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Shatis XaxaDepartment of Horticulture,
SHUATS, Allahabad, Uttar
Pradesh, India**Praveen Choyal**Department of Horticulture,
SHUATS, Allahabad, Uttar
Pradesh, India**Radhelal Dewangan**Department of Horticulture,
SHUATS, Allahabad, Uttar
Pradesh, India**Preeti Toppo**Department of Horticulture,
SHUATS, Allahabad, Uttar
Pradesh, India**Mithlesh Gupta**Department of Biological
Science, SHUATS, Allahabad,
Uttar Pradesh, India**Sunny Abhisek Tigga**Department of Soil Science,
SHUATS, Allahabad, Uttar
Pradesh, India**Correspondence****Shatis Xaxa**Department of Horticulture,
SHUATS, Allahabad, Uttar
Pradesh, India

Effect of different micronutrients on head quality of broccoli (*Brassica oleracea* var. *Italica*) palam samridhi

Shatis Xaxa, Praveen choyal, Radhelal Dewangan, Preeti Toppo, Mithlesh Gupta and Sunny Abhisek Tigga

Abstract

The experiment will be carried out at the Horticulture Research Farm, Department of Horticulture, Naini Agricultural Institute, SHUATS, Allahabad. The experiment will be conducted in Randomized block design having 15 (genotypes) in three replications. The maximum T.S.S (⁰Brix) value T₅ (B + Mn + Zn) 8.23. The lowest T.S.S (⁰Brix) value was recorded in T₀ (control) (6.27). The maximum Vitamin c mg/100g T₅ (B + Mn + Zn) 92.34. The lowest Vitamin c mg/100g was recorded in T₀ (control) (77.16). The maximum titrable acidity T₅ (B + Mn + Zn) (0.40). The lowest titrable acidity was recorded in T₀ (control) (0.32).

Keywords: broccoli, micronutrient, quality, growth and yield

Introduction

Broccoli is an edible green plant in the cabbage family whose large flowering head is eaten as a vegetable. Other familiar plants in the species *Brassica oleracea* include Brussels sprouts, cabbage, cauliflower, kale, and kohlrabi. Broccoli is a derivative of cabbage, and was selected for its edible, immature flower heads. Broccoli originated in the Mediterranean region where it has been cultivated since Roman times, but is a relatively new crop to the United States. The first commercial broccoli crop grown in the US was started in California in 1923, but Broccoli did not become a significant commercial crop in the US until after World War II.

India is world's largest producer of vegetables next to China with an annual production around 162.187 (Million tonnes) from 92.05 (Million hectare) of land (NHB, 2012-13). Ascorbic acid content of head was determined by diluting the known volume of juice with 3% metaphosphoric acid and titrating with 2, 6- dichlorophenol-indo-phenol solution (A.O.A.C., 1960)^[1], till the faint pink colour was obtained. Percentage of total Soluble Solid was determined with the help of Erma Hand Refract meter (range 0-32) in Brix. Averaged and Analysed. Measure the total acid concentration within a food, also called total acidity. Its determined by exhausting titration with a standard volumetric solution of sodium hydroxide in the present of phenolphthalein as indicator. Broccoli has about 14 times more beta-carotene a precursor of vitamin A than commonly cultivated cabbage (Sharma, 2000)^[8]. It has high amount of vitamin C and significant amount of potassium, folic acid and several phytochemicals.

Materials and Methods

The experiment was carried out at the Horticulture Research Farm, Department of Horticulture, Naini Agricultural Institute, SHUATS, Allahabad U.P. Design and layout of experiment Ten treatments having one variety were laid out in Randomized Block Design (RBD) with three replications. The treatments in each replication were allotted randomly. Ten treatments having one variety were tried in the experimental design. The details of the treatment presented in Table no. 1 & 2.

Allahabad is situated in the agro-climatic zone (Sub-tropical belt) of Uttar Pradesh. The Geographical area falls under sub-tropical climate and is located in between 25.870 North latitude and 81.150 E longitudes at an altitude of 78 meter above the mean sea level (MSL). The area of Allahabad District comes under sub-tropical belt in the south eastern Uttar Pradesh, which experience extremely hot summer and fairly cold winter. The maximum temperature of the location reaches up to 46 °C to 48 °C and seldom falls as low as 40 °C to 50 °C. The Relative humidity ranged between 20 to 94%. The average rainfall in this area is around 850-1100 mm annually.

Table 1: Details of Treatments

Treatment Symbol	Treatment Combination
T ₀	Control
T ₁	Boron(B) (2.5 kg/ha)
T ₂	Molybdenum(Mo)(0.5kg/ha)
T ₃	Manganese(Mn) (3 Kg/ha)
T ₄	Boron(2.5kg/ha) + Molybdenum(0.5 kg/ha)
T ₅	Boron(2.5 kg/ha) + Manganese (0.5) + Zinc (2 kg /ha)
T ₆	Molybdenum(0.5 kg/ha) + Manganese (3 kg/ha)
T ₇	Boron(2.5 kg/ha) + Molybdenum(0.5 kg/ha) + Manganese (3 kg/ha) + Zinc (2 kg/ha)
T ₈	Boron (2.5 kg/ha) + Zinc (2 kg /ha)
T ₉	Zinc (Zn) (2 kg/ha)

Table 2: Micronutrients combinations

S. No	Micro nutrients	Fertilizers source	% Content	Fertilizer Kg/ha	Micro nutrient	Per plot (mg)	Per plant (mg)
1.	Boron	Borax	10.50	12.50	2.50	300	50.00
2.	Molybdenum	Sodium Molybdenum	39.00	2.00	0.50	80.0	13.33
3.	Manganese	Manganese sulphate	30.50	12.00	3.00	380	63.30
4.	Zinc	Zinc sulphate	23.00	8.00	2.00	450	75.00

Results and Discussion

The results of the analysis of variance for different quantitative characters for 10 treatment and one variety of broccoli. The results indicated that there is highly significant variation among the genotypes for almost all the characters under study. The results of the experiments are presented in (Table 3) separately under this chapter with following heading.

Titration acidity

The maximum titration acidity T₅ (B + Mn + Zn) (0.40) followed by T₇ (B + Mo + Mn + Zn) (0.39) and T₆ (Mo + Mn) (0.38). The lowest titration acidity was recorded in T₀ (control) (0.32). These results were similar recorded by Nadia Gad and Abd El-Moez (2011) [4] and Kumar *et al.*, (2010) [5]

Bhagawati and Choudhary (2010) [5] in cauliflower.

Vitamin-C content in head (mg/100 g)

The maximum Vitamin c mg/100g T₅ (B + Mn + Zn) (92.34) followed by T₆ (Mo + Mn) (85.96) and T₉ (Zn). The lowest Vitamin c mg/100 g was recorded in T₀ (control) (77.16). These results were recorded to closely by Mohamed *et al.* (2011) [6] and Nadia Gad (2011) [4] in broccoli.

Total Soluble Solid (T.S.S. ° Brix)

The maximum T.S.S (°Brix) value T₅ (Bo + Mo + Zn) 8.23 followed by T₄ (B + Mo) (7.27) and T₆ (Mo + Mn) (7.17). The lowest T.S.S (°Brix) value was recorded in T₀ (control) (6.27). These result similar recorded by Raja Edward and Lyengar, (1987) [3].

Table 3: Effect of different micronutrients on quality parameters of broccoli

Treatment symbol	Treatment combination	Titration acidity	Vitamin-C (mg/100 g)	T.S.S. (° Brix)
T ₀	Control	0.32	77.16	6.27
T ₁	B	0.36	80.81	6.43
T ₂	Mo	0.37	81.22	7.00
T ₃	Mn	0.35	83.52	6.37
T ₄	B + Mo	0.36	84.66	7.27
T ₅	B + Mn + Zn	0.40	92.34	8.23
T ₆	Mo + Mn	0.38	85.96	7.17
T ₇	B + Mo + Mn + Zn	0.39	80.84	7.13
T ₈	B + Zn	0.37	81.44	6.33
T ₉	Zn	0.35	85.01	7.47
F-test		S	S	S
S.Ed(±)		0.016	0.749	0.294
C.D at 5%		0.033	1.574	0.617

Conclusion

The present investigation it is concluded that treatment T₅ B (2.5 kg/ha) + Mn (3kg/ha) + Zn (2 kg /ha) was found to be the best treatment combinations in terms of growth, yield, and flower bud quality.

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