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Effect of Nutrient Concentration on Fruit Quality and Quantity of Strawberry (*Fragaria* x *ananassa*)

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A B S T R A C T

An experiment on effect of nutrient concentration on fruit quality and quantity of Strawberry (*Fragaria* x *ananassa*) was carried out during winter season of the year 2016-2017 at Agriculture research farm, Department of Soil Science, Lovely Professional University. This trial was operated based on a Randomized Complete Block Design (RCBD) with nine treatments including different ratios of farmyard manure, vermicompost and recommended dose of fertilizer. The measured traits included number of branches/plant, number of flowers/plant, number of fruits/plant and fruit girth (mm). The results revealed that T9 significantly increase growth, quantity and quality attributing characters like number of flowers/plant (2.66), number of fruits/plant (2.33), fruit girth (9.2mm) at 90 days while maximum number of branches/plant (3.66) significantly find in T1 and T7 at 60 days, 75days and 90 days.

Introduction

Strawberry (*Fragaria* x *ananassa*) is the popular soft fruit and mainly grows in sub-tropical and hills at elevation of 3000 meter. The fruit of strawberry is characterized in sweetness, bright red colour, aroma, and juicy texture. Strawberry plants having more varieties but in India mostly Winter down, Chandler, Tioga, Torrey, Selva, Belrubi, Fern and Pajaro. Other varieties include Premier, Camarosa, Red cost, Local Jeolikot, Dilpas and, Bangalore, Florida 90, Katrain Sweet, Pusa Early Dwarf and Blakemore. Strawberry is propagated by runner. The ideal time of strawberry planting is Mid-Sep to Mid-Oct in hilly region. And Mid-Oct to Mid-Nov is good for plains region in India. It requires 30 x 60cm spacing for good plant growth. Strawberry is mostly found in whole world and called fruits of love by the Roman Poets Virgil and Ovid in the first century.

In England strawberry cultivated since sixteen century. At present strawberry is also cultivated on soil. It creates a good result on soil. Strawberry crops need the mulching technique for destroy the seeds of weeds by heating effect and also helps in conservation of water. Strawberry plants also take more potassium from soil and apply fertilizer in inorganic form.

Materials and Methods

Location of research

It is carried out at Experimental Farm of School of Agriculture, Lovely Professional University, Phagwara, Punjab. The experiment shall be laid out on pot with three replications. The package of practices for raising the crop shall be followed as per latest PAU guidelines and check the Nitrogen, Phosphorus, Potassium and organic carbon of soil.

Experimental details

Period of work: Mid November to march 2017
Treatments: 9
Replications: 3
Total number of pots: 9x3=27
Design: RCBD on pots
Variety: Chandler
Seed rate: seedling plants

Observation details

For the determination of the plants growth selected various parameters viz., Number of Branches/Plant, Number of flowers/Plant, Number of Fruits/Plant and Fruit Girth (mm).

Statistical analysis

The data collected during the course of investigation were subjected to statistical analysis by adopting appropriate method of analysis of variance as described by Fisher. The critical difference for the treatment comparison was worked out, wherever the SPSS 16 is used to analysis the data.

Results and Discussion

The number of branches is observed in between the 15 days to 90 days. At 45 days 50.15% increase number of branch in between all treatment; 30.03 % increase at 60 days. At 45 days the results shows the 44.66% increase in the number of branch as compare to the 30 days; however the variation in treatment are from 2.33-3.33 branches and T_3 (75%RDF + 25% vermicompost) gives best results on number of branches/plant (Table 1).

These results shows due to the vermicompost increase the uptake of nutrient and assimilation capacity and stimulate the hormones. It impact on the number of branches/plant (Rajiv *et al.,* 2010). No increase in the number of branches after the vegetative growth. The flowers on plants were seen after the 45 days of transplanting. And more flowers was comes after the 60 days. And these are fully mature into the fruits in 7 days.

In between the treatments at 45 days, 83.5% increase in the flowers/plant; at 60 days 67% increase in the flower/plant; 85.53% increase at 75 days; 75.1% increase in flower/plant at 90 days. At 60 days, the result shows that the 17% increase in the flower/ plant as compare to the 45 days; however the variation in treatments are from 0.66-2 flowers and T_9 (25%RDF+75%FYM), T_1 (control), T_7 (100% FYM) shows the best impact on the flower/plant (Table 2).

This is due to the Nitrogen is apply before one week of transplanting (Anita Sonsteby *et al.,* 2009). At 70 days observation shows that the 16.5% increase in the flower/plant as compared to the 60 days; however the variation in treatment from 0.33-2.33 flowers and the treatment is T_9 (25%RDF+75%FYM) shows the best impact on flowers/plant. And it's also depends on the type of cultivation like open system or poly-house system. The open cultivation shows the more flowering as compared to the poly house (Ashok Kumar *et al.,* 2011).

Details of treatment

T_1 = Control
T_2 = 100% Recommended dose of fertilizer (RDF)
T_3= 75% RDF + 25%Vermicompost
T_4 = 50% RDF +50% Vermicompost
T_5 = 25%RDF + 75%Vermicompost
T_6 = 100% Vermicompost
T_7 = 100% Farm yard manure (FYM)
T_8 = 50% RDF + 50% FYM
T_9 = 25% RDF + 75% FYM

Table.1 Data on the effect of nutrient concentration on strawberry number of branches/plant at 15, 30, 45, 60, 75 and 90 days. The mean followed by different letters are significant different at p<0.05, according to DMRT (Duncan's Range Test) for separation of means

Treatment	NB15Days	NB30 Days	NB 45 Days	NB 60 Days	NB 75Days	NB 90 Days
T1	1.33a±0.33	2.66ab±0.33	3.33a ±0.33	3.6a±0.33	3.66a±0.33	3.66a±0.33
T2	1.66a±0.33	3.00a ±0.00	3.00ab ±0.00	3.00a±0.0	3.00a±0.00	3.00a±0.00
T3	1.33a±0.33	3.33a ±0.33	3.33a ±0.33	3.33a±0.33	3.33a±0.33	3.33a±0.33
T4	1.33a±0.33	2.33ab±0.33	3.00ab ±0.00	3.00a±0.00	3.00a±0.00	3.00a±0.00
T5	2.00a±0.57	2.33ab±0.33	3.00ab ±0.00	3.33a ±0.33	3.33a±0.33	3.33a±0.33
T6	2.00a±0.57	2.33ab±0.33	2.33b ±0.33	3.33a ±0.66	3.33a±0.66	3.33a±0.66
T7	1.33a±0.33	1.66b ±0.33	2.66ab ±0.33	3.66a ±0.33	3.66a±0.33	3.66a±0.33
T8	2.00a±0.57	2.33ab±0.33	2.66ab ±0.33	3.33a ±0.33	3.33a ±0.33	3.33a±0.33
T9	1.33a±0.33	1.66b ±0.33	2.66ab±0.33	2.66a ±0.33	2.66a ±0.33	2.66a±0.33

NB= Number of branches

Table.2 Data on the effect of nutrient concentration on strawberry number of flowers/plant at 45, 60, 75 and 90 days. The mean followed by different letters are significant different at p<0.05, according to DMRT (Duncan's Range Test) for separation of means

Treatment	NF 45 Days	NF 60Days	NF 75Days	NF 90 Days
T1	1.66ab ±0.33	2.00a ±0.00	0.33b±0.33	1.66ab ±0.33
T2	0.33b ±0.33	1.00ab ±0.00	1.00ab ±0.57	1.00b ±0.00
T3	0.33b ±0.33	0.66b ±0.33	0.66ab ±0.33	1.00b ±0.57
T4	1.33ab ±0.33	1.66ab ±0.33	2.00ab ±0.57	1.66ab±0.33
T5	1.00ab ±0.57	1.0ab ±0.57	0.66ab ±0.33	0.66b ± 0.33
T6	0.33b ±0.33	1.0ab ±0.00	2.00ab ±0.57	0.66b ±0.66
T7	1.66ab ±0.33	2.00a ±0.57	1.66ab ±0.66	1.00b ±0.57
T8	1.33ab ±0.33	1.33ab ±0.33	2.00ab ±0.57	2.00ab ±0.33
T9	2.00a ±0.57	2.00a ±0.57	2.33a ±0.33	2.66a ±0.17

NF= Number of Flowers

Table.3 Data on the effect of nutrient concentration on strawberry number of Fruits/plant at 60, 75 and 90 days. The mean followed by different letters are significant different at p<0.05, according to DMRT (Duncan's Range Test) for separation of means

Treatment	FRUP 60	FRUP 75	FRUP 90
T1	1.0bc ±0.57	2.00a ±0.57	1.66ab ±0.33
T2	1.0bc ±0.33	1.33a ±0.33	1.0ab ±0.57
T3	0.66c ±0.33	1.33a ±0.33	0.66b ±0.33
T4	1.66abc ± 0.66	1.66a ±0.66	1.0ab ±0.00
T5	1.0bc ±0.33	1.66a ±0.33	1.0ab ±0.57
T6	1.33abc ± 0.00	1.0a ±0.00	2.0ab ±0.57
T7	2.00ab ±0.57	2.0a ±0.57	1.33ab ±0.33
T8	2.00ab ±0.33	0.66a ±0.33	1.66ab ±0.33
T9	2.33a ±0.33	1.66a ±0.33	2.33a ±0.33

FRUP= Fruits/Plant

Table.4 Data on the effect of nutrient concentration on strawberry Fruits girth at 60, 75 and 90 days. The mean followed by different letters are significant different at p<0.05, according to DMRT (Duncan's Range Test) for separation of means

Treatment	FG 60	FG 75	FG 90
T1	5.3ab ±0.27	3.76a ±3.11	4.03a ±3.48
T2	8.2a ±3.7	3.90a ±3.05	8.0a ±4.04
T3	4.3b ±0.23	7.6a ±0.06	3.53a ±3.23
T4	5.3ab ±0.23	4.40a ±3.80	8.0a ±0.05
T5	3.6b ±0.18	4.86a ±4.06	5.0a ±0.25
T6	3.8ab ±3.1	5.13a ±4.43	7.53a ±3.51
T7	8ab ±0.05	7.86a ±3.64	4.83a ±4.08
T8	7.53ab ±3.51	4.66a ±4.66	4.53a ±3.73
T9	4.23ab ±3.38	4.53a ±3.73	9.20a ±4.30

FG= Fruits Girth

The 12.40% increase shows at the 90days as compared to the 75days and the variation in the treatment from 1-2.66 flowers and treatment is T_9 (25% RDF +75% FYM) shows the best impact on flowering according to other researcher the vermicompost direct impact on the flowers and 37% increase in the flowering (Arancon *et al.*, 2006).

The fruits were developed from the flower in 7 days. And the number of fruits increases after the 60 days of transplanting. The observation is taken at 60, 75 and 90 days. In between treatment at 60days, the fruits/plant 71.67% increase; at 90days 71.67% increase in between the treatment. At 90days, the fruits/plant observation shows that 28.75% increase as compared to the number of fruits/plants at 60days; however the variation in treatment are from 0.66-2.33 fruits and treatment T_9(25% RDF +75% FYM) shows the best impact on the number of fruits/plant (Table 3). Some researchers (Papadopoulos *et al.*, 1987) show it is due to the nitrogen fertilizer apply with different concentration like 3.6,7.2 or 10.8 mmol Nl^{-1} and also change with the application of the combine application of Urea, ammonium nitrate and potassium nitrate. Fruits girth observation shows that the 94.75% decrease from the 75

days; however the variation is from 0.36-8.2 mm and T_2 (100% RDF) shows best impact on the fruit girth. In between the treatment at 60 days, 94.75% of fruits girth increase. At 60 days the fruits girth is 8.2 mm recorded in T_2 and minimum girth is 3.6 mm recorded in T_6 (100% vermicompost) (Table 4). The change in the fruits girth is due to the vermicompost due the biochemical activities in the soil (Ali *et al.,* 2001). At 90 days T_9 (25% RDF + 75% FYM) Shoes the best fruits girth 9.20mm and T_3 shows minimum 3.53mm fruits girth.

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