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Effect of foliar application of plant growth regulators on yield, quality and economics of cauliflower (*Brassica oleracea* var. *botrytis* L.) cv. pant Shubhra

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Abstract
A field experiment was conducted to evaluate the possible effect of plant growth regulators with different concentration levels as a foliar application on the yield, quality and economics of cauliflower cv Pant Shubhra. The experiment was carried out under randomized block design (RBD) with three replicates. The important parameters encompassed in the study were Curd yield (kg plot^{-1}), Curd yield (q ha^{-1}), Total soluble solids (^{0}Brix), Protein content in curd (%), Total cost of cultivation, Gross income, Benefit cost ratio and Net income. Although all the treatments showed a positive effect on yield, quality and economics but, T_6 revealed most significant influence on all parameters under study as compared to T_1 (control). Therefore, foliar application is suitable way to feed the cauliflower crop to enhance the marketable yield, quality and economics.

Keywords: Cauliflower cv. pant shubhra, plant growth regulators, yield, quality and economics

Introduction

Cauliflower (*Brassica oleracea* var. *botrytis* L.) Having chromosome number of 2n=18. Eastern mediterranean region is its centre of origin. Cauliflower was introduced in India in 1822 (Swarup and Chatterjee, 1972) [8]. It is propagated through seed and healthy seedling is important to raise a good crop. The edible part, *i.e.* curd is a prefloral fleshy apical meristem and it is generally white in colour and may be enclosed by inner leaves before its exposure. Adopting various improved agro-techniques can enhance the productivity of cauliflower.

Cauliflower has high quality protein. Hundred gram edible portion of cauliflower has high quality protein (2.6 g), moisture (90.8 g), fat (0.4 g), carbohydrates (4.0 g), calcium (33.0 mg), phosphorous (57.0 mg), iron (1.5 mg), carotene (30.0 µg), thiamine (0.04 mg), riboflavin (0.10 mg), vitamin C (56.0 mg) and energy (30 kcal) (Singh, 1998) [7].

Plant growth regulators are defined as an organic chemical other than nutrients which in small amount promote, inhibit or otherwise modify the plant physiological processes. It increases the yield and improve the quality by alerting the behavior of plant and number of physiological processes in plant systems. They help in synthesis of metabolites and translocation of nutrients and assimilation of these into different plant parts which ultimately resulting higher yields and improve the quality. Foliar applications of auxins are a common practice to increase the vigor and yield of crop plants. It has been reported that better results on yield or yield attributes and quality of Cauliflower and other crops by using substances, such as Napthaline acetic acid (NAA), Gibberellic acid (GA_3) (Voronova and kozakov, 1983) [10]

The vital role of growth regulators are used by several methods such as seed treatment, seedling dipping and plant spray. Some of the research workers (Kumar *et al.*, 2000) [2] have recommended the use of growth regulators to improve the yield and quality of cauliflower. The growth regulators and their uses are considered to be most technical and scientific in crop production. The selection of right hormones, their appropriate concentration and their time and method of application are most essential. Therefore, present studies were under taken. To determine the best growth regulator, optimum concentration of GA_3, IBA and NAA for better growth, yield and quality of cauliflower and economics of the treatment.

Materials and Methods

The experimental trial was carried out through *kharif* season of the year 2018-19 at Horticultural Research Instructional Farm, Indira Gandhi Krishi Vishwavidyalaya, Raipur (C.G.). The experiment was laid out according to Randomized Block Design (RBD). There were 10 treatments along with control having three replications.

The experimental plot size 2 × 2 meter and spacing of plant is 60 cm × 45 cm (R × P). The treatment combinations are T_1 - Control, T_2 - GA_3 @ 50 ppm, T_3 - GA_3 @ 100 ppm, T_4 - GA_3 @ 150 ppm, T_5 – NAA @ 100 ppm, T_6 – NAA @ 120 ppm, T_7 – NAA @ 150 ppm, T_8 – IBA @ 5 ppm, T_9 – IBA @ 10 ppm, T_{10} – IBA @ 15 ppm.

The first foliar spray was done at 30 days after planting in the morning hours. The second leaf application at 45 days and the third application at 60 days after planting was done after the wetting agent. The uniform spraying was carried out with the help of the knapsack sprayer, the leaves on both sides were completely wet with the spray solution. The total amount of solution required to be sprayed on experimental plants was decided by representative cauliflower plants.

The important parameters encompassed in the research study were Curd yield (kg $plot^{-1}$), Curd yield (q ha^{-1}), Total soluble solids (^{0}Brix), Protein content in curd (%), Total cost of cultivation, Gross income, Benefit cost ratio and Net income. The data collected from five randomly selected plants for above said parameters were subjected to analysis of variance technique (ANOVA) and least significance difference test was applied to separate different treatment means (Panse and Sukhatme, 1967) [3].

Results and Discussion

Data related to yield and yield attributes and quality are present in Table 1.

Yield (Kg/plot)

The curd yield per plot (kg) ranged from 2.88 to 6.55. Among the treatments, maximum yield per plot was recorded in T_6 NAA@ 120 ppm (6.55 kg) which was significantly superior over other treatments and followed by T_9 IBA@ 10 ppm (4.87 kg), T_8 - IBA @ 5 ppm (4.73 kg), T_3 - GA_3 @ 100 ppm (4.39 kg) and T_{10} – IBA @ 15 - ppm (4.25). Whereas, the minimum yield per plot (kg) was observed in T_1-control (2.88 kg) respectively). Similar results were reported by Yadav *et al.*, (2000) [11] and Sharma *et al.*, (1997) [5].

Yield (q/ha)

The curd yield per hectare in quintals was varying from 76.29 to 173.33. The maximum curd recorded by treatment T_6-NAA@ 120 ppm (173.33 q/ha) followed by T_9 – IBA@ 10 ppm (128.88 q/ha), T_8 - IBA @5 ppm (125.18 q/ha), T_3 - GA_3@ 100 ppm (116.29 q/ha), T_{10} -IBA@ 15 ppm (112.59 q/ha) and T_2 - GA_3@ 50 ppm (108.14). Whereas, the minimum yield per hectare in quintals was observed in T_1-control (76.29 kg) respectively). Similar results were reported by Similar results were reported by Rahman *et al.*, 2016) [4] and Jadon *et al.*, 2009 [1] used different doss of NAA@ 100, 120 and 140 ppm.

Total Soluble Solid (^{0}Brix)

The data presented on total soluble solid (%) of cauliflower as influenced by different Treatment are presented in Table 1. The findings indicated that total soluble solid (%) was significantly affected by different treatments. Total soluble solid (%) ranged from 3.66 to 6.56 (^{0}Brix). Among the treatments, maximum total soluble solid (^{0}Brix) was recorded in T_6- NAA@ 120 ppm (6.56 ^{0}Brix) followed by T_7 - NAA @140 ppm (5.96 ^{0}Brix), T_8 - IBA @5 ppm (5.7 ^{0}Brix) and T_{10} – IBA@ 15 ppm (5.52 ^{0}Brix). Whereas, the minimum total soluble solid was observed in T_1-control (3.66 ^{0}Brix). Similar results were reported by Thapa, *et al.*, (2013) [9] in sprouting broccoli.

Protein content (%)

The percent protein content in curd were varying from 7.79 to 8.89 % highest protein percentage was recorded by treatment T_6- NAA@ 120 ppm (8.89%) followed by T_7 - NAA @140 ppm (8.41 %), T_{10} -IBA@ 15 ppm (8.37 %), T_2 - GA_3@ 50 ppm (8.34 %), T_8 - IBA @5 ppm (8.32 %) and T_5 - NAA @100 ppm (8.14 %). Whereas, the minimum total soluble solid was observed in T_1-control (7.79 ^{0}Brix).

Economics

Studies on the economics of the treatments application are very important as they are of farmers primary concerned to monetary returns and profitability by crop recommendation and adaption of any package of practice by the farmer depends upon economics viability of the treatments hence, it becomes necessary to work out economics of different treatments of the experiment conducted for determining the best treatment. Data related to economics are present in Table 2.

Total cost of cultivation

Total expenditure of each treatment was divided into two parts viz., common expenditure and treatments wise extra cost. Common expenditure includes cost of field preparation seed, sowing expenses, weeding and use of insecticide spraying, watching, irrigation, harvesting and general expenses. The cost of cultivation of Rs 73000 was common for all the treatments (Table 2) but the cost of different treatments of plant growth regulators varied from treatment to treatment. The highest total cost of cultivation (Rs 79000/ha) was incurred under IBA @ 15 ppm (T_{10}) against the total cost of Rs 73000/ha involved in control (T_1).

Gross income

Data embodied in Table Table 2 revealed that the maximum gross income of Rs 17330/ha was obtained with the NAA @ 120 ppm (T_6) followed by in order resulting are T_9 (128880), T_8 (Rs 125180), T_3 (11690), T_{10} (11590), T_2 (Rs 108140), T_4 (Rs 91110), T_7 (90370) and T_5 (77770) against T_1 control (76290).

Net income

The net return obtained by foliar application of nine PGR treatment to cauliflower crop was ranging from Rs 1770 to Rs 96830 per hectare, maximum net return of 96830/ha was obtained with treatment T_6 followed by T_9 (Rs 50380, T_8 (Rs 48280), T_3 (39730), T_{10} (Rs 33590), T_2 (Rs 32140), T_7 (13370) T_1 (Rs 3290) and T_4 (Rs 3260) respectively against T_5 (Rs 1770).

Benefit cost ratio

The B:C ratio for foliar application of nine PGR treatments was ranging from 1.02 to 2.26 while maximum benefit : cost ratio obtained with T_6 (2.26) followed by T_9 (1.64), T_8 (1.62), T_3 (1.51), T_{10} and T_2 (1.42), T_4 and T_7 (1.17) and T_1 (1.04) respectively against T_5 (1.02). Similar results were reported by (Singh, B.K. 2015) [6] in cabbage.

Table 1: Effect of foliar application of plant growth regulators on yield and yield attributes and quality of cauliflower

Treatment	Yield (Kg/plot)	Yield (q/ha)	TSS content (^{0}Brix)	Protein content (%)
T_1 – control	2.88	76.29	3.66	7.79
T_2 - GA_3@ 50 ppm	4.08	108.14	5.49	8.34
T_3 - GA_3@ 100 ppm	4.39	116.25	4.32	8.1
T_4 - GA_3@ 150 ppm	3.44	91.77	4.14	8.12
T_5 - NAA @100 ppm	2.94	77.77	4.55	8.14
T_6- NAA@ 120 ppm	6.55	173.33	6.56	8.89
T_7 - NAA @140 ppm	3.41	90.37	5.96	8.41
T_8 - IBA @5 ppm	4.73	125.18	5.7	8.32
T_9 – IBA@ 10 ppm	4.87	128.88	3.87	8.06
T_{10} – IBA@ 15 - ppm	4.25	112.59	5.52	8.37
Mean	4.15	110.06	4.97	8.25
SE (m±)	0.22	5.71	0.26	0.42
CV	8.99	8.98	9.05	8.91
CD (0.05)	0.66	17.56	0.80	1.31

Table 2: Effect of different treatments on economics of cauliflower

Treatment	A	B	C	D=E-D	E	F=E-D	G=E/D
T_1 – control	76.29	0	73000	73000	76290	3290	1.04
T_2 - GA_3@ 50 ppm	108.14	3000	73000	76000	108140	32140	1.42
T_3 - GA_3@ 100 ppm	116.29	3560	73000	76560	116290	39730	1.51
T_4 - GA_3@ 150 ppm	91.11	4850	73000	77850	91110	13260	1.17
T_5 - NAA @100 ppm	77.77	3000	73000	76000	77770	1770	1.02
T_6- NAA@ 120 ppm	173.33	3500	73000	76500	173330	96830	2.26
T_7 - NAA @140 ppm	90.37	4000	73000	77000	90370	13370	1.17
T_8 - IBA @5 ppm	125.18	4500	73000	77500	125180	48280	1.62
T_9 – IBA@ 10 ppm	128.88	5500	73000	78500	128880	128880	1.64
T_{10} – IBA@ 15 - ppm	112.59	6000	73000	79000	112590	112590	1.42

References

1. Jadon RS, Lekhi R, Sharma S, Sharma R. Effect of Gibberelic acid, IBA and NAA as Foliar Spray on the Growth, Yield and Quality of Cauliflower (*Brassica oleracea* var. *botrytis* L.). Agriculture: Towards a New Paradigm of Sustainability, 2009, 230.
2. Kumar V, Ray N. Effect of plant growth regulators on cauliflower cv. Pant subhra. The Orissa Journal of Horti. 2000; 28(1):65-67.
3. Panse VG, Sukhatme PV. Statistical methods for agricultural workers. Indian Council of Agricultural Research, New Delhi, India. 1967, 152-161.
4. Rahman MA, Imran M, Ikrum M, Rahman MH, Rabbani MG. Effects of Planting Date and Growth Hormone on Growth and Yield of Cauliflower. Journal of Environmental Science and Natural Resources. 2016; 9(2):143-150.
5. Sharma SK, Gosal SS, Minocha JL. The effects of NAA, gibberellic acid (GA3) and kinetin on cauliflower. Indian Journal of Agricultural Sciences. 1997; 67(4):166-167.
6. Singh BK. Influence of growth regulators on growth, yield and economics of cabbage varieties. Annals of Plant and Soil Research. 2015; 17(1):41-44.
7. Singh SP. Production technology of vegetable crops, ARCC, Karnal, India, 1998, 335.
8. Swarup V, Chatterjee SS. Origin and genetic improvement in Indian cauliflower. Econ. Bot. 1972; 26:381-393.
9. Thapa U, Das R, Mandal AR, Debanath S. Influence of GA3 and NAA on growth, yield and quality attributing characters of sprouting broccoli [*Brassica oleracea* (L.) var. Italica Plenk]. Crop Research (Hisar). 2013; 46(1-3):192-195.
10. Voronova NL, Kozyakov VI. Effect of growth regulators on spring wheat yield, Sibirskii Vestniksel's Kokhpzyaistve-nno Nauki. [Field Crops Abstract, 1983-1985. 2000; 38(4):160-161.
11. Yadav RL, Dhaka RS, Fageria MS. Effect of GA3, NAA and succinic acid on growth and yield of cabbage cv. golden acre. Haryana J Hort. Sciences. 2000; 29(3/4):269-270.