

Effect of Foliar Application of Panchagavya on Yield and Quality Characteristics of Eggplant (*Solanum melongena* L).

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ABSTRACT

Nutritional quality of eggplant can vary depending on the cultivation methods and treatments. The present study was aimed to assess the effect of foliar application of panchagavya on yield and quality of eggplant. The results showed increase in plant height, number of branches, number of fruits and single fruit weight in panchagavya treated plants. It was due to the increased chlorophyll concentration resulting in more photosynthetic activity. Application of panchagavya also increased the total phenolic content (15.7%), total carotenoids (24.8%), DPPH activity (51%) and ascorbic acid (1.1%) as compared to the control.

Key words *organic production, vegetables, antioxidant, polyphenols*

Organic manures play an important role in improving the soil fertility and soil health. In recent times organic farming is gaining place in India and elsewhere in the world. The use of organics in crop production is nothing new to our agriculture and many organics like farmyard manure, compost, neem cake, vermicompost, poultry manure etc. are used as a substitute for chemical fertilizers to supply plant nutrients in traditional farming which also helps to sustain soil organic carbon and maintain favourable soil condition for crop growth. During the transitory period of organic farming, the use of farmyard manure and compost as source of plant nutrients, the fertility of soil depletes leading to low yield in initial years of cultivation (Natarajan, 2002). Besides, the decomposition of bulky organic materials takes longer time to meet the immediate nutrient requirement of plants. In recent years fermented, liquid organic fertilizers, effective microorganisms (EM) as foliar fertilizers have been introduced to modern agriculture to produce food with good quality and safety (Galindo *et al.*, 2007).

Panchagavya is one such fermented liquid organics, which is the blend of five products obtained from cow, namely cowdung, cow urine, cow milk, curd and ghee (Sugha, 2005). All the five constituents are known to have medicinal properties and were used singly or in combination against many diseases. It is well documented that the organically produced fruits, vegetables and grains are more beneficial for human health and contain higher hydrolysable polyphenols and higher soluble and hydrolysable antioxidant capacities (Zambrano-Moreno *et al.*, 2015). Several studies indicated the positive effect of foliar application of panchagavya on rice, tomato, chilli etc. In Andaman Islands such a positive effect on vegetables will be helpful in enhancing the vegetable yield and promote organic agriculture. Therefore, the present study was aimed to investigate the effect of foliar application of 3 % panchagavya on different physiological parameters, yield and quality attributes of brinjal (*Solanum melongena* L).

MATERIALS AND METHODS

Preparation of panchagavya

The Panchagavya solution was prepared by thoroughly mixing fresh cow dung (7 Kg), cow ghee (1 Kg), fresh cow urine (10 litres), cow milk (3 litres), cow milk curd (2 litres), jaggery (unrefined sugar from sugarcane juice, 3 Kg) and ripened banana (2 Kg) in a open plastic container. 7 Kg cow dung and 1 Kg cow ghee were mixed and kept for 72 hours. On 3rd day 10 litres of cow urine and 10 litres of water were added to the above mixture and allowed to ferment for 15 days. Thereafter the mixture was stirred twice in a day. On the 18th day, 3 Kg cow milk, 2 Kg cow curd, 3 Kg jaggery, 3L of tender coconut water and 2 Kg banana were added to the mixture and allowed to ferment for further seven days. The Panchagavya was ready for use after a period of 25- 30 days (Somasundaram *et al.*, 2003).

Table 1. Effect of panchagavya on growth and yield parameters of brinjal

Parameters	Treated Plants	Control
Plant height (cm)	94.3 ± 11.2	87.0 ± 8.45
No of Branches	11.7 ± 2.41	10.3 ± 1.95
No. of fruits	20.9 ± 3.03	13.4 ± 4.20**
Single fruit weight(g)	36.5 ± 7.95	25.3 ± 2.80**
Yield per plant (g)	824.7 ± 64.1	330.1 ± 22.6*

** -significant at 5% level;

* - significant at 10% level

Experimental setup

A field experiment was conducted at Field Crops Experimental Farm, Bloomsdale of Central Agricultural Research Institute, Port Blair from June to September 2015 with brinjal as test crop. The seedlings were transplanted at a spacing of 60 x 45cm during June 2015 and all cultural practices were common except foliar application of 3% panchagavya. After establishment the field was divided into two blocks. One block acted as control where panchagavya was not applied and in other block 3% panchagavya was applied as foliar spray at 15 days interval viz., 15, 30,45,60,75 and 90 days after transplanting. From each block 15 plants were randomly tagged to record observations on plant height, no. of branches, no. of fruits, single fruit weight and total fruit weight per plant.

Estimation of photosynthetic pigments

The leaves were collected from each plant at the time of final harvest of fruits for estimation of chlorophyll pigments. The pigments were extracted with 80% acetone and the amounts of chlorophyll_a and chlorophyll_b were determined as described by Sadasivam and Manickam (2010).

$$\text{Chlorophyll}_a = [12.7 A_{663} - 2.69 A_{645}] \times V / (1000 \times W) \text{ mg/g tissue}$$

$$\text{Chlorophyll}_b = [22.9 A_{645} - 4.68 A_{663}] \times V / (1000 \times W) \text{ mg/g tissue}$$

$$\text{Total Chlorophyll} = [20.2 A_{645} - 8.02 A_{663}] \times V / (1000 \times W) \text{ mg/g tissue}$$

Where, A_{663} and A_{646} represent the optical density (OD) values at the respective wavelengths.

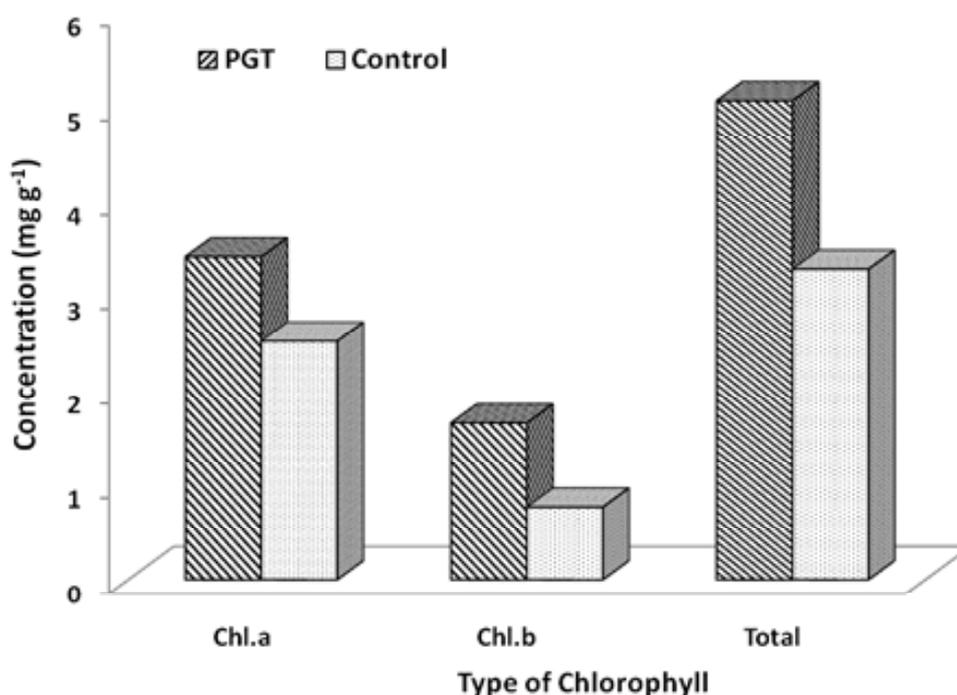


Fig.1. Effect of Panchagavya on chlorophyll content of fresh leaves of brinjal

Table 2. Effect of Panchagavya on quality parameters of brinjal

Parameter	Treated	Control	% increase
Total carotenoids (mg kg ⁻¹)	20.8	16.7	24.8
Total Phenols (mg GAE/100g FW)	56.0	48.4	15.7
Ascorbic acid (mg 100g)	35.4	35.0	1.1
DPPH (mg g)	44.3	29.3	51.3

Estimation of biochemical parameters

The total carotenoids, phenol, ascorbic acid and DPPH activity were determined from fruits as per standard procedure (Sadasivam and Manikam, 1996; Lichtenthaler and Buschmann 2001; Wong *et al.*, 2006).

Statistical analysis

The data recorded was subjected to independent t-test and test of significance was performed at 5% probability using the SAS software package.

RESULTS AND DISCUSSION

The observations on plant growth and yield parameters of brinjal (Var.VNR18) are shown in Table 1. The foliar application of 3% panchagavya increased the plant height and number of branches at all the observed stage of plant growth though no significant differences were recorded between treated and untreated plants. Panchagavya is fermented organic manure with high microbial load and effective micro organisms which could have enhanced the production of plant hormones like auxins and gibberellins stimulating the plant growth parameters like plant height, number of branches etc. (Sendurkumaran *et al.*, 1999).

The number of fruits and single fruit weight are the most important traits in determining the yield. Highly significant differences were observed by application of panchagavya on the above parameters which was reflected in total yield per plant as well, where the mean fruit yield per plant was 824.7 g in treated plants as against 330.1g/plant in control plants. Taller plants with more number of branches have increased photosynthetic area, favourable physiological activities might have resulted in more production and translocation of photosynthates which in turn accelerated the formation of more fruits with larger size ultimately leading to higher fruit yield (Naik and Srinivas, 1992). Moreover, the application of panchagavya

might have reduced the flower shedding with corresponding increase in fruit set as reported by Praba *et al.*, (2006). This is confirmed by the present study as there was a significant difference in no. of fruits between the treated and control plants. The increased fruit yield might also be due to increased photosynthetic efficiency resulting in higher accumulation of photosynthates as evidenced from significantly higher concentration of chlorophyll (a, b and total) content in panchagavya treated plants (Fig. 1). The fermented solutions of 'Panchagavya' contains various salts rich in N,P,K,S and micronutrients in plant available form which helps in the formation of chlorophyll in the leaves. Besides, cow dung and urine contains calcium (0.4%) and silica (1.5%) that plays an important role in the chlorophyll synthesis by increasing protein formation and cell division in the leaves (Natarajan, 2002). The increased biological efficiency of the plants by higher chlorophyll synthesis, supply of plant nutrients and growth promoting substances enhanced the fruit yield in brinjal as in other reported crops (Kumawat *et al.*, 2009).

Effect of panchagavya on quality parameters

The polyphenols are prominent source of antioxidants for human and the application of 3% panchagavya on brinjal increased the total phenolic content by 15.7% as against untreated plants. Similar increase was also observed for other parameters like total carotenoids (24.8%), DPPH activity (51%) and ascorbic acid content (Table 2). Lima *et al.* (2008) also reported increase in polyphenols and flavanoids in organic egg plants. The anti-oxidant capacity (DPPH) was also significantly higher (51%) in treated plants when compared to control. The results are in consance with that of Zambrano-Moreno *et al.*, (2015) who reported increase in such parameters under organic production system. The increase in phenolic content

on application of panchagavya could be due to increased allocation of N for production of secondary metabolites such as phenols as a natural defense system in the plants.

The study indicated that the application of panchagavya not only increased the yield parameters in terms of number of fruits and fruit yield but also the phyto chemicals especially carotenoids, phenolic compounds, ascorbic acid and anti-oxidant capacity in brinjal indicating the potential of panchagavya in organic production of fruits and vegetables.

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