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# Effect of different micronutrients on qualitative parameters of broccoli (*Brassica oleracea var italica* L.) under polyhouse condition

**Alka Minz, Dr. Nisha Jangre, Deepshikha, Vijay Jyoti Khalkho and Deepa Narayanappa**

**Abstract**
The Present investigation was conducted during Rabi season 2020-21 under department of Vegetable Science at "Center of Excellence on Protected Cultivation and Precision Farming", IGKV, Raipur (C.G.). Experiment was carried out with Completely randomized design with ten treatments and three replications. Treatments T9 -zinc sulphate @ 0.60% found highly effective for quality parameter as it showed greatest ascorbic acid content (86.44 mg) and total soluble solid (7.74%), followed by T5 (Boric acid @ 0.40%) and T8 (Zinc sulphate @0.40%), which were significant to the other treatments.

**Keywords:** Broccoli, growth, quality and micro-nutrients

## Introduction
Cole group of vegetables are important among all winter vegetables. The group 'cole crop' is said to be derived from the wild cabbage, "cole warts" (*Brassica oleracea var. sylvestris*). Broccoli (*Brassica oleracea var. italica*) belongs to the genus Brassica and the family Brassicaceae, chromosome no. (2n=18) which comprises a diverse variety of crop plants originated from the Mediterranean Sea and changed over time by selection and breeding (Decoteau, 2000) [3]. Vegetables, which are classified as herbaceous plants from which a portion is eaten cooked or raw during the main course of a meal, are an essential part of our agricultural system. After China, India is the world's second-largest producer of vegetables (Thamburaj and Singh, 2001) [9].

Nutritionally, it contains vitamin A (9000 mg/100 g), vitamin B1 (0.05 mg/100 g), vitamin B2 (0.12 mg/100g), vitamin C (137 mg/100 g), minerals *viz*; calcium (1.29%), phosphorus (0.79%), potassium (3.5%), sulphur (1.26%), iron (205 ppm), iodine (1.965 ppm), copper (24 ppm), protein (3.3%), total carbohydrates (5.5%), fat (0.2%), water (89.9%) and calories (36/100 g) (Thamburaj and Singh, 2001) [9].

India is the world's second largest producer of vegetables, after China with an annual production of approximately 162.187 (million tonnes) from 92.05 (million hectare) of land, (Anon, 2013) [1]. India ranks second in terms of area and production of cauliflower and broccoli. In 2019, global production of broccoli (combined for production reports with cauliflowers) was 27 million tonnes, where as China and India together contribute for 73% of the world total. In India (2019) the production of broccoli was 9.1 million tonnes. Major broccoli producing growing states of India are West Bengal, Bihar, Odisha, Madhya Pradesh, Haryana, Gujarat and Jharkhand (FAO, 2019) [1]. However, this production does not meet the requirement of 300 g of vegetables per capita per day. As a result, India's vegetable production must be greatly increased.

Horticultural crops suffer widely in zinc deficiency followed by boron, manganese, copper, iron and molybdenum deficiencies. The most appropriate method to overcome such deficiencies in crops is foliar spray of nutrients such as boron, copper, and zinc for growth and metabolism. Foliar application of micronutrients has different advantageous over soil application, in that nutrients are given and taken up directly by the target organs, resulting quick response. Zinc is another essential micronutrient, highly essential for most of the Crucifers, specifically for broccoli. Boron is important in glucose translocation, cell wall construction, and RNA synthesis, and it regulates these processes (Narayanamma *et al.*, 2007) [5]. Copper is found in large amounts in enzyme proteins, which control the rate of a number of biochemical reactions in plants.

## Materials and Methods

The experiment was conducted at Centre of Excellence on Protected Cultivation and Precision farming under Polyhouse condition, CoA, IGKV, Raipur (C.G.). Raipur district is established in the central part of Chhattisgarh, Agro-climatologically known as Chhattisgarh plains and lies between 21o 16' N latitude and 81o 36' E longitude with an altitude of 289.56 meters above the mean sea level. The experiment was laid out in Completely Randomized Design (CRD) with 10 treatments in three replications and total number of plots was 30. Broccoli (*Brassica oleracea var. italica*) was sown in rabi season plots size of 4x1 meter with row spacing 45 cm and Plant to Plant distance 30 cm. The experiment consisting of 10 treatments *viz*., copper sulphate @ 0.20%, copper sulphate @ 0.40%, copper sulphate @ 0.60%, boric acid @ 0.20%, boric acid @ 0.40%, boric acid @ 0.60%, zinc sulphate @ 0.20%, zinc sulphate @ 0.40% and zinc sulphate @ 0.60%.

## Results and Discussion

**Table 1:** Quality attributes parameters

| Notations | Treatments | Ascorbic acid (mg) | Total soluble solid (%) |
|---|---|---|---|
| T0 | Control (Water spray) | 80.54 | 6.24 |
| T1 | Copper sulphate (Cu) @ 0.20% | 81.78 | 6.71 |
| T2 | Copper sulphate (Cu) @ 0.40% | 82.78 | 7.16 |
| T3 | Copper sulphate (Cu) @ 0.60% | 82.15 | 6.82 |
| T4 | Boric acid (B) @ 0.20% | 81.64 | 6.74 |
| T5 | Boric acid (B) @ 0.40% | 84.59 | 7.58 |
| T6 | Boric acid (B) @ 0.60% | 83.30 | 7.24 |
| T7 | Zinc sulphate (Zn) @ 0.20% | 83.24 | 6.75 |
| T8 | Zinc sulphate (Zn) @ 0.40% | 84.48 | 7.04 |
| T9 | Zinc sulphate (Zn) @ 0.60% | 86.44 | 7.74 |
| SE (m) | | 0.53 | 0.03 |
| C.D (p= 0.05) | | 1.59 | 0.09 |

### Influence of foliar nutrition of copper sulphate, Boric acid and Zinc sulphate on quality attributes

### Ascorbic acid (mg/100g)

There was a significant difference among the various treatments are presented on table.1 and fig.1. The highest ascorbic acid content was found 86.44mg under the treatment T9 {Zinc sulphate (ZnSO4) @ 0.60%} followed by T5 {Boric acid (H3BO3) @ 0.40%} is 84.59mg and T8 {Zinc sulphate (ZnSO4) @0.40%} is 84.48mg, which were significant to the other treatments. With T0 (Control) lowest ascorbic acid is 80.54 mg.

This could be due to influential role of zinc in ascorbic acid production. It has already been established that the zinc is helped in synthesis of tryptophan and indole acetic acid and function as an activator of number of enzymes and simultaneously assists the consumption of phosphorous and nitrogen in plants. Similar finding was obtained by Kotecha *et al*. (2016) [4] in cabbage, Singh *et al.* (2018) [7] and Sharma (2012) [8] in broccoli.

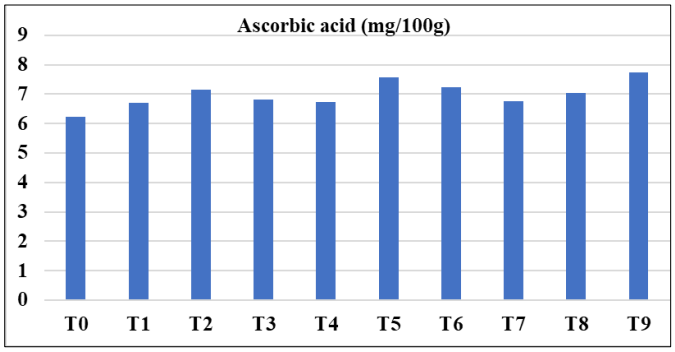


**Fig 1:** Ascorbic acid as affected by foliar spraying of micronutrients on broccoli cv. Green Magic under polyhouse condition

### Total soluble solid (%)

In Table.1 and fig 2 data are presented and showed that there was a significant difference among the various treatments. The highest TSS (%) value was found in T9 {Zinc sulphate (ZnSO4) @ 0.60%} is 7.74 followed by T5 {Boric acid (H3BO3) @ 0.60%} is 7.58 and T8 {Zinc sulphate ($ZnSO_4$) @ 0.40%} is 7.04 and the lowest TSS value was recorded in T0 (Control) is 6.24.

The improvement in TSS content of broccoli head with the application of micronutrients might be attributed to increased metabolic activities associated with production of total soluble solids, such as carbohydrates, organic acid, amino acid and other inorganic elements, Acharya *et al*. (2015) [2]. This might be due to the increased carbohydrate production during the process of photosynthesis and photosynthetic activity of plant, Vasconcelos *et al.* (2011) [10]. Similar results were recorded by Pankaj *et al*. (2018) [6] in broccoli.

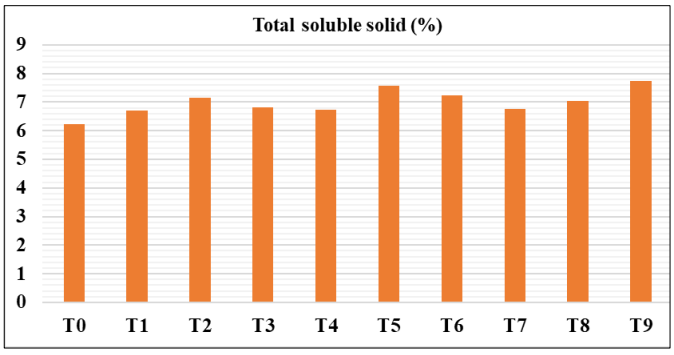


**Fig 2:** TSS (%) affected by foliar spray of micronutrient on broccoli cv. Green Magic under polyhouse condition.

## Conclusion

1. Maximum ascorbic acid (mg) content was recorded in T9- zinc sulphate (ZnSO4) @ 0.60% followed by T5- Boric acid (H3BO3) @ 0.40% and the minimum ascorbic acid content recorded under T0- control (water spray).
2. Maximum total soluble solid (%) was recorded under the T9- zinc sulphate (ZnSO4) @ 0.60% and minimum were observed under T0- control (water spray).

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