Effect of Inorganic and Bio-fertilizers on Growth, Yield and Physico-chemical characters of Strawberry (*Fragaria x annanasa* L. Duch.) cv. Chandler in Central Uttar Pradesh

SUMMARY

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SUMMARY

Strawberry is an important fruit crop whose cultivation has ample scope near the cities and belongs to the family Rosaceae. The commercial variety of strawberry *(Fragaria x ananassa Duch.)* has cultivated in about 75 countries**.** Strawberry *(Fragaria × ananassa Duch)* is one the most popular soft fruits cultivated in plains as well as in the hills up to an elevation of 3000 m in humid or dry regions. Strawberry fruits are in great demand for fresh market processing, industries as well as used in preserve and confectionaries purpose. Its popularity can be judged from the phenomenal increases in production during the recent years. Organic agriculture is an alternative production system that decreases negative ecological balance. The system recommends organic and green manure, crop rotation, and soil protection to utilize on-site parasite and predators for biological control and to enhance biodiversity.

Azotobacter represents the main group of heterotrophic, non symbiotic, gram negative, free living nitrogen-fixing bacteria. They are capable of fixing an average 20 kg N/ha/year. The genus *Azotobacter* includes 6 species, with *A. chroococcum* most commonly inhabiting in various soils all over the world (Mahato *et al*., 2009). Organic fertilizers improve soil fertility by modifying soil structure, pH, biophysical conditions and availability of essential nutrients (Atiyeh et al., 2002). Considering the future prospects of organic agriculture, studies were carried out to evaluate the influence of different organic amendments on growth related parameters, productivity and fruit quality of strawberry cv. Chandler.

Bio-fertilizers play a very important role in improving soil fertility by fixing atmospheric nitrogen, both in association with plant roots and without it, solubilise insoluble soil phosphates and produce plant growth substances in the soil. They are in fact being promoted to harvest the naturally available biological system of nutrient mobilization (Venkatashwarlu, 2008).

Keeping in view of the above present investigation **"Effect of Inorganic and Bio-fertilizers on growth, Yield and Physico – chemical characters of Strawberry (*Fragaria* x *annanasa* L. Duch.) cv. Chandler in Central Uttar Pradesh"** carried out with the following objectives:

1. To find out the effect of Inorganic and Bio-fertilizers on vegetative growth of Strawberry.
2. To assess the effect of Inorganic and Bio-fertilizers on fruit yield of Strawberry.
3. To ascertain the effect of Inorganic and Bio-fertilizers on Physico–chemical characteristics of Strawberry.
4. To work out the effect of Inorganic and Bio-fertilizers on benefit: cost ratio of Strawberry.

The experiment was conducted at the Horticultural Research Farm-I, of the Department of Applied Plant Science (Horticulture), Babasaheb Bhimrao Ambedkar University, Vidya Vihar, Rae Bareli Road, Lucknow. The experimental plot located approximately 10 km from Lucknow on the Rae Bareli Road towards the south city of the Lucknow. The farm is situated at an elevation of 129 meters above the mean sea level. Lucknow is geographically situated in the subtropical tract of central U.P. at 26^{o} 46' North latitude and 80^{o} 55' East longitudes.

The runners of Chandler variety of strawberry were brought from the Dr Yashwant Singh Parmar University of Horticulture & Forestry, Nauni, Solan (H. P.) in both years. The runners were kept for two days in shade for hardening before transplanting in well- prepared beds under open field condition plots which were distributed randomly in three replications with thirteen treatments. Standard cultural practices were followed during the period of the experiment for maintaining the runners quality and yield also.

The experimental field was ploughed to the depth of 30 cm with the help of tractor. The field was kept open to sun for at least 10 days for killing the weeds and eggs of insects by repeated plough followed by planking to obtain fine tilth. Required area was marked and prepared according to the lay out plan. A total 48 plots were made with a size 2.1 x 1.2 m^2 of each plot. 0.5 m wide drainage channel were made between the two replications. Each plot contains 6 rows (rows were raised by 15 cm from main field) and runners were planted at distance of 30 x 15 cm (6 plants in each row), accommodated 36 plants in each plot. The strawberry runners were planted on 29^{th} October (date matched by planting material brought) in the evening 2013-14 and 2014-15, respectively.

The planting was done in single row system, healthy runners was transplanted on 10th October 2015 and October 2016 during evening hours. Runners were planted in four rows in each plot at a distance of 30 cm row to row and 15 cm plant to plant. The first irrigation was applied immediately after planting and the subsequent irrigation were given at an interval of 7-10 days during winter and 4-5 days during summer.

The beds were kept clean by regular weeding and hoeing. Weeding and hoeing were done manually with the help of hand hoe and khurpi. Generally four to five weeding and hoeing were done during the crop period

An area of 17.60 m x 7.60 m size was divided into 39 plots having the size of 1.2 m x 1.2 m and arranged in the three replications of 13 plots. The experiment was laid out in R.B.D under 13 treatments. The salient features of the experiment are summarized below:-

- The maximum plant height was noticed by the application of 100 Kg N ha^{-1} + Azotobacter i.e. T_2 which was at par with T_6 i.e. 60 Kg P ha^{-1} + Azotobacter. The minimum plant height was observed in control T_1 Control i.e. No Inorganic and no Bio-fertilizers.
- The maximum number of leaves was studied in the application of 100 Kg N ha^{-1} + Azotobacter i.e. T_2 which was at par with T_4 i.e. 75 Kg N ha^{-1} + Azotobacter. The minimum number of leaves was assessed in control T_1 Control i.e. No Inorganic and no Bio-fertilizers.
- In North-south direction the maximum spreading was observed in treatment T_2 i.e. 100 Kg N ha^{-1} + Azotobacter at par with treatment T_4 i. e. 75 Kg N ha^{-1} + Azotobacter, minimum spreading in T_1 Control i.e. No Inorganic and no Bio-fertilizers.
- In case of East-west direction the highest spreading of plant examined in treatment T_2 i.e. 100 Kg N ha^{-1} + Azotobacter at par with treatment T_4 i. e. 75 Kg N ha^{-1} + Azotobacter and minimum spreading in T_1 Control i.e. No Inorganic and no Bio-fertilizers.

- The superior leaf length was observed in the treatment T_2 i.e. 100 Kg N ha^{-1} + Azotobacter at par with treatment T_3 i.e. 100 Kg N ha^{-1} + PSB whereas, minimum leaf length in T_1 Control i.e. No Inorganic and no Bio-fertilizers.
- The maximum leaf width was recorded the treatment T_2 i.e. 100 Kg N ha^{-1} + Azotobacter at par with treatment T_3 i.e. 100 Kg N ha^{-1} + PSB , minimum in T_1 Control i.e. No Inorganic and no Bio-fertilizers.
- Number of fruit was maximum in T_{12} i.e. 45 Kg K ha^{-1} + Azotobacter at par with T_{13} i.e. 45 Kg Kha^{-1} + PSB and minimum was observed in T_1 Control i.e. No Inorganic and no Bio-fertilizers.
- The runner production was superior find out in treatment T_2 i.e. 100 Kg N ha^{-1} + Azotobacter at par with treatment T_3 i.e. 100 Kg N ha^{-1} + PSB, T_4 i. e. 75 Kg N ha^{-1} + Azotobacter. Minimum runner was observed in T_1 Control i.e. No Inorganic and no Bio-fertilizers.
- The highest length of fruits was assess in the treatment T_2 i.e. 100 Kg N ha^{-1} + Azotobacter followed by treatment T_4 i. e. 75 Kg N ha^{-1} + Azotobacter. Minimum length of fruit was observed in T_1 Control i.e. No Inorganic and no Bio-fertilizers.
- The minimum width was recorded in the in T_1 Control i.e. No Inorganic and no Bio-fertilizers, maximum in treatment T_2 i.e. 100 Kg N ha^{-1} + Azotobacter at par with treatment T_3 i.e. 100 Kg N ha^{-1} + PSB.
- In view of fruit weight was superior in the treatment T_2 i.e. 100 Kg N ha^{-1} + Azotobacter followed by treatment T_3 i.e. 100 Kg N ha^{-1} + PSB. Minimum weight of fruit was assessing in treatment T_1 Control i.e. No Inorganic and no Bio-fertilizers.
- In terms of fruit yield per plant, fruit yield per plot was highest in treatment T_2 i.e. 100 Kg N ha^{-1} + Azotobacter at par with treatment T_3 i.e. 100 Kg N ha^{-1} + PSB but poorest observations found in treatment T_1 Control i.e. No Inorganic and no Bio-fertilizers.
- Yield per hectare was superior in the application of 100 Kg N ha^{-1} + Azotobacter i.e. T_2 which was at par with T_3 i.e. 100 Kg N ha^{-1} + PSB and the minimum per hectare yield was observed in T_1 Control i.e. No Inorganic and no Bio-fertilizers.

- The highest T.S.S. reading was observed in treatment T_6 i.e. 60 Kg P ha-^{1} + Azotobacter followed by treatment T_7 i.e. 60 Kg P ha^{-1}+ PSB. In view of minimum T_1 Control i.e. No Inorganic and no Bio-fertilizers.
- The acidity was recorded minimum in treatment T_6 i.e. 60 Kg P ha-^{1} + Azotobacter, maximum acidity was find out in treatment T_1 Control i.e. No Inorganic and no Bio-fertilizers.
- The maximum value of ascorbic acid was observed in treatment T_6 i.e. 60 Kg P ha-^{1} + Azotobacter followed by treatment T_7 i.e. 60 Kg P ha^{-1}+ PSB. In view of minimum value of ascorbic acid was noticed in T_1 Control i.e. No Inorganic and no Bio-fertilizers.
- In case of pigment anthocyanin maximum value was assess in treatment T_{10} i.e. 60 Kg K ha^{-1} + Azotobacter followed by treatment T_{11} i.e. 60 Kg K ha^{-1} + PSB and minimum value of anthocyanin find out in treatment T_1 Control i.e. No Inorganic and no Bio-fertilizers.
- Total, Reducing and Non-reducing sugar was maximum in treatment T_6 i.e. 60 Kg P ha-^{1} + Azotobacter followed by treatment T_7 i.e. 60 Kg P ha^{-1}+ PSB. In view of minimum values of sugar was noticed in T_1 Control i.e. No Inorganic and no Bio-fertilizers.
- The highest benefit cost ratio was recorded in treatment T_2 i.e. 100 Kg N ha^{-1} + Azotobacter at par with treatment T_3 i.e. 100 Kg N ha^{-1} + PSB but poorest observation was found in treatment T_1 Control i.e. No Inorganic and no Bio-fertilizers.

On the basis of above result obtained in the present investigation, it was concluded that the plant height (cm), number of leaves, spreading of plant (cm), leaf length (cm), leaf width (cm), runner production, yield (t/ha) and benefit cost ratio was highest in treatment T_2 i.e.100 Kg N ha^{-1} + Azotobacter followed by T_3 i. e. 100 Kg N ha^{-1} + PSB. Whereas, minimum benefit cost ratio was found in treatment T_1 i.e. No Inorganic and no Bio-fertilizers but for qualitative parameters was observed in treatment T_6 i.e. 60 Kg P ha-^{1} + Azotobacter followed by treatment T_7 i.e. 60 Kg P ha^{-1} + PSB.

Therefore, it may be recommend that the treatment T_2 i.e.100 Kg N ha^{-1} + Azotobacter for higher yield and as well as higher return under Lucknow condition.