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Influence of organic manures on growth, yield and quality of strawberry (*Fragaria × ananassa* Duch.) under naturally ventilated polyhouse

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Abstract

The study was carried out to investigate the influence of organic manures on vegetative growth, yield and yield attributing traits of strawberry during 2019-20. Among the treatments tested, application of Vermicompost + Jeevamruth @ 500 ml per pot + Beejamruth seedling treatment recorded maximum vegetative growth characteristics viz., (plant height 28.85 cm, number of trifoliolate leaves/ plants 27.51, leaf area 106.78 cm², plant spread 30.42 cm N-S and 30.04 cm E-W, number of crowns/ plants 4.65, number of runners/ plant 6.21 and plant dry weight 36.87 g). Yield and yield attributes (berry length 4.31 cm, berry diameter 3.48 cm, berry weight 18.41 g, number of berries/ plant 19.05 and yield/ plant 350.79 g). However, maximum vegetative growth, yield and yield attributing traits of strawberry cv. "Winter dawn" was recorded in treatment with the application of Vermicompost + Jeevamruth @ 500 ml per pot + Beejamruth seedling treatment.

Keywords: Berry, VC, FYM, Jeevamruth, Beejamruth and Strawberry

Introduction

The commercially important strawberries (*Fragaria x ananassa* Duch.) belongs to the family Rosaceae and the genus *Fragaria*, which comprises of 23 species (Rousseau-Gueutin *et al.*, 2009) [14]. It is one of the most delicious, delicate flavoured, refreshing and attractive red fruit of the world (Sharma, 2002) [16]. With its high nutritional value, the strawberry is one of the most popular among berry fruits in the world. All of these strawberries have seven basic types of chromosomes. However, they exhibit a series of ploidy levels, ranging from diploid species such as *Fragaria vesca* (2n = 2x = 14), to decaploid species, such as some accessions of *Fragaria iturupensis* (2n = 10x = 70). The cultivated strawberry, *Fragaria x ananassa* is an octoploid (2n = 8x = 56) Nathewet *et al.* (2010) [10]. Strawberry (*Fragaria x ananassa* Duch.), the fleshy fruit of strawberry is classified as an aggregate fruit. Strawberries mainly consist of water (91%), carbohydrates (7.7%) and only minor amounts of fat (0.7%). The taste of fruit mainly depends on three different compounds viz., sugars, acids and aromatic compounds. The strawberry fruit contains 0.5 per cent total sugar and 0.90 per cent to 1.85 per cent acidity and also prominently mallic and citric acids (Watt and Merrill, 1959) [18]. As compared to other berry fruits, strawberries contain a higher percentage of vitamin C, phenolics and flavonoids (Hakkinen and Torronen, 2000) [8]. They are also rich in phenolic compounds, including anthocyanins, hydrolyzable tannins and phenolic acids (Giampieri *et al.*, 2012) [7]. The current global scenario of firmly emphasizes the need to adopt eco-friendly agricultural practices for sustainable food production. The use of organic manures in such situation is, therefore practically a paying proposal. Organic farming is a holistic way of farming with the aim of conserving the natural resources. Organic manures like Beejamruth, Jeevamruth, Vermicompost and FYM *etc.* have been utilized in agriculture as a significant source of organic manure. Organic manures improve the physical properties of soil (water holding capacity, soil aeration, drainage and water retention capacity) and increase important beneficial microorganism population. Organic agriculture has grown during the last decade and continues to grow as consumers become increasingly concerned about the negative impacts of conventional farming practices on human health and the environment.

The Jeevamruth and Beejamruth are eco-friendly organic preparations made from cow products. The use of organic liquid products such as Beejamruth and Jeevamruth result in higher growth, yield and quality of crops. These liquid organic solutions are prepared from cow dung, urine, milk, curd, ghee, legume flour and jaggary. They contain macro nutrients, essential micro nutrients, many vitamins, essential amino acids, growth promoting factors like

IAA, GA and beneficial microorganisms (Palekar, 2006 and Natarajan, 2007) [12, 9]. Jeevamruth promotes immense biological activity in soil and makes the nutrients available to crop. Beejamruth protects the crop from soil borne pathogens (Devakumar *et al.*, 2008) [9]. Vermicompost and FYM applications are also known to increase Strawberry plant growth and yield. Vermicompost and FYM applications in strawberries can increase beneficial microbial populations, which enhance the production of plant growth hormones (auxin, gibberellins and cytokinins) and humic acids. Several experiments in strawberry have indicated that these hormones and acids may improve plant growth *viz.*, leaf area, shoot biomass, number of flowers and runners (Arancon *et al.*, 2004) [2] and yield (Arancon *et al.*, 2004 and Singh *et al.*, 2008) [2, 17]. Earlier studies clearly indicated the beneficial influence of use of organic manure, but these organic manures can also be applied in combination to harness greater benefits. The present study aims at understanding the benefits of using different bulky and liquid organic manures in combination in terms of enhanced growth and yield parameters.

Material and Methods

Experiment was conducted in a naturally ventilated polyhouse at the Department of Fruit Science, College of Horticulture, Mudigere coming under University of Agricultural and Horticultural Sciences, Shivamogga, Karnataka, India during 2019-2020. Mudigere is situated in the Western Ghats, represents the typical climate of Hill zone (Zone- 9 and Region- V) of Karnataka. It is located at 13°7' North latitude and 74° 37' East longitude with an altitude of 980 m above mean sea level (MSL). The pots were filled with media *viz.*, Soil: Vermicompost: Vermiculite: Cocopeat in the ratio of 1:1:1:1 on volume (v/v) basis. The test variety was "winter dawn" and the planting was taken up on 7th November 2019. The different organic manure treatment combination includes T₁-100 per cent RDN through FYM, T₂-100 per cent RDN through FYM + Jeevamruth @ 500 ml per pot at two stages, T₃-100 per cent RDN through FYM + Beejamruth seedling treatment, T₄-100 per cent RDN through FYM + Jeevamruth @ 500 ml per pot at two stages + Beejamruth seedling treatment, T₅-100 per cent RDN through vermicompost, T₆-100 per cent RDN through vermicompost + Jeevamruth @500 ml per pot at two stages, T₇-100 per cent RDN through vermicompost + Beejamruth seedling treatment, T₈-100 per cent RDN through vermicompost + Jeevamruth @500 ml per pot at two stages + Beejamruth seedling treatment and T₉-Recommended Dose of Fertilizers (150:100:120 kg/ha).The design applied for the study was Randomized Complete Block Design (RCBD) with three replications and nine treatments. Jeevamruth @ 500 ml per plant is drenched at two stages *i.e.*, flowering and fruit development stage. Seedling roots were dipped in Beejamruth for 12 hours at concentration or quantity of 50 ml per seedling. Vermicompost supplies 1.25 per cent Nitrogen, so 100 per cent RDN is supplied by applying 21 g of VC per pot at flowering and fruit development stage. 100 per cent RDN is supplied by applying 52.5 g of FYM per pot at flowering and fruit development stage. The effect of organic manures application observed by determining the different growth parameters like plant height (cm), number of trifoliolate leaves/ plants, leaf area (cm²), plant spread (cm), number of crowns/ plants, number of runners/ plant and plant dry weight recorded at different intervals of time. The leaf area meter (LAM 211) and expressed in cm².

Further yield and yield attributing parameters like berry length (cm), berry diameter (cm), berry weight (g), number of berries/ plants, yield/ plant were also recorded. The data subjected to statistical analysis for drawing conclusion (p=5%).

Result and Discussion

The data pertaining to the study (Table 1) indicated that application of different organic manures significantly influenced the vegetative growth of strawberry. Application of 100 per cent RDN through vermicompost + Jeevamruth @ 500 ml per pot at two stages + Beejamruth seedling treatment significantly increased the plant height (28.85 cm), number of trifoliolate leaves/ plants (27.51), leaf area(106.78 cm²), plant spread (30.42 cm N-S and 30.04 cm E-W), number of crowns/ plants (4.65), number of runners/ plant (6.21)and plant dry weight (36.87 g). On the other hand, strawberry plants applied with Recommended Dose of Fertilizers recorded minimum vegetative growth parameters.

The probable reason for enhancement of vegetative growth might be attributed to the role of Vermicompost in terms of nutrient availability and increase in beneficial enzymatic activities, increased population of beneficial microorganisms or the presence of biologically active plant growth influencing substances such as plant growth regulators or plant hormones and humic acids (Arancon *et al.*, 2006) [1]. The fermented liquid organic manures also contain microbial load and plant growth promoting substances in addition to nutrients that help in improving plant growth. The beneficial microorganisms present in Beejamruth produced IAA and GA and resulted in improvement in seedling length. Similar results were also obtained by Arancon *et al.* (2006) [1], Nileema and Sreenivasa (2010) [11] and Chauhan *et al.* (2016) [4].

Among different treatments, application of 100 per cent RDN through vermicompost + Jeevamruth @ 500 ml per pot at two stages + Beejamruth seedling treatment recorded significantly higher berry length 4.31 cm, berry diameter 3.48 cm, berry weight 18.41 g and number of berries per plant 19.05. Meanwhile minimum yield and yield attributing traits berry length, berry diameter, berry weight, number of berries per plant and yield per plant was recorded with the application of recommended dose of fertilizers alone.

Recommended dose of fertilizers yielded lowest (198.89 g/plant) while application of 100 per cent RDN through vermicompost + Jeevamruth @ 500 ml per pot at two stages + Beejamruth seedling treatment recorded maximum (350.79 g/plant) an increase of 76.37 per cent.

The increase in yield and yield attributing traits in strawberry plants applied with 100 per cent RDN through vermicompost + Jeevamruth @ 500 ml per pot at two stages + Beejamruth seedling treatment might be due to maximum flowers production, fruit set percentage and production of more photosynthates due to maximum vegetative growth of plants as influenced physico-chemical status of media combination and presence of available nutrients in the form of nitrate, phosphate, soluble potassium exchangeable calcium and magnesium which in turn helped the photosynthesis process and phosphorus content enhanced the bud break to increase fruit set percentage, resulting in increased flowering and fruit set in strawberry (Edwards and Burrows, 1988; Sardoei *et al.* 2014) [15]. The similar results were also obtained by Cantliffe *et al.* (2003) [3], Paranjpe *et al.* (2003) [13] and Arancon *et al.* (2004) [2].

Table 1: Effect of organic manures on vegetative growth parameters of strawberry under naturally ventilated polyhouse

Treatment	Plant height (cm)	No. of trifoliolate leaves/plants	Leaf area (cm ²)	Plant spread (cm)		No. of crowns/plant	No. of runners/plant	Plant dry weight (g)
				N-S	E-W			
T ₁	21.41	20.45	92.85	23.54	24.32	2.39	5.05	21.85
T ₂	24.98	25.23	96.31	27.52	28.65	3.31	5.78	29.25
T ₃	22.76	23.01	94.91	25.03	26.41	2.87	5.43	24.89
T ₄	27.57	26.53	100.92	29.97	29.85	4.21	6.02	33.51
T ₅	22.83	21.17	93.22	24.14	25.35	2.56	5.21	22.32
T ₆	25.71	26.12	98.77	28.20	29.41	3.92	5.89	31.13
T ₇	23.26	24.34	95.81	26.13	27.45	3.15	5.65	27.82
T ₈	28.85	27.51	106.78	30.42	30.04	4.65	6.21	36.87
T ₉	18.65	19.21	89.14	22.07	23.18	2.22	4.82	19.76
S. Em ±	0.05	0.05	0.08	0.04	0.04	0.01	0.01	0.09
CD @ 5%	0.15	0.14	0.24	0.13	0.12	0.04	0.02	0.27

Table 2: Effect of organic manures on yield and yield attributing parameters of strawberry under naturally ventilated polyhouse

Treatment	Berry length (cm)	Berry diameter (cm)	Berry weight (g)	Number of berries per plant	Yield per plant (g)
T ₁	2.64	2.54	14.63	15.07	220.49
T ₂	3.58	3.13	15.82	17.31	273.85
T ₃	3.01	2.82	15.48	16.22	251.13
T ₄	3.89	3.36	17.26	18.56	320.35
T ₅	2.87	2.63	15.39	15.65	240.93
T ₆	3.71	3.25	16.53	17.85	295.17
T ₇	3.32	2.97	15.45	16.82	260.01
T ₈	4.31	3.48	18.41	19.05	350.79
T ₉	2.35	2.32	13.80	14.41	198.89
S. Em ±	0.01	0.01	0.02	0.02	0.73
CD @ 5%	0.03	0.02	0.06	0.07	2.20

**Fig 1:** General view of the experimental plot**Fig 2:** Fruit yield in different treatments**Fig 3:** Beejamruth seedling treatment and Jeevamruth preparation

Conclusion

The result of the present study revealed that cultivation of strawberry variety "winter dawn" by application of 100 per cent RDN through vermicompost + Jeevamruth @ 500 ml per pot at two stages + Beejamruth seedling treatment found better for increasing vegetative growth, yield and yield attributing traits under naturally ventilated polyhouse.

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