzene indicating, that, *panchakavya* can be utilized as an organic component to increase yield in tomato.

Key words: Tomato, *panchakavya*, salicyclic acid, nitrobenzene

Tomato (*Solanum lycopersicum* Mill.) is one of the most important and largely cultivated vegetable crops. It occupies a pre-eminent position among vegetables for its high nutrient content. Lately, greater emphasis is laid on organic production of vegetables. Growth regulators and foliar nutrient sprays are used for increased flower production, retention and higher yield in tomato.

When foliar nutrition is applied, lower quantities of fertilizers are needed compared to nutrient application through soil. Foliar nutrition also reduces fixation or leaching of nutrients. One of the most significant benefits of using foliar feeding is that it is less expensive than many other means for boosting plant growth.

These days, major nutrients (N, P and K) are applied to vegetable crops through foliar sprays (Chaurasia *et al*, 2005). The ultimate goal of foliar nutrition is to supply the plant with the right amount of nutrients.

Panchakavya is a formulation prepared from products obtained from the cow and consists of dung, urine, milk, curd and ghee. Physio-chemical properties of *panchakavya* reveal that it contains almost all the major nutrients, micronutrients and growth harmones such as IAA and GA. It also possesses aromatic compounds like phenyl acetic acid and benzoic acid, products that have a definite role in plant metabolism (Vadivel, 2006).

A field trial was conducted at Horticultural College and Research Institute, Tamil Nadu Agricultural University, Coimbatore. The experimental farm is situated in South Western region of Tamil Nadu at 11°N latitude and 77°E longitude at an altitude of 426.6m above MSL.

Present study was conducted with the main objective of assessing the effect of bio-stimulants and growth regulators on yield and quality of tomato variety PKM 1.

Soil in the experimental field was well-drained, sandy clay-loam in texture, with pH 6.5 and EC 0.206dsm^{-1}. Soil nutrient status was checked and recommended dose of fertilizers was applied.

Experimental design and layout

The experiment was laid out in Randomized Block Design with twelve treatments and was replicated thrice. Details of treatments are given below

1. *Panchakavya* (3%) seed treatment
2. *Panchakavya* (3%) seedling dip
3. *Panchakavya* (3%) root drench
4. *Panchakavya* (3%) foliar spray
5. Nitrobenzene (150ppm) foliar spray
6. Salicylic acid (100ppm) foliar spray
7. Nitrobenzene (150ppm) + *Panchakavya* (3%) foliar spray

8. Salicylic acid (100ppm) + *Panchakavya* (3%) foliar spray
9. Nitrobenzene (150ppm) + Salicylic acid (100ppm) foliar spray
10. Nitrobenzene (150ppm) + Salicylic acid (100ppm) + *Panchakavya* (3%) foliar spray
11. Farm yard manure @ 25t/ha
12. Recommended fertilizer dose (150:100:100kg NPK/ha)

Seeds were soaked in *Panchakavya* 3% for an hour, shade-dried and then sown in the nursery. Root dip with *Panchakavya* (3%) was done just before transplanting the seedlings. Root drench (50ml/plant) with *Panchakavya* (3%) was done on the same day after planting. All the foliar sprays were given twice (once each before and after flowering). Farm yard manure @ 25t/ha was applied as basal dose at the time of last ploughing. The above treatments were imposed with no application of synthetic fertilizers.

Recommended dose of fertilizer (150:100:100kg of NPK/ha) was applied at half of N and full dose of P and K as basal dose, and the remaining half of N was top-dressed on 30th day after planting.

Morphological observations were recorded on plant height, number of branches, days taken for 50% flowering, number of fruits per cluster, number of fruits per plant, fruit weight, yield per plant and estimated yield per hectare.

Chlorophyll content was estimated as per Yoshida *et al* (1971), carbohydrate content was estimated by the procedure suggested by Sadasivam and Manickam (1996) and soluble protein was estimated by Lowry's method (Lowry *et al*, 1951).

Results (Table 1) of the present study revealed that spraying *panchakavya* (3%) + salicylic acid (100ppm) and nitrobenzene (150ppm); and *panchakavya* (3%) alone recorded maximum plant height (80.36cm and 78.63cm respectively). Maximum number of branches per plant (9.33) was recorded both in spray of *panchakavya* (3%) + salicylic acid (100ppm) + nitrobenzene (150ppm), and *panchakavya* (3%) + nitrobenzene (150ppm) and was on par with recommended fertilizer dose (150:100:100kg NPK/ha) (8.99), salicylic acid (100ppm) + nitrobenzene (150ppm) spray (8.44), and *panchakavya* (3%) spray (8.21).

In addition, nutrients in urine are readily soluble and are in a liquid form which allow them to be taken up by the plant at once (Sharma, 1998). Salicylic acid, a phenolic compound, is known to prevent auxin oxidation (Schneider and Whiteman, 1974). Salicylic acid spray may have increased the level of auxin which, in turn, could have increased plant height. Nitrobenzene also has a synergistic effect with auxin which may have also caused increased N. Due to increased level of auxin in the growing tip, plant height may have increased. The same observation has been recorded in okra too (Savitha, 2004).

Days taken for 50% flowering was significantly influenced by various treatments. Earliest flowering was observed with foliar application of *panchakavya* (3%) alone (37.33 days), and was on par with nitrobenzene (150ppm) spray (38.00 days), *panchakavya* (3%) + salicylic acid (100ppm) + nitrobenzene (150ppm) spray (38.00 days),

Table 1. Effect of biostimulants and growth regulators on yield and quality in tomato

Treatment	Plant height (cm)	No. of branches	Days taken for flowering	No of fruits/ plant	Single fruit weight (g)	Yield/ plant (kg)	Yield (t/ha)	Total chlorophyll (mg/g)	Carbo-hydrate content (mg/g)	Soluble protein (mg/g)
Seed treatment 3% PK	57.50	6.06	42.23	32.53	40.60	0.68	18.18	0.34	1.79	15.60
Seedling3% PK	67.43	6.86	40.66	29.53	41.44	0.65	15.66	0.36	1.98	14.21
Root drenching3% PK	64.16	5.20	42.00	33.06	41.03	0.70	15.84	0.35	2.34	14.43
PK 3% foliar spray	78.63	8.21	37.33	37.6	42.98	0.85	22.16	0.45	2.94	17.31
Nitrobenzene150ppm	61.03	7.77	38.00	42.76	36.11	0.75	18.74	0.36	1.88	15.36
Salicylic acid 100pm	62.56	7.40	40.00	26.66	41.26	0.66	16.05	0.43	2.83	14.44
PK+NB	76.23	9.33	38.38	41.76	33.88	0.59	15.12	0.44	2.40	14.13
PK+SA	75.93	9.10	39.33	37.13	43.67	0.85	23.27	0.46	2.83	16.70
NB+SA	62.10	8.44	38.66	34.50	41.40	0.73	17.70	0.38	2.24	14.42
P+SA+NB	80.36	9.33	38.00	44.76	37.02	0.86	22.88	0.51	3.05	18.42
FYM (25t/ha)	57.46	6.77	40.66	30.13	37.04	0.60	14.30	0.36	2.22	13.71
NPK 150:100:100kg/ha	77.26	8.99	39.33	44.53	45.30	1.14	29.48	0.54	3.13	17.90
CD (*P=0.05*)	2.69	1.24	1.59	2.16	3.82	0.54	2.47	0.07	0.25	1.73

*Note: PK - *Panchakavya*; NB - Nitrobenzene; SA - Salicylic acid; FYM - Farm Yard Manure

panchakavya (3%) + nitrobenzene (150ppm) spray (38.38 days) and salicylic acid (100ppm) + nitrobenzene (150ppm) spray (38.66 days). Readily available N, P, K and growth regulators in *panchakavya* may have induced early flowering in tomato. Similarly, earlier flowering in rose with *panchakavya* (5%) spray was reported by Thamarai Selvi *et al* (2002).

Combined spray of *panchakavya* (3%) + salicylic acid (100ppm) + nitrobenzene (150ppm) significantly increased number of fruits per plant (44.76), followed by application of the recommended dose of fertilizers (44.53), and nitrobenzene (150ppm) spray (42.76). Maximum number of fruits recorded in the above treatments could be due to increased level of auxin by nutrients applied thus increasing the flower production and retention. Presence of auxin in *panchakavya* was reported by Kanimozhi (2004). Florigenic activity of salicylic acid was demonstrated by Kumar *et al* (1997). Savitha (2004) reported increased number of fruits in okra with application of nitrobenzene (150ppm).

Application of recommended dose of fertilizers significantly improved fruit weight. The treatment was on par with foliar application of *panchakavya* 3% + salicylic acid (100ppm), and foliar spray of *panchakavya* alone (3%). Soluble forms of nutrients are easily available in *panchakavya* and salicylic acid makes the plant physiologically more active, which influences fruit weight positively (Kumar *et al*, 1999).

Fruit yield per hectare was significantly higher with application of recommended dose of fertilizers (1.14kg/ plant). Among foliar sprays, *panchakavya* (3%) + salicylic acid (100ppm) + nitrobenzene (150ppm) spary (0.86kg/plant), *panchakavya* (3%) spray (0.85kg/plant), and *panchakavya* (3%) + salicylic acid (100ppm) spary (0.84 kg/plant) were on par. This indicated a better effect of *panchakavya* over salicylic acid and nitrobenzene. Increased yield due to *panchakavya* was mainly due to better availability of nutrients. Total chlorophyll, carbohydrates and protein content also followed a similar trend.

Regulation of stomata has been shown to be favorably influenced by bio-active substances produced by beneficial micro-organisms present in *panchakavya* (Kanimozhi, 2004). Favorable influence of salicylic acid in soybean was reported by Kumar *et al* (1999).

Senthil and Kumaresan (2006) observed that soil application of Controlled Release Fertilizer (CRF) Aagroblen @ 30g m^{-2}, plus WSF plant starter @ 2g l^{-1} as foliar spray significantly enhanced quality of red ripe pods of chilli, registering higher levels of capsaicin (4.26mg $100g^{-1}$), i.e., 3.9% increase over the Control. This may have been influenced by nitrogen uptake.

Results in the present investigation revealed that recommended dose of fertilizers gave higher yield. The next best results were obtained with spraying *panchakavya* (3%) + salicylic acid (100ppm) + nitrobenzene (150ppm); *panchakavya* (3%) + salicylic acid (100ppm), and *panchakavya* (3%) alone. Total chlorophyll, carbohydrate and protein content were also higher in the above treatments. This suggests that *panchakavya* can be effectively sprayed to increase yield in tomato as an organic component along with recommended dose of fertilizers.

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