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# Influence of Zinc, Iron, and Organic Manure on the Growth Attributes of Strawberry

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**ABSTRACT: The study, which was conducted from January to April 2023, examined the 'Influence of Zinc, Iron, and Organic Manure on the Growth and Quality Attributes of Strawberry' research farm at Desh Bhagat University in the Mandi Gobindgarh region of Fatehgarh Sahib, Punjab. With ten treatments and five replications, the experiment uses a fully Random Block Design (RBD). Ten distinct degrees of treatment were available. $T_1$ = Zinc Sulphate (0.2%) + Organic Manure (5%), $T_2$ = Iron Sulphate (0.2%) + Organic Manure (5%), $T_3$ = Zinc Sulphate (0.4%) + Organic Manure (10%), $T_4$ = Iron Sulphate (0.4%) + Organic Manure (10%), $T_5$ = Zinc Sulphate (0.6%) + Organic Manure (15%), $T_6$ = Zinc Sulphate (0.6%) + Organic Manure (20%), $T_7$ = Zinc Sulphate (0.8%) + organic manure (20%), $T_8$ = Iron Sulphate + Organic Manure (20%), $T_9$ = Zinc Sulphate (0.8%) + Iron Sulphate (0.8%) + Organic Manure (20%), and $T_{10}$ = Control. Using the chandler variety of strawberry (*Fragaria ananassa* Duch.), the experiment quality-attributing characteristics were noted every seven days. The highest levels of height of plant, plant spread, petiol length, number of leaves and leaf area per plant content were found in the treatments 0.8% $ZnSO_4$ + 20% Organic manure + 0.8% $FeSO_4$ + 20% Organic manure.**

**Keywords:** Organic Manure, Quality Attributes and micronutrients.

## INTRODUCTION

Strawberry (*Fragaria* × *ananassa* Duch.) is one of the most delicious fruits of the world, which is a rich source of vitamins and minerals, and has fabulous flavour and tantalizing aroma. Strawberry is an important fruit of family Rosaceae and occupies an important place among the small fruits. It is monoecious octoploid hybrid of two largely dioecious octoploid species, *Fragaria chiloensis* and *Fragaria virginiana* (Hassan, 2015). The fruit is known for its characteristic aroma, bright red color, juicy texture, and sweetness. The cultivated strawberry is one of the attractive, delicious, tasty and nutritious fruit and distinct and pleasant flavour. It has a unique place among cultivated berry fruits (Yogesh *et al.*, 2021).

The strawberry fruit contain 0.5% total sugar and 0.90% to 1.85% acidity, the prominent being mallic and citric acids. As reported 100g of mature strawberry fruit contains protein 0.7g, fat 0.5g, carbohydrate 8.4g, vitamin A 60 I.U., thiamin 0.03 mg, riboflavin 0.07 mg, niacin 0.60 mg, vitamin C 59.0 mg, calcium 21.0 mg, phosphorus 21.0 mg, iron 1.0 g, potassium 164 mg and sodium 1.0 mg. Even more, strawberries are rich in phyto-chemical compounds with potential anti-oxidant compounds, mainly ellagic acid and flavonoids, which can lower the risk of cardio- vascular events and tumorogenes. These qualities have enhanced the economic importance of this crop throughout the world and nowadays, it remains as a crop of primary interest for both research and fruit production, (Kumar *et al.*, 2010). Micronutrients and organic manure can have a significant impact on the growth, yields, and quality of strawberries. The strawberry required an optimum day temperature of 22ºC to 23ºC and night temperature of 70ºC to 130ºC for maximum growth and development. Strawberry can be grown on a wide range of soils from heavy clays to light sand and gravels. Strawberry consumption can reduce the risk of developing cancer by 50% due to high levels of Vitamin C (30-100 mg/100g of fruit) as well as foliate and photochemical compound such as the ellagic acid present in the fruit (Wang *et al.*, 2017). Besides this, it is also a fairly good source of Vitamin-A (60 IU/100g of edible portion), (Sönmez *et al.*, 2019). In India the cultivation was confined only to hilly tracts of Himachal Pradesh, Dehradun and Nanital (U.K.), Mumbai (Maharastra) and Kashmir valley. It is grown commercially in China (38.7%), USA (17%), Mexico (4.9%), Italy (5%), Rusia (4%), Turkey (4.8%) and Poland (4%) of world production. The area, production and productivity of strawberry in India during 2018-19 was reported 1000

Ha, 5000MT and 7 MT/Ha respectively (NHB, 2018-19).

## MATERIALS AND METHODS

**Experimental Site.** The experiment was conducted in the research farm of Desh Bhagat University, Village-Saunti, Tehsil-Amloh, District- Fatehgarh sahib. The campus is located at 30°.6261 'N latitude and about 76.2492°'E longitude. The agriculture field is located at an elevation of 348.65 meters above sea level. The presentation investigation was made on five month old strawberry plants in the field. The climate of the state is typically subtropical with hot summers and cold winters is generally sub-tropical to sub-temperate; May and June are the hottest months and December to February are the coldest months. The average annual rainfall is 1,110.7 mm of which 75 percent is recorded during June to September.

**Edaphic condition.** The climatic conditions of Mandi Gobindgarh Dist. Fatehgarh Sahib are sub-tropical with three distinct season's *i.e* winter, summer, and rainy. During the winter month (December – January), temperature fall 7-10°C or even low, while in summer month (May-June) it reaches as high as 42-45°C and sometimes there is frost and precipitation may be during winters (Walkley and Black 1966). Most of rainfall occurs in the mid-June to end September after which the intensity of rainfall decreases. The mean annual rainfall received is 67 cm. The climate of the state is typically subtropical with hot summers and cold winters is generally sub-tropical to sub-temperate; May and June are the hottest months and December to February are the coldest months (Olsen *et al.,* 1954). The average annual rainfall is 1,110.7 mm of which 75 percent is recorded during June to September.

**Treatment Details.** The total number of treatments were ten in which different micronutrients are applied with organic manure and in different combinations. The treatments were allocated randomly in each block. With ten treatments and five replications, the experiment uses a fully Random Block Design (RBD).

**Table 1: List of the Treatment Combinations.**

| Treatment | Treatment Combinations |
|---|---|
| $T_1$ | Zinc Sulphate (0.2%)/plot + Organic manure (5%)(FYM @ 5 kg/plot) |
| $T_2$ | Iron Sulphate (0.2%)/plot + Organic manure (5%)(FYM @ 5 kg/plot) |
| $T_3$ | Zinc Sulphate (0.4%)/plot + Organic manure (10%)(FYM @ 10 kg/plot) |
| $T_4$ | Iron Sulphate (0.4%)/plot + Organic manure (10%)(FYM @ 10 kg/plot) |
| $T_5$ | Zinc Sulphate (0.6%)/plot + Organic manure (15%)(FYM @ 15 kg/plot) |
| $T_6$ | Iron Sulphate (0.6%)/plot + Organic manure (15%)(FYM @ 15 kg/plot) |
| $T_7$ | Zinc Sulphate (0.8%) plot + Organic manure (20%)(FYM @ 20 kg/plot) |
| $T_8$ | Iron Sulphate (0.8%)/plot + Organic manure (20%)(FYM @ 20 kg/plot) |
| $T_9$ | Zinc Sulphate(0.8%)/plot + Iron Sulphate (0.8%)/plot + Organic manure(20%) (FYM @ 20 |
| $T_{10}$ | Control |

**Preparation of the Experimental Field.** The observations on growth, yield and quality of strawberry were recorded during the course of investigation to get a complete view of response of the height of plants was measured individually with measuring scale from the crown level to the apex of primary leaves and the results were expressed as average height in centimeters. The plant spread was measured in two directions (NS and EW) at right angles to each other for five tagged plants in each treatment and in each replication, the average value was worked out and expressed in centimeters. Their average was calculated and subjected to statistical analysis. The character was measured with a scale from the base of the crown to the base of the leaf blade and data was expressed in centimeters. From each representative plant, five leaves were selected and their area was measured by using the leaf area meter.

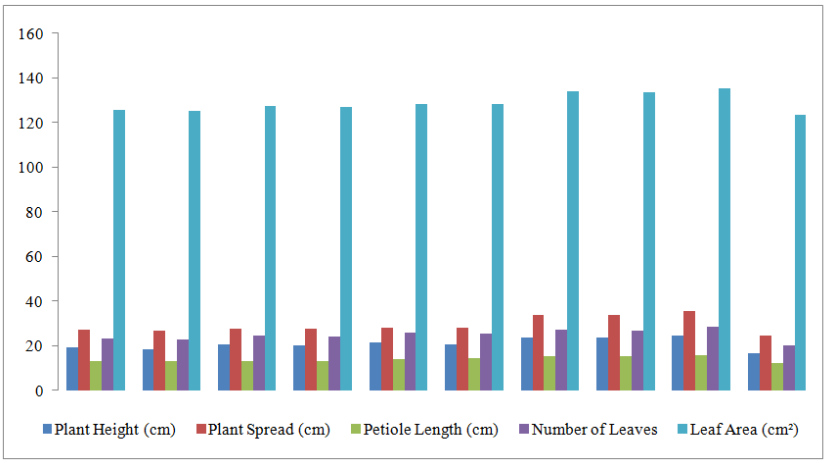
## RESULTS AND DISCUSSION

**Growth Parameters.** The data related to the plant height as affected by different treatments have been it is clearly noticeable from the data that different treatments presented significant difference for average height of plant and the treated plants were un-doubtedly taller than the untreated plants. Maximun plant height was recorded (24.7 cm) in $T_9$ (Zinc sulphate (0.8%)/plot + Iron sulphate (0.8%)/plot +Organic manure (20%) (FYM 20 kg/plot) which were statistically at par with (23.7 cm) while the minimum plant height was recorded (16.8 cm) under $T_{10}$ control. The resulting increased height and a wider plant spread was also reported by Cervantes *et al.* (2019). The data depicting plant spread by different treatments have been presented it is clearly observable from the data that plant spread is maximum in treated plants than untreated plants. Maximum plant spread (35.5 cm) was recorded $T_9$ (Zinc sulphate (0.8%)/plot + Iron sulphate (0.8%)/plot + Organic manure (20%) (FYM 20 kg/plot) which were statistically at par with (33.9 cm) while the least plant spread (24.5) cm was recorded under $T_{10}$ control. The result obtained from the present study was similar with the findings by Van Gelderen *et al.* (2018) who observed significantly higher number of Plant spread.

**Table 2: Influence of Zinc, Iron and Organic Manure on the Growth and Quality Attributes of Strawberry.**

| Treatment | Plant Height (cm) | Plant Spread (cm) | Petiole Length (cm) | Number of Leaves | Leaf Area (cm²) |
|---|---|---|---|---|---|
| $T_1$ | 19.3 | 27.1 | 13.1 | 23.1 | 125.9 |
| $T_2$ | 18.6 | 26.8 | 13.2 | 22.8 | 125.3 |
| $T_3$ | 20.7 | 27.6 | 13.3 | 24.5 | 127.6 |
| $T_4$ | 20.0 | 27.5 | 13.3 | 24.2 | 126.9 |
| $T_5$ | 21.6 | 28.0 | 14.2 | 25.9 | 128.5 |
| $T_6$ | 20.8 | 28.0 | 14.4 | 25.6 | 128.3 |
| $T_7$ | 23.7 | 33.9 | 15.5 | 27.3 | 133.9 |
| $T_8$ | 23.5 | 33.9 | 15.5 | 27.0 | 133.8 |
| $T_9$ | 24.7 | 35.5 | 15.6 | 28.7 | 135.5 |
| $T_{10}$ | 16.8 | 24.5 | 12.4 | 20.0 | 123.4 |
| SE | 0.43 | 0.55 | 0.15 | 0.62 | 0.60 |
| CD(0.05) | 1.28 | 1.62 | 0.43 | 1.74 | 1.79 |

The data expressed that the number of leaves per plant by different treatments have been presented it is observable that maximum number of leaves per plant 28.7 was recorded $T_9$ (Zinc sulphate (0.8%)/plot + Iron sulphate (0.8%)/plot + Organic manure (20%) (FYM 20 kg/plot) which was statistically at par with (27.3) while the number of leaves were minimum (20) was recorded under $T_{10}$ control per plant. The result obtained from the present study was similar with the findings by Uddin *et al.* (2018). The data pertaining to leaf area per plant as influenced by different treatments are the relevant data are presented it is clearly depicted by the data that maximum petiole length 15.6 cm was observed in treated plant than untreated plants. Maximum petiole length was observed in $T_9$ (Zinc sulphate (0.8%)/plot + Iron sulphate (0.8%)/plot + Organic manure (20%) (FYM 20 kg/plot) which was statistically at par with (15.5 cm) while the minimum petiole length 12.4 cm was recorded in $T_{10}$ control. The result obtained from the present study was similar with the findings by Peng *et al.* (2020). The data leading to leaf area as affected by different by treatments have been presented. The data clearly depicted that the Maximum leaf area (135.5 $cm^2$) was observed in $T_9$ (Zinc sulphate (0.8%)/plot + Iron sulphate (0.8%)/plot + Organic manure (20%) (FYM 20 kg/plot) which was statistically at par with (133.9 $cm^2$) while the minimum leaf area per plant (123.4 $cm^2$) was recorded in $T_{10}$ control. The result obtained from the present study was similar with the findings by Chen *et al.* (2017).




## CONCLUSIONS

On the basis of results obtained in present investigation, it can be concluded that plants treated with $T_9$ {Zinc sulphate (0.8%) + Iron sulphate (0.8%) + Organic manure (20%)} significantly increased the vegetative growth (height of plant, plant spread, petiol length, number of leaves and leaf area per plant) as compare to control. Further research and experimentation are recommended to validate these results in different environmental conditions and crop species.

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