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"Effect of Micronutrients Growth, Yield and Quality of Strawberry cv. Camarosa in central Plain Region of Punjab"

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Abstract

To study the effect of pre-harvest foliar application of nutrients on growth, yield and fruit quality of strawberry cv.Camarosa an experiment was conducted at the Agriculture Research Farm, Department of Agriculture, Mata Gujri College, Sri Fatehgarh Sahib, Punjab during the year 2020-22. The experiment was laid out in a Randomized Block Design (RBD) having ten treatments with three replications. Treatments consisted of ZnSO 4 (0.2, 0.4% and 0.6%), FeSO 4 (0.2, 0.4% and 0.6%) and Boron (0.2, 0.4% and 0.6%), while the plants sprayed with water served as the control. The result revealed that plants treated with 0.6% ZnSO 4 showed maximum plant height (26.12 cm), plant spread (35.75 cm), number of leaves per plant (25.00), leaf area (88.65 cm 2), leaf area index (4.71), number of flowers per plant (18.67), number of fruits per plant (11.38). However, the plants treated with 0.6% Boron showed highest fruit weight (22.23 g), fruit length (40.11 mm), fruit breadth (39.22 mm), yield per plant (211.12 g), yield per hectare (9.10 tonnes), TSS (10.09 0 B) , total sugar (6.03 %) and titerable acidity (0.88 %). Studies indicated that pre-harvest foliar application of iron, zinc and boron are quiet useful for improving vegetative growth, quality and shelf-life of strawberry cv. Camarosa and getting higher marketable value in subtropical region.

Key words: Strawberry, Growth, Iron, Boron, Quality, Yield, Zinc.

Introduction

The Strawberry (Fragaria x ananassa Duch.) is one of the most important soft fruits of the world. The fruit is attractive, luscious, tasty and nutritious; it has a distinct, pleasant aroma and delicate flavor. The strawberry is rich in proteins, vitamins and minerals fruits are used for preparation of jam, jelly and squash and used in the cosmetic industry (Bergamachi, et al; (1996).

The modern cultivated strawberry (Fragaria X ananassa Duchesne) is one of the most delicious, refreshing and nutritious soft fruits of the world. Fragaria species belongs to the family Rosaceae with a basic chromosome number of n =7. The cultivated strawberry Fragaria X ananassa Duch. has chromosome number (2n) of 56. It is a monoecious octoploid hybrid of two largely dioecious octoploid species. It is assumed that hybridization between Fragaria chiloensis and Fragaria virginiana had taken place spontaneously in Europe in early

seventeenth century when female plants of Fragaria chiloensis of Chilean origin were grown in proximity to male Fragaria plants of North American origin (Gallette and Bringhurst, 1990).

Cultivated strawberry (Fragaria × ananassa Duch.) is an octoploid species (2n = 8x = 56) belonging to the genus Fragaria of the family Rosaceae. This genus comprises at least 15 species from which two wild species, F. vesca and F. moschata, are also commercially grown on a reduced scale. The modern cultivated strawberry arose in Europe in the 18th century as a chance cross between two American native species, F. virginiana and F. chiloensis. In spite of its recent origin and the restricted location of its progenitors, breeders have developed new cultivars adapted to a wide range of environmental conditions. Currently, strawberry is grown in almost all the temprate regions of the world. Although strawberry is not an essential component of the diet, its delicious flavor and taste, attractive appearance and seasonal availability make this fruit an excellent fruit.

The fruit of strawberry is a complete fruit with 98% edible portion. The fruit is rich in vitamins and minerals. The taste of the fruit is mainly depends on three different compound viz. sugars, acids and aromatic compounds. The strawberry fruit contain 0.5% total sugar and 0.90% to 1.85% acidity, the prominent being malic and citric acids. As reported 100g of mature strawberry fruit contains protein 0.7 g, fat 0.5 g, carbohydrate 8.4 g, 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 (Hannum 2004). 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.

The modern cultivated strawberry (Fragaria × ananassa Duch.) is a man made hybrid that was originated from the hybridization of two American species Fragaria chiloensis and Fragaria virginiana in France in seventeen century. The strawberry is a monoecious octoploid hybrid with chromosome number 2n = 56 and belongs to the family Rosaceae. India early afford to popularize it’s cultivation in Himachal Pradesh and foot hills of Uttarakhand (Yadav et al. 2018).

The review of literature

The salient findings of the present investigation with the following objectives and to draw valid conclusions based on the significant findings of the present investigation have been summarized below.

1. To study the effect of foliar application of micronutrients on growth & yield of strawberry.

2. To study the effect of foliar application of micronutrients on fruit quality of strawberry.

3. To analyze the economics of different treatments.

Micronutrients are essentially as important as macronutrients to have better growth, yield and quality in plants. In the past, there was no need of micronutrients because these trace elements were naturally supplied by soil. But due to intensive cultivation, increase in salinity and soil pH in most of soils, these nutrients are present but are not available to plants. Among various micro-nutrients, iron and zinc plays an important role in promoting vegetative growth, flowering, yield and quality of strawberry (Chaturvedi et al. 2005). Iron is one of the essential elements which take part in number of plant biochemical processes such as biosynthesis of cytochrome and chlorophyll besides being component of various flavoprotein, peroxidases and catalase (Das 2006).

Zinc is component of many enzymes and proteins organisms, it is an essential metal for normal plant growth and development. It is also required for the synthesis of tryptophan, a precursor of IAA which acts as a growth promoting substance (Nasiri et al. 2010).

Boron is essential for plant growth, new cell division in meristematic tissue, translocation of sugar, starch, nitrogen, phosphorus, certain hormones, synthesis of amino acids and protein, regulations of carbohydrate metabolism, development of phloem (Ekka et al. 2018).

Among the macronutrients, calcium is peculiar because of its desirable effect particularly in fruits where it can reduce respiration, delay ripening, increase firmness, ascorbic acid content and reduce storage rot etc (Dunn and Able 2006).

A lot of work on nutrients has been done in fruit crops. An attempt has been made in this chapter to record the relevant effect of nutrients in fruit crop in general & strawberry in particular under appropriate heads.

1. Effect of nutrients on vegetative growth parameters

Abdollahi et al. (2010) conducted an experiment to study the effect of paclobutrazol, boron and zinc on vegetative growth, yield and fruit quality of strawberry (Fragaria × ananassa Duch.) cv. Selva. They found that zinc sulphate (100, 200 mg l -1) had positive effect on the criteria measured viz. number of leaves, leaf area, length and diameter of petiole, fresh and dry shoot root ratio in Selva strawberry.

Bakshi et al. (2013) evaluated the influence of foliar application of iron (0, 0.2 and 0.4%) and zinc (0, 0.2 and 0.4%) on vegetative growth, flowering, yield and fruit quality of strawberry (Fragaria × ananassa Duch.) cv. Chandler. They reported that plants treated with 0.4% FeSO 4 showed maximum plant height (19.65 cm), plant spread (30.12 cm), number of leaves per plant (19.12), leaf area (64.60 cm 2), number of crowns per plant (2.97).

Bakshi et al. (2013) carried out an experiment in Chandler cultivar of strawberry (Fragaria × ananassa Duch.) to assess whether pre-harvest foliar application of calcium (Ca), iron (Fe) and zinc (Zn) influences vegetative growth, flowering, fruit yield and quality. They found that plants treated with 0.6% FeSO 4 showed maximum plant height (20.34 cm), plant spread (31.02 cm), number of leaves/plant (19.63), leaf area (64.74 cm 2).

Ekka et al. (2018) examined the effect of foliar application of micronutrients influenced vegetative growth, yield and quality traits of strawberry (Fragaria × ananassa Duch.) cv. Chandler. They found that treatment T 6 (Fe 0.4%) was found to be best in terms of maximum plant height (20.11 cm), plant spread (30.33 cm), number of leaves (30.33), petiole length (16.83 cm).

2. Effect of nutrients on yield attributing character and yield parameters

Abdollahi et al. (2010) conducted an experiment with the aim of reducing vegetative growth and increasing yield and fruit quality of Selva strawberry cultivar using paclobutrazol (0, 100 mg l^{-1}), boric acid (0, 150, 300 mg l^{-1}) and zinc sulfate (0, 100, 200 mg l^{-1}). They reported that foliar application of ZnSO 4 prior to flowering was recommended to increase fruit quality and yield of strawberry.

Awasthi and Lal (2009) reported the effect of calcium, boron and zinc foliar sprays on the yield and quality of guava (Psidium guajava L.). They observed that zinc sulphate recorded the highest values for number of fruits per tree, yield, fruit length, fruit diameter and fruit weight.

Bakshi et al. (2013) carried out an experiment in Chandler cultivar of strawberry (Fragaria × ananassa Duch.) to assess whether pre-harvest foliar application of calcium (Ca), iron (Fe) and zinc (Zn) influences vegetative growth, flowering, fruit yield and quality. They found that the plants treated with 0.6% ZnSO 4 showed highest fruit weight (12.00 g), fruit length (3.68 cm), fruit diameter (2.62 cm), fruit volume (15.74 cc) and plants treated with 0.6% FeSO 4 showed maximum number of fruits/plant (21.02), yield/ha (24.32 tonnes) and per cent berry set (75.82).

3. Effect of nutrients on chemical parameters

Abdollahi et al. (2010) conducted an experiment with the aim of reducing vegetative growth and increasing yield and fruit quality of Selva strawberry cultivar using paclobutrazol (0, 100 mg l^{-1}), boric acid (0, 150, 300 mg l^{-1}) and zinc sulphate (0, 100, 200 mg l^{-1}). They found that foliar application of ZnSO 4 prior to flowering had positive effect to increase fruit quality, total soluble solid, acidity and vitamin C content of Selva strawberry.

Abd El-Gleel Mosa et al. (2015) studied an experiment to study the effect of the foliar application of potassium, calcium, boron and humic acid on vegetative growth, fruit set, leaf mineral, yield and fruit quality of 'Anna' Apple trees. They reported that potassium sulphate + calcium chloride + boric acid + humic acid combination was the best treatment which improves the yield & quality of fruits.

Baranwal et al. (2017) studied the effect of foliar application of zinc and boron on fruit growth, yield and quality of winter season guava (Psidium guajava L.). They observed that foliar spray of Borax @ 0.6% solution attained significantly maximum values of 8.25 % total sugar, 12.04 0 Brix TSS, and 186.92 mg Ascorbic acid per 100g fruit.

Bhatt et al. (2012) conducted an experiment to study the effect of the foliar application of potassium, calcium, zinc and boron enhanced yield, quality and shelf life of mango. The treatments included CaCl 2 @ 1.2%, Borax @ 0.5%, K 2 SO 4 @ 0.5%, Ca(NO 3) 2 @ 1.0%, ZnSO 4 @ 0.5%, ZnCl 2 @ 0.3% and control. They reported that the trees sprayed with 0.5% borax showed maximum T.S.S. (17.8 0 B), reducing sugar (6.42 %), non reducing sugar (9.29 %) and ascorbic acid content (34.05 mg/100g pulp).

Awasthi and Lal (2009) evaluated the influence of calcium, boron and zinc foliar sprays on the yield and quality of guava (Psidium guajava L.). They found that boric acid recorded the highest values for contents of total soluble solids, reducing sugar, non-reducing sugar and total sugar.

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