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Assessment the influence of Auxins on growth, yield and economics of cabbage (*Brassica oleracea* var. *capitata* L.) in Bihar

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Abstract

An On Farm Trial was carried out at 8 farmers' field of Madhepura district under supervision of KVK, Madhepura, BAU, Sabour (Bhagalpur) during Rabi-2019 to evaluate the effect of different auxins on growth, yield and economics of cabbage cultivar cv. Golden Acre. Three treatments viz. T₁- Farmers practice (no application of PGR), T₂- Application of IAA @ 150 ppm at 4 leaf stage and T₃- Application of IBA @ 150 ppm at 4 leaf stage were arranged in Randomized Block Design with eight replications. Cabbage var. Golden Acre was used in the experimentation. The experimental result showed that the treatment T₃ (Application of IBA @ 150 ppm) displayed better response to almost all the growth and yield attributes except plant height and head maturity, which showed better response under the application of IAA @150ppm (T₂). The maximum plant growth (12 and 16.40cm) at 30 DAS and 60 DAS, respectively was recorded by the application of T₂ (Application of IAA @ 150 ppm), which was statistically higher than T₁ (farmers practice) and T₃. The maximum yield of cabbage (315 q/ha), net profit and B:C ratio (1: 3.13) was observed under the treatment T₃ (Application of IBA @150 ppm) however, the minimum values were noted in treatment without application of PGRs (T₁). The study revealed that the application of IBA @150 at 4 leaf stage is more effective than IAA @ 150 ppm and the farmers practice (no use of PGR) in respect to higher yield and net profit per rupee investment.

Keywords: Auxin, IBA, IAA, Cabbage, Yield

Introduction

Cabbage (*Brassica oleracea* L. var. *capitata*) is a biennial vegetable crop belonging to the family Brassicaceae. It is an important and popular vegetable among Cole groups grown under winter season. The edible part of cabbage is head and it is also known by the name of heading cabbage which is compact form of leaves. It is the rich source of Vitamin A and C and contains significant amount of Glutamine, an amino acid, which has anti-inflammatory properties. It has indole-3 carbinol which is used in adjuvant therapy for recurrent respiratory papillomatosis, a disease of the head and neck caused by human papillomatosis that causes growth in the airway that can leads to death. Due to anti carcinogenic properties, cabbage has been reported to reduce the risk of certain types of cancer (Birt, 1988). China ranks first in production of cabbage followed by India and Russian federation. The 100 g edible part constitutes 91.9 g moisture, 1.8 g protein, 0.1 g fat, 0.6 g minerals, 2000 I.U. vitamin A, 0.06 mg thiamine, 0.03mg riboflavin and 124 mg vitamin C.

In India, cabbage is grown in an area of about 0.399m ha. with annual production of 9.037mt and productivity of 22.64 t ha⁻¹ (NHB, 2017-18). The productivity of cabbage is influenced by several factors such as soil, varieties, fertilizer management and also various agro-techniques used for growing crops, However growth hormones are also having its own importance in improving growth, yield and quality of cabbage. In modern time, the use of plant growth regulators is becoming quite popular in the field of horticulture. Many growth regulators have been synthesized which are used to increase in growth, yield and quality of cabbage. Out of these auxins contribute to organ shaping; they are also fundamentally required for proper development of the plant itself. Auxins are a class of plant hormones with some morphogen like characteristics. Auxin helps the plant to maintain the polarity of growth, and actually "recognize" where it has its branches connected. Indole acetic acid and Indole butyric acid has

been used extensively to create considerable amount of variations among the characters. The responses of growth regulators on large number of crops are available but there is meagre information on the effect of IAA and IBA are available on cabbage crop. Therefore, the present investigation entitled "Influence of Auxins on growth, yield and economics of Cabbage (*Brassica oleracea* var. *capitata* L.)" was executed.

Material and Methods

The present investigation was carried out on eight farmers' field of different villages (Sadhua, Bhatkoda, Kolhua-Shankarpur) in Shankarpur and Madhepura block of Madhepura district under supervision of KVK, Madhepura, BAU, Sabour (Bhagalpur), Bihar during Rabi season 2019-20. Krishi Vigyan Kendra, Madhepura is situated at latitude of 25.92° and longitude of 86.79° and an elevation of 49.1m from sea level. The soil of experimental field was sandy to sandy loam in texture. All the three treatments like IAA@150ppm, IBA@150ppm and without spray of PGRs i.e. farmers' practice were arranged in randomized block design with eight replications. The crop was transplanted at 60 cm x 60 cm spacing. The cabbage cultivar Golden Acre was sprayed with IAA @ 150 ppm, IBA @ 150 ppm at 4 leaf stage, however, there was no spray of PGR under the farmers' practice. All the recommended cultural package of practices was adopted to raise a good crop. The observations on various growth and yield attributing traits like plant height (cm) and number of leaves/plant at 30 and 60 days after transplanting, respectively, plant spread (cm²), days taken to head formation, days to head maturity, average weight of head (g) and yield per hectare (q ha⁻¹). Were recorded on five randomly selected plants in each replication. The statistical analysis of data recorded on various aspects was computed by methods of analysis of variance and treatments were compared with the help of critical difference as suggested by Panse and Sukhatme (1989)^[8] to draw the valid conclusion.

Results and Discussion

Growth, development and productivity of cabbage crop largely depend on plant genetics, hormonal and environmental condition under which the crop is grown. Data in respect to various growth parameters, yield attributes and yield displayed in mean summary Table 1 revealed that the use of PGRs showed the better response as compared to farmers' practice (no use of PGRs). The highest plant height (12.00 and 16.40 cm) was measured due to T₂ (Application of IAA @ 150 ppm) treatment at 30 and 60 DAT, respectively, which was statistically at par with the treatment T₃ (Application of IBA @ 150 ppm) and significantly superior to T₁ (treatment without PGR) at both the stages of 30 and 60 DAT, respectively. The higher plant height achieved due to the use of IAA and IBA@ 50ppm might be due to the faster cell division, cell multiplication and cell elongation in meristematic region of the plant, which stimulated the metabolic process of the plant by the activation of desirable enzymes. The present finding is in close conformity with the findings of Patil *et al.* (2003)^[9], Matevosyan *et al.* (2009)^[7], Lendve *et al.* (2010)^[6], Saravaiya *et al.* (2010)^[10] and Kushwah *et al.* (2015)^[5].

An application of IBA@150ppm significantly increased the number of leaves/plant and recorded the maximum number of leaves per plant (8.40 and 11.70 at 30 and 60 DAT, respectively) over IAA @150ppm and without spray of PGR.. It obviously indicated that the application of auxins significantly improved the number of leaves per plant. The result is in accordance with Patil *et al.* (2003)^[9] and Kushwah *et al.* (2009)^[5]. An application of IBA @ 150ppm produced the maximum plant spread (38.50cm²), which was statistically superior to IAA 150ppm and without spray of PGRs. The progressive increment due to use of Auxins might be due to more number of leaves that might have synthesized more photosynthates and promoted the plant spread.). The similar findings have also been reported by Patil *et al.* (2003)^[9], Karuppaiah *et al.* (2007)^[4] and Kushwah *et al.* (2015)^[5]. The application of various PGRs significantly improved the yield attributing parameters *viz.*, days taken to head formation, days taken to head maturity, average weight of head per plant and consequently the yield (q/ha.) of cabbage. The average weight of head per plant (1250g), yield (302.49q/ha) was recorded under the treatment when application of IBA @ 150 ppm was done at 4 leaf stage, which was statistically superior to all other treatment, however, IAA@150 hastened the days to head formation (47.10days) and head maturity (84.40days) of cabbage as compared to IBA @ 150ppm. The present findings are in accordance with Lendve *et al.* (2010)^[6], Sawant *et al.* (2010)^[11], Patil *et al.* (2003)^[9] and Kushwah *et al.* also reported that the higher yield achieved in knol khol and cabbage was mainly due to obtaining of higher yield attributes *viz.* Average weight of head per plant that contributed a lot in enhancing yield.

The data presented in Table: 1 clearly indicated that the highest cost of cultivation (48234.76Rs./ha) was calculated under T₃ (Application of IBA @ 150 ppm) and (48306.76 Rs./ha) in T₂ (Application of IAA @ 150 ppm). The minimum cost of cultivation (42276.76 Rs./ha.) was recorded by the use of T₁ (Farmers Practice- no use of PGR). The maximum gross income of (151250 Rs./ha) was calculated from T₃ (Application of IBA @ 150 ppm) under the Golden acre variety while the minimum gross income (116000.00 Rs./ha) was calculated under T₁ (Farmers Practice- no use of PGR). Net profit (Rs./ha) was calculated by subtracting the cost of cultivation from the gross income. The maximum net profit (103015.24 Rs./ha) with the use of T₃ (Application of IBA @ 150 ppm) was obtained which is the best from other treatments T₂ (91093.24 Rs./ha) However, the minimum net income (73723.24Rs./ha) was worked out from T₁ (Farmers Practice- no use of PGR). The maximum cost: benefit ratio (1: 3.13) was noted from T₃ (Application of IBA @ 150 ppm) than other treatment T₂ (1: 2.88) and T₁ (1: 2.74). It is clearly indicated that treatment T₃ (Application of IBA @ 150 ppm) was found better than other treatments and this ratio is also best from farmer's point of view, which helps in taking decision for crop production of cabbage crop. The optimal requirement of better combination of auxins and variety have been determined in present studies for higher yield with better quality of cabbage which would be very helpful to the farmers in Bihar.

Table 1: Effect of PGR on Yield and Economics of Cabbage

Details of treatments	Plant height (cm)		No of leaves		Diameter (cm)	Days to head formation	Days to head maturity	Head wt.(g)	Yield (q/ha)	COC (Rs./ha)	GR (Rs./ha)	Net Return (Rs./ha)	B:C
	30 DAT	60 DAT	30 DAT	60 DAT									
TO1- FP (no use of pgr)	10.50	14.40	6.80	10.20	32.80	49.20	88.20	1051.00	232.00	42276.76	116000	73723.24	1:2.74
TO2- Use of IAA @150 ppm	12.00	16.40	7.50	10.90	37.50	47.10	84.40	1145.00	278.80	48306.76	139400	91093.24	1:2.88
TO3- Use of IBA @150 ppm	11.61	15.80	8.40	11.70	38.50	47.80	86.40	1250.00	302.50	48234.76	151250	103015.24	1:3.13
SEm±	0.163	0.307	0.287	0.093	0.213	0.170	0.157	2.409	1.194				
CD	0.498	0.940	0.878	0.283	0.651	0.520	0.481	7.378	3.657				

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