Original Research Article

Effect of city-compost on plant growth, fruit yield and quality of strawberry cv. Festival in Nagaland

ABSTRACT

In this experiment, the effect of different doses of city-compost were conducted including the dose of Nitrogen, phosphorous and potassium through chemical fertilizer as control (T_1=100:60:150 Kg ha $^{-1}$) and it comprises of eight treatments as a total (T_2=1. 25 t ha^{-1}, T_3=2.5 t ha^{-1}, T_4=3.5 t ha^{-1}, T_5=4 t ha^{-1}, T_6= 5t ha^{-1}, T_7=5.5t ha^{-1}, T_8= 6t ha^{-1}). Under growth parameters T_1 gave the maximum plant spread, leaf area, number of runners and number of fruits per plant (6.33). Under yield parameters fruit size in terms of length was obtained highest in T_4 (4.15 cm) and in diameters T_1 gave the maximum size (2.81 cm). Maximum yield were found under T_1 (81.43 g plant-1). Under quality parameters, total soluble solids (TSS) (8.03 °Brix), non-reducing sugar (2.87 %), total sugar (5.20 %) and vitamin C (41.67 mg/l00ml) were recorded maximum in T4 as compared to other treatments.

Key words: City-compost, Nagaland, growth, yield, quality.

Introduction:

Strawberry *(Fragaria* X *ananassa* Duch.) is a soft fruit which belongs to the family Rosaceace and genus *Fragaria* is a unique fruit with highly desirable taste, flavour and excellent source of vitamins, potassium, fibre and sugars (Sharma and Sharma, 2004). Compared to other berry fruits, strawberries contain a higher percentage of vitamin C, phenolics and flavonoids (Hakkinen and Torronen, 2000). Though it is a major fruit of temperate region, with the advent of day neutral cultivars, it grows well in tropical and sub-tropical regions of the world. In India its cultivation is confined only to hilly tracts of Himachal Pradesh, Uttaranchal, parts of Uttar Pradesh and Kashmir valley, but with the introduction of day neutral cultivars its cultivation has spread to tropical and sub-tropical regions too. Its cultivation can be extended to other suitable areas having assured irrigation and transport facilities. The NorthEast States, particularly Nagaland, Meghalaya, Arunachal Pradesh, Sikkim and Mizoram provide ample opportunity for successful strawberry cultivation due to its mild climatic condition. Strawberry gives the quickest returns in shortest possible time. The strawberry fruit is the first of the season's home-grown supplies to reach the markets and while the principal demand is for desserts, it is also used for jam and ice-cream, canning and quick freezing (Hughes *et al.* 1969).

It is commercially propagated by runners and generally one plant produces 7-10 runners but under proper management, it can go up to 15 runners per plant. Daylight period of 12 hour or less and moderate temperatures are important for flower-bud formation, but different cultivar may have a different day length and temperature requirement. Strawberry can be grown in any type of soil-poor sand to heavy clay-provided proper moisture, organic matter and drainage is present.

The importance of study on effect of city-compost has not been done under foothill of Nagaland so far. City-compost is a finely divided peat like biodegradable

material with high porosity, aeration, water holding capacity, most available micro and macro nutrients and rich microbial activity which makes it an excellent soil conditioner. Keeping in view, the present study "Effect of city-compost on plant growth, fruit yield and quality of strawberry in Nagaland" was taken to quantify and test the performance strawberry cultivar festival under sub-humid sub-tropical part in Nagaland with the following objectives: to study the effect of various doses of city-compost on plant growth, fruit yield, quality of fruit and to study the economics of various treatments of strawberry cultivation.

Methods and materials:

The experiment was conducted at Horticultural Experimental Farm, School of Agriculture Sciences and Rural Development (SASRD), Nagaland University, Medziphema Campus. The experimental farm is situated in the humid and sub-tropical region with an average rainfall ranging from 2000 to 2500 mm annually, the mean temperature ranges from 21°C to 32°C during summer an rarely goes below 8°C in winter. The experimental plot was laid out in randomized block design with different doses of city-compost along with paddy straw as mulch material and one control (inorganic fertilizers) and replicated thrice. $T_{1:}$ Inorganic fertilizer (N_{100}: P $_{60:}$ K_{150} Kg ha^{-1}) as control, T_2: City-compost @ 1. 25 t ha^{-1}, T_3: City-compost @2.5 t ha^{-1}, T_4: City-compost @3.5 t ha^{-1}, T_5: City-compost @4 t ha^{-1}, T_6: City-compost @5t ha^{-1}, T_7: City-compost @5.5 t ha^{-1}, T_8: City-compost @6 t ha^{-1}.Growth parameters like plant spread, leaf area, number of runners and yield parameters like days taken to flowering, days taken to fruit set, number of fruits, days taken for ripening, fruit size, weight, yield, marketable fruit yield and projected yield was calculated by the relationship given below:

$$Marketable\ fruit\ yield\ (g/plot) = \frac{Total\ fruit\ yield}{average\ number\ of\ fruits/plant}$$

$$\text{Projected yield } (q/ha\ ) = \frac{\text{Average yield per plant}}{\text{plant density per hectare}}$$

Mean data obtained during the period of investigation were statistically analyzed by the analysis of variance method (Panse and Sukhatme, 1995). The significant of different source of variance were tested by error mean square, using Fisher Snedecor 'F' test of probability at 0.5 % level of significance.

Results and discussion:

The data pertaining to the plant growth, development, yield and quality of fruits under the different treatments obtained during the course of investigation are represented below: Plants under T_1 gave the maximum spread (13.53cm and 12.67cm, 14.00cm and 13.37cm, 14.40cm and 13.67cm) at 15, 30 and 45 days after planting and minimum spread was recorded in T_6.Data pertaining to leaf area presented in Table 1 shows the slight differences among different doses of city-compost. The highest leaf area was recorded in T_1 (27.33 cm^2, 30.26 $cm^{2,}$ 33.88 cm^2 and 36.1 cm^2) at 15, 30, 45 and 60 DAP and the least is found under T_2. The various dose of city-compost did not influence to produce any runners at 60 and 90 DAP.

However, at 120 and 150 DAP it was found varying significantly among the treatments. It was observed that of all the treatments T_1 produced maximum runners per plant (4.67 and 5.33) at 120 and 150 DAP respectively. The treatment T_2 was recorded with the minimum number of runners on both the dates of observation. The results are also in agreement with findings of Abadi *et al*., 2011 who reported on effect of municipal compost application on micro elements concentration in soil and tissue of plant of mint. Lima *et al.,* 2004 in corn confirmed the beneficial effectiveness of municipal solid waste compost and sewage sludge in maintaining plant growth and yield. With regard to plant growth parameters, the application of chemical fertilizers showed highest significant variance, it might be due to the fact that inorganic fertilizers source from Urea, SSP and MOP provides sufficient quantity of NPK which are the major elements for the production of photosynthates and accumulation of chlorophyll in the leaves.

Table 1: Effect of various doses of city-compost on plant growth parameters of Strawberry cv.Festival

Treatments	Plant Spread (cm)						Leaf area(cm^2)				Number of runners	
	North-South			East-West								
	15DAP	30DAP	45DAP	15DAP	30DAP	45DAP	15DAP	30DAP	45DAP	60DAP	120DAP	150DAP
T_1	13.53	14.00	14.40	12.67	13.17	13.67	27.33	30.26	33.88	36.18	4.67	5.33
T_2	12.53	12.97	13.37	11.54	11.93	12.33	19.99	21.05	22.20	23.10	2.33	3.00
T_3	13.17	13.53	13.93	12.30	12.80	13.27	20.74	21.19	23.34	24.11	2.67	3.33
T_4	12.93	13.33	13.80	11.90	12.60	13.00	24.47	26.07	27.16	29.39	3.00	3.67
T_5	12.37	13.03	13.47	11.30	11.87	13.07	21.55	22.27	24.04	25.23	3.33	4.00
T_6	11.60	12.00	12.47	11.19	11.70	12.10	22.15	23.21	24.26	25.89	3.67	4.67
T_7	12.07	12.67	13.07	12.07	12.67	13.07	22.92	23.92	24.94	26.04	4.00	5.00
T_8	12.33	12.83	13.27	11.80	12.40	12.83	23.24	24.84	25.79	26.98	4.33	5.00
***Sem*±**	**0.31**	**0.31**	**0.30**	**0.29**	**0.30**	**0.30**	**0.36**	**0.54**	**0.62**	**0.65**	**0.32**	**0.36**
CD (P=0.5)	**0.95**	**0.94**	**0.91**	**0.89**	**0.91**	**0.92**	**1.10**	**1.63**	**1.89**	**1.98**	**0.96**	**1.09**

***DAP: Days After Planting**

The perusal of the data regarding flowering revealed that the number of days taken to flower showed variation among the different treatments. T_4 took the least duration (76.67days) for flower initiation among all treatments and maximum was in T_1 (91.27). The data regarding days taken to fruit set did not show significant variance among the treatments. In general, T_2 took least duration (15.07 days) and longest period in T_1 (16.93days). Number of fruits per plant were highest under T_1 (6.33) and least recorded in T_2 (4.00). The results of days taken for fruit ripening under T_1 showed least number of days (24.20) and longest has been recorded in T_2(28.87). In terms of fruit diameter, the maximum fruit size was obtained from plants under T_1 (2.81cm) and the minimum in T_2 (2.37). The weight of the fruit varied significantly among different treatments was showed in Table 2. Maximum fruit weight was recorded under treatment T_4 (13.47g) while the minimum in T_2 (8.87g). The data regarding highest yield per plant was recorded in T_1 (81.43g/plant) and lowest in T_2 (34.42g/plant). The increase in yield of strawberry plants in the present experiment could be explained by increase the microbial population resulting from adding city-compost in soils, these microorganisms can produce substances which effects on fruit weight and number of fruits. The data of highest marketable fruit yield were recorded in T_1 (725.67g/m^2) while lowest was recorded in T_2 (307.89g/m^2). A perusal data of projected yield revealed that T_1 (75.82 q/ha) has shown highest and lowest in T_2 (32.89 q/ha). Kavitha and Subramanian (2007) in rice,

Kasturi *et al.*, 2011 in fenugreek, Tzortzakis *et al*., 2012 in pepper confirmed the effect off enriched municipal waste, solid waste on growth and yield.

Table 2: Effect of various doses of city-compost on flower, fruit and yield attributes of Strawberry cv. Festival

Treatments	Days taken to flowering	Days taken to fruit set	Number of fruits/plant	Days for fruit set to ripening	Fruit diameter (cm)	Fruit weight (gm.)	Yield (g/plant)	Marketable Fruit yield (g/plot)	Projected yield (q/ha)
T_1	91.27	16.63	6.33	24.20	2.81	13.07	18.43	725.67	75.82
T_2	83.47	15.07	4.00	28.87	2.37	8.87	34.42	307.89	32.89
T_3	89.53	16.27	4.93	27.13	2.33	10.47	50.41	454.56	47.38
T_4	76.67	16.27	5.67	27.33	2.42	13.47	75.78	682.64	70.67
T_5	78.33	16.47	5.33	26.27	2.59	13.20	70.63	635.89	64.13
T_6	79.07	16.47	5.53	28.13	2.43	13.00	67.03	603.76	62.12
T_7	82.60	16.73	5.07	25.47	2.35	12.47	63.67	573.54	58.38
T_8	83.60	16.73	5.15	27.53	2.59	11.80	59.14	533.09	54.33
***Sem*±**	**3.09**	**0.90**	**0.39**	**0.54**	**0.08**	**0.84**	**1.91**	**10.31**	**1.31**
CD (P=0.5)	**9.37**	**NS**	**1.20**	**1.63**	**0.24**	**2.54**	**5.79**	**31.27**	**3.97**

A perusal of data related to quality parameters in Table 3. The treatments T_5 and T_7 (4.33days) were shown maximum storage life under refrigerated conditions and T_2, T_4 and T_8 (3.33days) were shown lowest shelf life. The fruits of T_6 showed maximum shelf life (2days) under room conditions and minimum was in T_8 (1.00days). The data regarding TSS recorded highest in T_4 (8.03°B) and lowest in T_2 (6.20°B). The lowest titratable acidity has been recorded in T_2 (0.55%) and highest in T_1 (0.72%). The highest reducing sugar percentage was found in T_7 (2.87%) and minimum in T_2 (2.33%). The different doses of city-compost had influence on non-reducing sugar content of fruits which showed variation among the different treatments. The highest was recorded in T_4 (2.87 %) while the least was recorded in T_7 (1.30%). The fruits under T_4 gave the highest total sugar content (5.20%) and lowest in T_2 (3.93%). The ascorbic acid content was estimated highest in T_4 (41.67 mg/100ml juice) and T_2 (28.33 mg/100ml juice) recorded lowest. Increased TSS and total sugars at higher levels of compost might have resulted since humic acid played a specific regulatory role and accumulate higher amounts of carbohydrates in the fruits which might have resulted in to higher TSS and sugar content in fruits. Shehata *et al*., 2011 and Mahaden, 2009 conducted an experiment on strawberry and revealed that organic fertilizers influence significantly on fruit yield and quality parameters.

Table 3: Effect of various doses of city-compost on fruit quality parameters of Strawberry cv. Festival

Treatments	Shelf life in days		Total soluble solids(°B)	Titratable acidity (%)	Reducing sugar (%)	Non-reducing sugar (%)	Total Sugar (%)	Vitamin C (mg/100ml)
	Under refrigerator	Under room condition						
T_1	4.00	1.67	7.55	0.72	2.63	1.73	4.37	40.00
T_2	3.33	1.33	6.20	0.55	2.33	1.60	3.93	28.33
T_3	4.00	1.67	6.46	0.56	2.43	1.63	4.07	30.00
T_4	3.33	1.67	8.03	0.57	2.33	2.87	5.20	41.67
T_5	4.33	1.67	8.00	0.59	2.50	1.97	4.4	40.00
T_6	3.67	2.00	7.78	0.62	2.23	2.37	4.60	38.33
T_7	4.33	1.33	7.04	0.64	2.87	1.30	4.17	35.00
T_8	3.33	1.00	6.97	0.67	2.47	1.83	4.30	33.33
***Sem*±**	0.2	0.21	0.40	0.03	0.10	0.12	0.08	2.84
CD (P=0.5)	NS	NS	1.20	0.10	1.30	0.36	0.24	2.62

Conclusion:

Under growth parameters T_1 gave the maximum plant spread, leaf area, number of runners and number of fruits per plant (6.33). Maximum yields were also found under T_1 (81.43 g plant-1). Under quality parameters, total soluble solids (TSS) (8.03 °Brix), non-reducing sugar (2.87 %), total sugar (5.20 %) and vitamin C (41.67 mg/l00ml) were recorded maximum in T4 as compared to other treatments.

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