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Impact of boron, urea and GA_3 on the soluble protein content of Broccoli

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Abstract
Broccoli (*Brassica oleracea* var. *italica*), an Italian vegetable which belongs mainly to Mediterranean region, is becoming popular day by day in India. Owing to its great taste and nutritive value, it is fastly becoming a choice in cities. The proteins are building blocks of the body and an important constituent of various enzymes and hormones. Boron is one of the most important micronutrient essential for plants. Urea on the other hand,is the major nutrient required for plants and main source of nitrogen which is an important constituent of various proteins.GA_3 is the most widely used plant growth regulator. In light of above facts an investigation was carried out at the Horticulture Farm, Birsa Agricultural University, Ranchi, Jharkhand. The experiment consisted of sixteen treatments with three replications in Randomized Block Design. The content of total soluble content of protein was estimated spectrophotometrically using Lowry's method. The result showed that foliar application of treatment having Urea@1.5% with GA_3@75ppm had recorded the maximum protein content of 9.53 mg/100g, which was significantly at par with treatment having Urea@1.0% with GA_3@50 ppm which recorded the value of 9.40mg/100g and treatment having urea@1.5% which recorded the value of 9.26mg/100g in the year 2014-15. These three treatments remained statistically at par also in the year 2013-14.

Keywords: Broccoli, Protein, Lowry's method, Boron, Urea and GA_3

Introduction
Broccoli (*Brassica oleracea* var .*italica*) an important member of the family Brassicaceae has originated in the Mediterranean region. The name, "Broccoli" has been derived from the Italian word "Brocco", meaning shoot is one of the most nutritious cole crop. Broccoli is considered a good source of vitamins, minerals, proteins and various other nutrients. Foliar application of macro and micronutrients are widely acclaimed these days. These are one of the safest mode of fertilizer application as well as responsive too. In addition these are less voluminous, so are convenient for transportation. Foliar application is also the solution for the problem of soil residue.

Among the micronutrients, the essential role of boron was first demonstrated by Warington in 1923. The basic role of boron lies in stabilizing certain constituent of cell wall & plasma membrane & enhancing membrane permeability, cell elongation, cell division, tissue differentiation as well as metabolism of nucleic acid, carbohydrates, proteins etc. Among the macro nutrients required by plants, nitrogen is the most essential. It is an essential constituent of protein, chlorophyll, alkaloids and vitamins. Similarly the role of plant growth regulators in various physiological and biochemical processes in plants to influence growth and yield of cole crop vegetables is well known (Arora *et al.* 1989). Proteins are the polymers made up of various amino acids which are linked together by polypeptide bonds. These are the building blocks of the body and of the chief nutrient required by the body. Keeping in view, the study has been carried out to evaluate the impact of B, Urea and GA_3 on one of the most successful variety of broccoli, Fiesta.

Materials and methods
The present investigation was conducted in Rabi season 2013-14 and 2014-2015 in the vegetable section of Department of Horticulture, Faculty of Agriculture, Birsa Agricultural University, Ranchi (Jharkhand). There are sixteen treatments combinations comprising of various doses of Boron, Urea and GA_3as foliar application were applied in Randomized Block Design having three replications. The content of total soluble protein was estimated spectrophotometrically using Lowry's method. To test the significance of variation in the data obtained, the technique of analysis of variance was adopted as suggested by Fisher (1950) for Randomized block design.

Result and discussion

The minute analysis of data presented in table 1, figure 1 and figure 2 revealed that various treatments had shown different effects on the soluble protein content of broccoli. In the year2013-14, treatment T_3 i.e. Urea @ 1.5% had shown the maximum content of protein, 9.48 mg/100g, which was stastistically at par with $T_{11,}$ (Urea (1.0%) + GA_3 (50 ppm) and T_{12}, Urea (1.5%) + GA_3 (75 ppm). In the year 2015-15, treatment T_{12}, Urea (1.5%) + GA_3 (75 ppm) had recorded the maximum value of 9.53 mg/100g, which was statistically at par with T_{11} and T_3.

Nitrogen is an important constituent of amino acids, the units of which the protein is made up of. Further nitrogen is also an important component of various enzymes engaged in protein synthesis Urea contains forty six percent of nitrogen. So foliar application of urea supplied nitrogen which ultimately might have resulted in enhanced protein content. Similar findings has been observed by various workers, Brahma *et al*. (2006), Kumar *et al*. (2012) & Borowski & Michalek(2009). GA_3 is one of the most widely advocated plant growth regulator. Although required in a very small quantity, it has pronounced effect on the overall physiological and metabolic activities of the plants. This sound health condition might have resulted into good assimilation of food, which might have resulted as enhanced protein content of broccoli. The result is in agreement with Paleg (1965) & Chouhan *et al*. (2009). The Urea and GA_3 showed a synergistic effect when used in combination.

Effect of Boron, Urea and GA_3 on The Soluble Protein content of Broccoli

Treatments		The soluble Protein content (mg/100g)	
		2013-14	2014-15
T_1	Urea (0.5%)	8.70	8.50
T_2	Urea (1.0%)	8.68	9.01
T_3	Urea (1.5%)	9.48	9.26
T_4	GA_3 (25 ppm)	8.10	8.40
T_5	GA_3 (50 ppm)	8.25	8.51
T_6	GA_3 (75 ppm)	8.35	8.70
T_7	B as Borax (1.0%)	8.16	8.10
T_8	B as Borax (1.5%)	8.20	8.38
T_9	B as Borax (2.0%)	8.70	8.26
T_{10}	Urea (0.5%) + GA_3 (25 ppm)	8.90	8.60
T_{11}	Urea (1.0%) + GA_3 (50 ppm)	9.15	9.40
T_{12}	Urea (1.5%) + GA_3 (75 ppm)	9.28	9.53
T_{13}	Urea (0.5%) + GA_3 (25 ppm) + B as Borax (1%)	8.30	8.82
T_{14}	Urea (0.5%) + GA_3 (50 ppm) + B as Borax (1.5%)	8.61	8.85
T_{15}	Urea (0.5%) + GA_3 (75 ppm) + B as Borax (2%)	9.02	8.68
T_{16}	Control	8.08	8.70
	S.E. (m) ±	0.15	0.17
	C.D. at 5%	0.43	0.50
	C.V. (%)	2.98	3.44

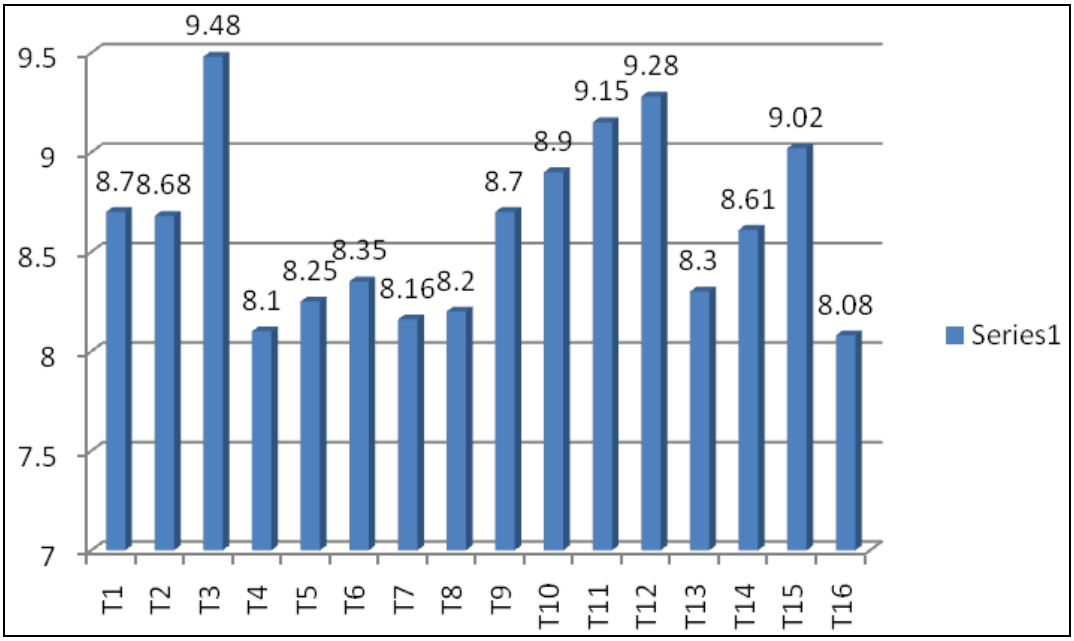

Fig 1: Effect of various treatments on the Soluble protein content of Broccoli (2013-14)

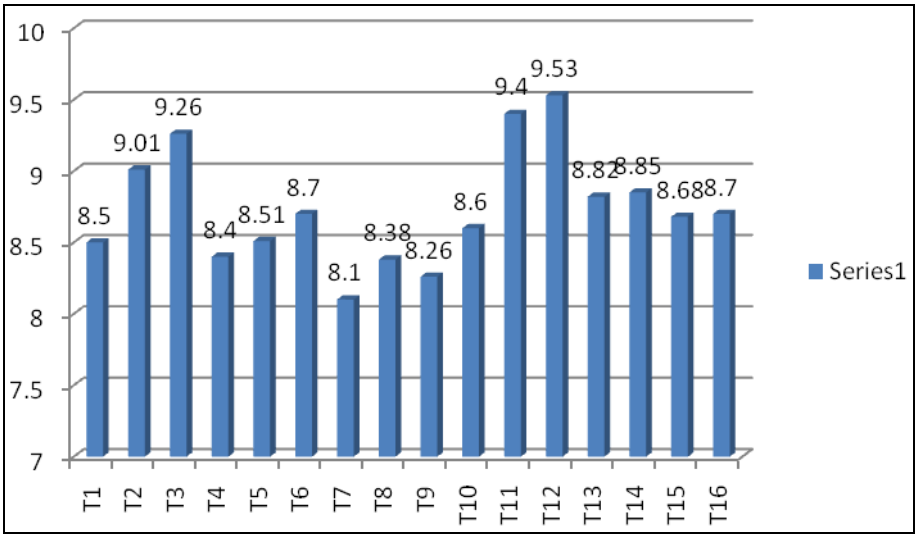

Fig 2: Effect of various treatments on the Soluble protein content of Broccoli (2014-15)

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