



Research Article

A study of certain organic inputs on phenological, yield and quality related traits of Strawberry (cv. Camarosa) in pot culture

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Abstract

Organic agriculture is on a pacing rate at the present time at the global level to protect nature and promote good health conditions for people. Keeping this in mind, the study was conducted using four different organic amendments on Strawberry (cultivar camarosa) which included T1=Panchagavya, T2=Jeevamrutham, T3=Fish meal extract, T4=Vermiwash and T5= Controlled during 2017-2018 at School of Agriculture, Lovely Professional University, Punjab. Panchagavya recorded the highest values for plant height, number of leaves, leaf area, number of runners, plant spread, pedicel thickness, number of flowers and fruits, fruit set%, fruit length and grith, fruit weight, yield per plant, TSS, fruit firmness and TSS: titrable acidity and showed less value for days to flowering. Panchagavya performed better than other treatments followed by fish meal amino acid, vermi wash, jeevamrutham and controlled. The better performance of panchagavya is due to the presence of beneficial microbes mostly lactic acid bacteria, yeast, actinomyces and certain fungi and it is having good amount of both macro (N, P, K and Ca) and micro (Zn, Fe, Cu, Mn) nutrients.

Keywords antioxidants, organic, strawberry, vitamin

Introduction

Strawberry (cultivar camarosa) is a major herbaceous temperate fruit crop which is grown worldwide and most of it is being grown under protected structures [1], and in major parts of Himachal Pradesh, Punjab, Haryana, Uttar Pradesh and sub-tropical parts of Jammu Kashmir. It belongs to the family Rosaceae and is considered not a true berry. The flower receptacles become fleshy and seeds are embedded in them and this is known as an aggregate fruit [2]. Strawberries are an excellent source of vitamins, minerals [3], fibre and antioxidants [4]. They are well known for their appearance, aroma and flavor [5]. This fruit consists of a high level of bioactive Vitamin-C concentration in it [6]. Its cultivation area is around 396,401 hectares and with a production of 8,885,028 tonnes [7]. Strawberry is mainly a vegetatively propagated crop and the propagation material is known as runners. They may be consumed as fresh fruits or they can be processed into juices, jams, jellies and artificial flavours. Therefore this fruit gets great attention in national and international markets. Therefore by cultivating this fruit in organic culture then we can get a lot of returns from this because the organic cultivated is having great taste, flavour and aroma when compared to others. Considering the future scope of organic agriculture, studies were carried out to evaluate the effects of organic

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treatments on vegetative, flowering and fruiting, yield and quality parameters.

Methodology

The present studies were conducted at Lovely Professional University, School of Agriculture in a protected environment in 2017-2018 to estimate the effects of certain organic treatments on strawberries. The herbs were grown in pots which are having pot mixture ratio of 2:1:1 (coco peat: soil: sand). The soil pH and E.C. is 7.2 and 0.63 mmhos/cm. The N: P: K ratio of the soil used in the pot mixture was around 16:22-56:109 kg/ha [8]. The 5 treatments were randomly arranged in 4 replication in CRD layout. 5 treatments were T1=Panchagavya, T2=Jeevamrutham, T3=Fish meal extract, T4=Vermiwash and T5=Controlled. Panchagavya is made by incubating desi cow dung (7kg) and ghee (1kg) for two days, then mixing desi cow urine (3 litres) plus 10 litres of water for a week, then adding sugarcane juice (3 litres) or jaggery with water in a 1:6 ratio plus cow milk, cow curd, coconut water, yeast, and 12 fully ripened bananas were added and stirred in a clockwise direction for 30 minutes in the morning and evening for three weeks. Jeevamrutham is prepared with the mixture of desi cow dung, cow urine, powered jaggery and chickpea flour and mixed well for a week. Fish meal extract was prepared from whole fish mixed with jaggery and water and it was fermented for 10 to 12 days and purified and stored. Vermi wash was a liquid extract which was derived from the culture of earthworms. Panchagavya, Fish meal extract, and Vermi wash were foliar applied by using a sprayer and jeevamrutham is drenched directly into the soil. The treatments were prepared 15-20 days early to the potting and applied at 5-day intervals. Data were recorded every five days and the least significant difference was calculated at a 5% level by using STAR statistical software.

Results

Effect of various organic substrates on phenological in strawberry cv. Camarosa

Observations on 'phenological parameters' viz., plant height, No. of leaves per plant, leaf area, No. of runners per plant, and plant spread was recorded. The results of the observations were presented below. Phenological characters along with flowering and fruiting characters were mentioned in Table 1.

Table 1. Phenological, flowering and fruiting parameters of strawberries under different organic amendments

Treatments	PH	NLPP	LA	NOR	PS	DOF	PT	NOF	NOFR	FS
T1	13.69 ^a	8.91 ^a	17.27 ^a	2.87 ^a	28.49 ^a	47.75 ^c	0.24 ^a	19.10 ^a	17.19 ^a	85.95 ^a
T2	10.98 ^c	6.36 ^d	12.38 ^c	0 ^d	25.15 ^b	57.54 ^{ab}	0.21 ^c	12.41 ^d	10.50 ^d	80.79 ^{ab}
T3	12.03 ^b	7.32 ^c	13.48 ^b	0.95 ^c	24.59 ^{bc}	54.10 ^b	0.22 ^b	14.32 ^b	12.41 ^b	82.70 ^a
T4	11.46 ^b	7.96 ^b	13.56 ^b	1.91 ^b	22.60 ^d	54.67 ^b	0.21 ^c	13.37 ^c	11.46 ^c	81.84 ^a
T5	10.82 ^c	7 ^c	11.46 ^d	0 ^d	23.24 ^{cd}	59.45 ^a	0.19 ^d	9.55 ^e	7.64 ^e	76.40 ^b

N.B. PH: Plant height, **NLPP**: Number of leaves per plant, **LA**: Leaf area, **NOR**: Number of runners, **PS**: Plant spread, **DOF**: Days to flowering, **PT**: Pedicel thickness, **NOF**: Number of flowers, **NOFR**: Number of fruits, **FS**: Fruit set%.

Note: Means followed by the same letters do not differ significantly at a 5% probability level according to the LSD test

Phenological characters

Plant height (cm)

The plant height is measured by using a scale and it is measured from the bottom to the topmost leaf. The mean value on 'plant height' after transplanting the seedlings into the pots revealed variations among different treatments. Among all the seedlings, seedlings treated with Panchagavya registered a maximum mean value for plant height (13.69 cm) whereas those in control recorded the least plant height (10.82 cm) in all the stages of observation.

Number of leaves per plant



The leaf was visually counted. The mean value on 'the number of leaves per plant' after transplanting the seedlings into the pots revealed variations among different treatments. Among all the seedlings, seedlings treated with Panchagavya registered a maximum mean value for plant height (8.91) whereas those in Jeevamrutham recorded the least value for 'Number of leaves per plant (6.36) in all the stages of observation.

Leaf area (cm²)

The leaf area was determined by using graph paper. The mean value on 'leaf area' exhibited variations in different treatments. Among all the seedlings, seedlings treated with Panchagavya registered a maximum mean value for leaf area (17.27 cm) without any damaged leaves in it, whereas those in control recorded the least leaf area (11.46 cm) in all the stages of observation.

Number of runners per plant

Runners were visually counted. The mean value on 'the number of runners per plant' exhibited variations with different treatments. Among all the seedlings, seedlings treated with Panchagavya registered a maximum mean value for a number of runners per plant (2.87), whereas the remaining seedlings treated does not show any runner production with them except Vermiwash (1.91) and Fish meal extract (0.95) in all the stages of observation.

Plant spread (cm)

It was measured by using the scale to know which direction the spread is. The mean value on 'plant spread' exhibited variations among different treatments revealing the nature of strawberry spreading with different media applied. Among all the seedlings, those seedlings treated with Panchagavya registered the maximum mean value for plant spread (28.49 cm), whereas those in vermi wash recorded the least plant spread (22.60 cm) in all the stages of observation.

Flowering and fruiting Parameters

Duration of flowering

The mean value of 'duration of flowering' revealed that variations persist among different treatments. About all treatments, plants treated with Panchagavya registered less no. of days for flowering (47.75 days) and control registered maximum duration for flowering (59.45 days) in all the stages of observation.

Pedicle thickness (mm)

Pedicle thickness was measured by using vernier callipers. The mean value on 'pedicle thickness' after fruit was set in the pots revealed variations persist among different treatments. About all treatments, plants treated with Panchagavya registered a maximum value for pedicle thickness (0.24) and whereas those in Control registered a value for pedicle thickness (0.19) in all the stages of observation.

No of flowers per plant

The number of flowers was visually counted. The mean value of 'the number of flowers per plant' revealed that variations persist among different treatments. About all treatments, plants treated with Panchagavya registered a maximum value for the number of flowers (19.10) and those controlled registered the least no. of flowers (9.55) in all the stages of observation.

No. of fruits per plant

The number of fruits was visually counted. The mean value of 'no of fruits per plant' revealed that variations persist among different treatments. About all treatments plants treated with Panchagavya registered maximum value for No. of fruits (17.19) and controlled recorded the minimum no. of fruits (7.64) in all the stages of observation.

Fruit set percentage



It is the percentage between flowering and the flowers which end up in fruits. The mean value of 'the fruit set revealed that variations persist among different treatments. About all treatments plants treated with Panchagavya registered a maximum value for fruit set percent (85.95%) and controlled recorded the least percent (76.40%) in all the stages of observation

Effect of various organic substrates on yield and quality related traits of strawberry cv. Camarosa

The treatments regarding the impact of various organic substrates through foliar spray were rendered as per the proposed technical programme. Observations on 'yield and quality parameters'. The results of those were presented below in Table 2.

Fruit length (cm)

The vertical axis of the fruit was measured by using vernier callipers. The mean value of 'fruit length' revealed that variations persist among different treatments. About all treatments, plants treated with Panchagavya registered a maximum value for fruit length (5.46 cm) and controlled ones registered the least fruit length (3.58 cm).

Fruit girth (cm)

The horizontal axis was measured using vernier callipers. The mean value of 'fruit girth' revealed that variations persist among different treatments. About all treatments, plants treated with Panchagavya registered a maximum value for fruit girth (3.01 cm), whereas the control registered the least fruit girth (1.88 cm).

Fruit weight (g)

It was measured using the weighing balance. The mean value of 'fruit weight' revealed that variations persist among different treatments. About all treatments, plants treated with Panchagavya registered a maximum value for fruit weight (16.33 g) and controlled recorded the least fruit weight (11.33 g) in all the stages of observation.

Yield per plant (g)

The mean value of 'yield per plant' revealed that variations persist among different treatments. About all treated plants, Panchagavya registered a maximum value for yield (292.33 g) and controlled recorded the least yield (90.61 g).

Total Soluble Solids (⁰Brix)

It is the measure of sugar content. Its principle is based on the refractometer. The mean value of 'total soluble solids' exhibited variations in different treatments revealing the response of strawberries to the treatments applied. Among all the plants, plants treated with Panchagavya registered a maximum value for TSS (7.24 ⁰B) and the control recorded the least value for TSS (4.41 ⁰B).

Titration acidity (g/l)

It is the measure of acid content in fruit. It is done by titrating 10ml of clear juice with 0.1 N NaOH [8]. The mean value of 'titration acidity' exhibited variations in different treatments revealing the response of strawberries to the treatments applied. Among all the plants, plants treated with Jeevamrutham registered a maximum mean value for titration acidity (0.76), whereas Panchagavya recorded the least value for titration acidity (0.65).

Fruit Firmness (kg/cm²)

It was measured by a penetrometer. The mean value of 'fruit firmness' revealed that variations persist among different treatments. About all treatments, plants treated with Panchagavya registered a maximum mean value for fruit firmness (2.41) and controlled recorded the least value for fruit firmness (1.67) in the observation.



TSS: Acid Ratio

The mean value of the ‘TSS: Acid ratio’ revealed that variations persist among different treatments. About all treatments, plants treated with Panchagavya registered a maximum mean value for TSS: Acid ratio (10.50) and control recorded the least value for TSS: Acid ratio (5.96) in the observation.

Table 2. Yield and quality parameters of strawberries under different organic treatments

Treatments	FL	FG	FW	YPP	TSS	TA	FFM	TSSA
T1	5.46 ^a	3.01 ^a	16.33 ^a	292.3 ^a	7.24 ^a	0.65 ^c	2.41 ^a	10.50 ^a
T2	4.87 ^b	2.58 ^b	13.96 ^b	153.5 ^c	5.65 ^b	0.76 ^a	2.01 ^c	7.07 ^c
T3	5.40 ^a	2.10 ^c	14.48 ^b	193.6 ^b	5.96 ^b	0.65 ^c	2.17 ^b	8.63 ^b
T4	4.78 ^b	2.50 ^b	13.64 ^b	163.6 ^c	4.58 ^c	0.67 ^b	1.96 ^c	6.46 ^d
T5	3.58 ^c	1.88 ^d	11.33 ^c	90.6 ^d	4.41 ^c	0.70 ^b	1.67 ^d	5.96 ^d

N.B. FL: Fruit length, FG: Fruit grith, FW: Fruit weight, YPP: Yield per plant, TSS: Total soluble solids,

TA: Titrable Acidity, FFM: Fruit firmness, TSS: Total soluble solids, TA: Titrable Acidity.

Note: Means followed by the same letters do not differ significantly at a 5% probability level according to the LSD test

Discussion

To our knowledge, this is the first study in which Panchagavya, Fish meal extract, Vermiwash, and Jeevamrutham were used as foliar sprays and Jeevamrutham was applied directly to the soil to evaluate their effects on strawberry growth, yield, and quality. The higher performance of plants treated with Panchagavya [9] is attributable to its growth promoter and immunity booster properties, as well as its ability to reduce the incidence of common diseases [10-11]. Growth regulators such as IAA, GA, and cytokinin have been found in Panchagavya. Using panchagavya and microbial fertigation, significant improvements in *Vitis vinifera* growth and nutritional content were reported [12]. Panchagavya had the highest population of total bacteria, actinomycetes, phosphate solubilizers, fluorescent pseudomonads, and nitrifiers of all the microorganisms studied [13]. Dehydrogenase activity and microbial biomass were also discovered to be greater in panchagavya [14]. Panchagavya's antifungal effectiveness against three plant diseases, *Rhizoctonia solani*, *Fusarium oxysporium*, and *Sclerotium rolfsii*, was recently reported [15]. Plants treated with Fish meal extract perform better because it functions as a nitrogen source to boost growth and size [16]. Fish amino acid foliar treatment may boost uptake and prevent runoff or leaching, giving enough N for chlorophyll output to keep plants healthy [17]. The growth (plant height and number of leaves) and yield (number of flowers and fruits per plant) parameters of *Solanum melongena* have been greatly improved by Vermiwash spray. In addition, the ratio of flowering and fruiting was enhanced [18-19]. Vermiwash treatment increased overall macronutrients (N, P, K, and C) as well as micronutrient levels (Fe, Cu, Mg and Zn) [20]. Foliar application of Panchagavya, Vermiwash, and Fish meal extract resulted in better production and quality strawberries when compared with soil-drenched jeevamrutham.

Conclusion

In this study, panchagavya, vermiwash, fish meal extract, and Jeevamrutham treated strawberry plants outperformed chemical fertilisers and control strawberry plants in terms of growth and quality. Surprisingly, the panchagavya, fish meal extract, and vermiwash-treated groups showed remarkable growth-promoting benefits. The acquired results strongly suggest that they could be considered as an effective foliar spray for better horticultural crop growth in the near future.

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