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Effect of Plant growth regulators on growth and yield of cabbage *(Brassica oleracea* var. *capitata* L.)

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ABSTRACT

The present investigation entitled "Effect of plant growth regulators on growth and yield of a cabbage (*Brassica oleracea* var. *Capitata* L.)" is an experiment was conducted during 2020-21 at research form of Udai Pratap Autonomous College, Varanasi (U.P.). The nine treatment comprising of T_1 - Control , T_2 – NAA (50ppm), T_3 - NAA (75ppm), T_4 – NAA (100 ppm), T_5 - NAA (120 ppm), T_6 -GA_3 (50 ppm), T_7- GA3 (75ppm), T_8 - GA_3 (100 ppm) and T_9 - GA_3 (150 ppm), were evaluated in randomised block design with three replications. The experimental finding revealed that the treatment T_9 showed better response to plant growth and yield attributes. However, maximum yield 400.74 q/ha was obtained with the application of T_9 (GA_3 150 ppm) fallowed by T_5- (NAA 120 ppm). On the basis of economic analysis with the application of GA_3 150 ppm in T_9 gave maximum cost benefit ratio is 1: 2.57 During 2020-21, respectively and was found most beneficial and feasible for the cultivation of cabbage.

Key words : *Brassica oleracea, Plant growth, regulators, cabbage*

Introduction

Cabbage is uses as salad boiled vegetable, coocked currie, pickle as well as dehydrated vegetable. Cabbage head contains minerals and also rich in vitamin like A, B and C. It is assumed that, half a cup of cooked cabbage has about a third the vitamin C we need for the day. It also gives you doses of fibre, foliate, potassium, magnesium, vitamin K and more. In india west bengal is the leading producer of cabbage 2288.50(000MT) but the productivity is highest in Uttar Pradesh, i.e. 33.44 tonnes/ha. With an 9.06 (000 ha) and Production 302.97 (000 MT) Second largest producer is Orissa with 1058.78 (000 MT) and area 37.74 (000 ha) then Madhya Pradesh in the rank of third in case of Production with 686.91 (000MT) and area 29.89 (000 ha). (Source: National horticulture board, NHB 2017-18).

Plant growth regulators are defined as an organic chemical other than nutrients which in small amount promote, inhibit or other-wise modify the plant physiological processes. It increases the yield and improves the quality by alerting the behavior of plant and number of physiological processes in plant systems. GA3 has been reported beneficial in cabbage because it is involved in the regulation of growth through both cell division and enlargement NAA is also being used in many vegetable crops at various stages of development for increasing growth and yield by way of cell elongation, cell enlargement, cell division and differentiation. The plant growth regulators used are NAA and GA3. Use of growth regulators is very crucial increasing the vegetative growth and simultaneously the yield of Cole crops. Therefore the present study was carried out looking to the above finding of different work on PGRs.

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Materials and Methods

The present experiments was conducted at Research Farm, department of Horticulture U.P autonomous college Varanasi in well developed crop field having proper draianage during rabi season..The experimental was laid out in RBD with 9 treatments replicates three times. The experimental material of different growth regulators namely NAA and GA_3 in Pusamukta variety of cabbage. The two plant growth regulators *viz.* NAA 50, 75, 100, 120 ppm and GA_3 50, 75, 100, 150 ppm were tried and compared with control. The spraying was done at 30 and 60 days after transplating (DAT), all the standard packages and practices were followed. The plant transplanted in row to row 60cm and plant to plant 45cm apart by hand in 2.40m x 1.80m plots farmyard manure 10 t/ha should be incorporated in the soil at the time of initial ploughing and full dose inorganic fertilizers of NPK. The observation were recorded on growth and yield parameter of cabbage. The growth character *viz*. Height of plants (cm), No. of leaves per plant and leaf area (cm^2). Reproductive characters *viz.* No. of days to 50% head maturity and No. of days to maturity of head. The yield character *viz.* Diameter of head (cm), weight of head (g), yield of head (kg/plot) and yield (q/ha). Economics of crop cultivation were recorded after harvesting. Statistical analysis of the data was done by using analysis of variance (ANOVA).

Results and Discussion

Results, presented in Table 1 and 2 revealed that all most all the studied traits were affected by the treatments and there was completely significant difference between control and foliar application (Table-2). The results of the present experiment indicates that foliar application of NAA and GA_3 significantly increased the growth and yield parameters of Cabbage. At 30 DAT highest plant height was recorded application of GA_3 150 ppm (14.41 cm) whereas minimum plant height (12.31 cm) was recorded in the treatment (T_1) control and at 60 DAT application of GA_3 150 ppm significantly maximum plant height of 20.00cm and minimum plant height was recorded in control T_1 (16.82 cm). Among different plant growth regulators, GA_3 recorded maximum plant height followed by NAA was observed. Similar results were reported by Yadav,*et al.* (2000), and Dev *et al.* (2020). Significantly maximum number of leaves per plant 30 DAT was recorded with treatment GA_3 150 ppm (11.23) whereas minimum number of leaves per plant was recorded in (T_1) control (8.79) at 60 DAT maximum number of leaves per plant was recorded $GA_3$150 ppm (13.33) whereas minimum number of leaves per plant was recorded in (T_1) control (10.35). The increase in number of leaves per plant due to the activity of gibberellic acid at the apical meristem resulting in more nucleoprotein synthesis was responsible for increasing the leaf initiation and expansion. the same result were noted by Meena, *et al.* (2018) and Dev, *et al.* (2020). Maximum leaf area (cm^2) At 30 DAT was recorded application of GA_3 150 ppm (1821.17 cm^2) whereas minimum leaf area (1537.59 cm^2) was recorded in treatment (T_1) control and at 60 DAT application of GA_3 150 ppm significantly maximum leaf area 2044.23 cm^2 and minimum leaf area was recorded in control T_1 (1689.02 cm^2). Among different plant growth regulators, GA_3 recorded maximum leaf area followed by NAA was observed. The earlier 50% ma-

Table 1. Plant height (cm), No. of leaves per plant, Leaf area (cm^2), 50% head maturity and 100% head maturity.

Treatment	Plant height (cm)		No. of leaves/plant		Leaf area (cm^2)		50% head maturity Days	100% head maturity Days
	30 DAT	60 DAT	30 DAT	60 DAT	30 DAT	60 DAT		
Control	12.31	16.82	8.79	10.35	1,537.59	1689.02	68.29	76.11
NAA (50ppm)	12.76	18.11	9.52	11.16	1,654.13	1885.75	67.16	75.06
NAA (75ppm)	13.70	19.28	10.47	11.60	1,715.54	1939.16	66.05	74.26
NAA(100ppm)	13.87	19.41	10.88	12.19	1,728.20	1987.25	63.98	73.36
NAA(120ppm)	14.25	19.94	11.15	13.21	1,812.64	2027.39	62.07	72.06
GA_3 (50ppm)	13.02	18.31	10.29	11.28	1,605.64	1820.85	67.28	75.18
GA_3 (75ppm)	12.39	18.47	10.85	12.19	1,684.82	1921.20	66.07	74.20
GA_3 (100ppm)	13.16	19.42	11.17	12.60	1,706.42	1996.86	63.91	73.25
GA_3 (150ppm)	14.41	20.00	11.23	13.33	1,821.17	2044.23	61.65	71.23
SEm±	0.21	0.27	0.20	0.19	17.52	15.31	0.48	0.24
CD (P=0.05)	0.64	0.82	0.60	0.56	52.51	45.90	1.43	0.71

Table 2. Head diameter (cm), Fresh weight of head (g), Yield per plot (kg) and Yield (q/ha).

Treatment	Head diameter (cm)		Fresh weight of head (gm)	Yield per plot (kg)	Yield (q/ha)
	30 DAT	60 DAT			
Control	10.08	15.11	1,116.13	26.25	283.87
NAA (50ppm)	10.52	15.99	1,137.25	26.77	360.08
NAA (75ppm)	11.34	17.03	1,223.97	27.46	356.62
NAA(100ppm)	11.73	17.93	1,284.18	27.61	365.59
NAA(120ppm)	12.05	19.46	1,305.84	28.81	390.18
GA_3 (50ppm)	10.75	16.99	1,118.91	27.86	335.76
GA_3 (75ppm)	11.41	17.89	1,190.78	27.92	369.73
GA_3 (100ppm)	11.80	18.79	1,248.21	28.53	372.07
GA_3 (150ppm)	12.36	19.56	1,310.67	29.62	400.74
SEm±	0.13	0.14	25.35	0.16	5.47
CD (P=0.05)	0.38	0.43	76.01	0.47	16.39

turity was found in the treatment T_9 (150 ppm GA_3) was recorded data 61.65 days. Whereas the delayed head maturity was recorded by the treatment T_1 (control) were recorded for 68.29 days. The results in the present study are supported Dhengle, *et al*. (2002) and Dev, *et al*. (2020) in cabbage. The earlier 100% maturity of head was found in the treatment T_9 (150 ppm GA_3) was recorded in 71.23 days. Whereas the delayed head maturity was recorded by the treatment T_1 (control) was recorded data 76.11 days. The results in present study are supported Dhengle, *et al*. (2002) and Dev, *et al*. (2020) in cabbage. Maximum head diameter at 30 DAT (12.36 cm) was noticed under treatment (150 ppm GA_3), while at 60 DAT (19.56 cm) it was noticed under treatment (150 ppm GA_3). Meena and Dhaka (2003)

All yield and yield attributes characters *viz.* Fresh weight of cabbage heads (g), Yield per plot (kg) and Yield per hectare (q). Were analyzed and significantly higher fresh weight of cabbage head (1310.67) was recorded in the treatment with 150 ppm GA_3 and minimum fresh weight of cabbage head was recorded for control (1116.13). The results in the present study are supported by Dhengle, *et al*. (2002) and Dev, *et al*. (2020) in cabbage. Significantly highest yield per plot of cabbage 29.62 kg was recorded in treatment with 150 ppm GA_3 which was at par with 120 ppm NAA (28.81 kg) and minimum yield per plots was recorded with control (26.25 kg). Similar findings were reported by Dhengle, *et al*. (2002) and Dev, *et al*. (2020). Significantly highest yield per hectare of cabbage head was recorded in treatment with 150 ppm GA_3 (400.74 q/ha) and minimum yield per plots was recorded for control (283.87 q/ha). Similar results were reported by Chaurasiy,*et al.* (2014), Dhengle, *et al*. (2002) and Dev, *et al*. (2020) On the basis of said results it can be concluded that treatment T_9 150 ppmGA_3 foliar spray can enhance the yield and yield attributes of cabbage.

Conclusion

Based on experiment it is concluded that with the application of 150ppm GA_3 in treatment T_9 gave the maximum plant growth, highest yield (400.74 qha^{-1}) and second best application of 120 ppm NAA in Treatment T_5 (390.18 qha^{-1}) for economic and farmers point of view treatment T_9 is more effective.

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