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Original Research Article

Effect of Foliar Application of Boron, Urea and GA_3 on Harvest Index of Broccoli (*Brassica oleracea* var. *Italica*)

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Keywords

Harvest index, Broccoli, foliar application, GA_3, Urea and Boron

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The experiment was conducted during rabi of two consecutive years i.e. 2013-14 and 2014-15 at horticultural farm of Birsa Agricultural University, Ranchi, Jharkhand, India. Sixteen treatments were used in a randomized block design with three replications. The treatments consisted of urea at three different concentrations of 0.5, 0.1 and 1.5%, GA_3 at three different concentrations of 25 ppm, 50 ppm and 75 ppm, B at three different concentrations of 1.0%, 1.5% and 2.0%. Different combinations of urea, Boron and GA3 were sprayed twice at 20 and 40 days after transplanting and a control was used with no spray. The data pertaining to harvest index of curd was recorded in both the consecutive years. The Harvest Index was markedly increased in the year 2013-14 and 2014-15 by the spray of GA_3 @ 75 ppm and GA_3 @ 25ppm respectively and proved their superiority over rest of the treatments.

Introduction

Broccoli (*Brassica oleraceae var. italica*) is becoming a fresh market and processing vegetable crop in many parts of the world (Morelock Peerson and Motes, 1972, Magnifico, Lattanzio and Sarli, 1979). Being a highly nutritious vegetable, it contains about 130 times more vitamin A content than cauliflower and over 22 times more than cabbage. Besides this, it has enormous nutritional and medicinal value due to high content vitamin C, minerals and indole-3 carbinol which is anti-cancerous substance. It is also a rich source of anti-oxidants.

The curd is morphologically similar to cauliflower (*Brassica oleraceae var. botrytis*) although certain characteristics such as branching and time of floral initiation are different (Wiebe, 1975). Broccoli produces green curd with long slender floret stalks bearing fertile flower buds while cauliflower produces single compact white curd which forms fertile flower buds only after the normal harvest stage. The maturity of this crop is determined by developmental stage of its florets. It is harvested shortly before it loses its compactness or just before bud starts to open (Marshall and Thompson, 1987).

In India, however it is not so popular yet. However it is gaining fast popularity during the last few years among the consumers particularly in and around bigger cities

owing to the increased awareness about the nutritional properties as well as palatability. So, there is a trend to increase cultivation by farmers, as well as consumption by consumers. Though broccoli is a health promoting crop, it has low harvest index. Harvest index of a crop is the ratio of yield to the total amount of biomass that has been produced (biomass of shoot plus root) but above-ground biomass is more common because root mass is so difficult to obtain. Enhancing harvest index is associated with numerous endo- and exogenous factors. Among them, various interrelated morpho-physiological mechanisms contributing to an enhanced allocation of biomass (plant assimilates) to the reproductive plant parts appear to be crucial. The present study aims to improve Harvest index of broccoli through foliar application of urea, GA3 and boron.

Materials and Methods

The experiment was conducted under field conditions in the horticultural farm of Birsa Agricultural University, Ranchi, Jharkhand in the year of 2013-14 and 2014-15, on Broccoli variety Fiesta. The experimental site comes under the seventh Agro-Climatic region of country, i.e. Eastern plateau and hills which enjoys a sub-tropical climate with summer comparatively cool, heavy rainy season and moderate winters. The soil of the site is sandy loam with acidic pH which ranged between 5.4 to 5.7. Sixteen treatments were arranged in a randomized block design with three replications. The treatments consisted of urea at three different concentrations of 0.5, 0.1 and 1.5%, GA_3 at three different concentrations of 25 ppm, 50 ppm and 75 ppm, B at three different concentrations of 1.0%, 1.5% and 2.0%. Different combinations of urea, Boron and GA3 were sprayed twice at 20 and 40 days after transplanting and a control was used with no spray. The randomly selected plants were tagged for observations and harvest index for them was calculated in percentage. HI in percentage was calculated as ratio of fresh weight of curd over fresh weight of whole plant multiplied by 100. The value was then subjected to statistical analysis.

Results and Discussion

The relevant data on Harvesting on index percentage as influenced by the application of Boron, Urea and GA_3 have been presented in Table no. 1. In the year 2013-14, the maximum harvesting index was recorded with T_6 i.e. GA_3 @ 75 ppm. The control, T_{16} was recorded with the harvesting index of 37.67 percent. The data in total was however comes to be in significant. In the year 2014-15, the maximum harvesting index of 42.22 percent was recorded with the T_4 i.e. GA_3 @ 25 ppm. T_4 was however recorded at par with T_5, T_7, T_8, T_{10}, T_{12} and T_{13}. The control, T_{16} recorded with the harvesting index of 35.71 percent. As per the Harvest Index is considered, it is directly dependent upon the curd weight and fresh weight of whole plant with curd.

Individual doses of various concentration of Urea had relatively lower curd weight and higher fresh weight of whole plant that ultimately resulted into lower harvest index. On the other hand individual doses of GA_3 and B, had resulted into higher curd weight comparatively and lower fresh weight of whole plant, resulted in higher harvest index. A positive impact on the harvest index was noticed when Urea and GA_3 were used in combination having different concentrations. However a declining tendency, through non-significant in nature was noticed when Urea, B and GA_3 all used in different concentrations.

Effect of Boron, Urea and GA_3 on Harvest Index of Broccoli

Treatments		Harvest Index (%)	
		2013-14	2014-15
T_1	Urea (0.5%)	36.62	35.23
T_2	Urea (1.0%)	34.04	31.74
T_3	Urea (1.5%)	35.58	33.27
T_4	GA_3 (25 ppm)	36.46	42.22
T_5	GA_3 (50 ppm)	35.75	37.75
T_6	GA_3 (75 ppm)	37.99	36.19
T_7	B as Borax (1.0%)	34.88	38.03
T_8	B as Borax (1.5%)	36.60	37.86
T_9	B as Borax (2.0%)	36.54	36.30
T_{10}	Urea (0.5%) + GA_3 (25 ppm)	35.89	38.68
T_{11}	Urea (1.0%) + GA_3 (50 ppm)	34.50	37.13
T_{12}	Urea (1.5%) + GA_3 (75 ppm)	35.85	38.22
T_{13}	Urea (0.5%) + GA_3 (25 ppm) + B as Borax (1%)	35.52	38.52
T_{14}	Urea (0.5%) + GA_3 (50 ppm) + B as Borax (1.5%)	36.72	35.98
T_{15}	Urea (0.5%) + GA_3 (75 ppm) + B as Borax (2%)	36.14	35.26
T_{16}	Control	37.67	35.71
	S.E. (m) ±	1.33	1.59
	C.D. at 5%	NS	4.58
	C.V. %	6.37	7.47

Thus harvesting index was directly proportional to the curd weight, and inversely proportional to the vegetative growth of the plant. It might be due to the reason that that foliar application of urea, GA3 and boron induced the early growth of reproductive tissue relative to shoot biomass, which lead to faster curd development and higher harvest index.

Also is the commonly known to increase the efficiency of the process and source-sink balance of the crop (Evans, 1993; Acevedo *et al.*, 2002; Lawlor, 2002; Reynolds *et al.*, 2007). Thus it may be concluded that proper nutrient management along with the judicious use of phytohormones holds great promise to enhance harvest index and consequently achieve the dual goal of increasing production and increasing the income of farmers.

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