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Effect of plant growth regulators (GA_3 and NAA) on yield of Cabbage (*Brassica oleracea* var. *capitata* L.) in hilly regions of Chhattisgarh

Santosh Kumar Singh and Annu Verma

Abstract
The experiment was conducted in the Potato & Temperate fruit Research Station, Mainpat, Sarguja under the Department of Vegetable Science, Indira Gandhi Krishi Vishwavidyalaya, Raipur in India. during the period 2020-21 to find out the effect of plant growth regulators (GA_3 and NAA) on growth and yield of cabbage (*Brassica oleracea* var. *capitata* L.) cv. OBAMA in hilly regions of Chhattisgarh. The experiment was laid out in RBD with three replications. The experiment considered different concentrations of GA3 (25. 50 and 100 ppm), NAA (25, 50 and 100 ppm) and GA3 + NAA (25-25, 50-50 and 100-100 ppm). T_8 gave the maximum (49.17cm) head diameter and highest head yield (32.15 t/ha) and T_0 gave the minimum head diameter (40.20 cm) and lowest head yield (20.83 t/ha). So, GA_3 @ 50-50 ppm may be used for cabbage cultivation.

Keywords: Cabbage, GA_3, NAA, growth and yield

Introduction
Cabbage (*Brassica oleracea* var. *capitata* L.) belongs to the family Cruciferae. It is one of the important vegetable crops in India and origin is the Western Europe and north shores of the Mediterranean Sea (Chauhan, 1986) [1]. Vegetables are indispensable part of food, providing vitamins, minerals, proteins, carbohydrates and fiber in the diet besides having medicinal value and provide nutritional security. India continuous to be the second largest producer of vegetables in the world next to the China and accounts 11.4 per cent of world vegetable production (Rai and Pandey, 2005) [2], according to latest report, the vegetable production in India is about 191.77 million metric tons (National Horticulture Board, 2019-20). In India, most of the people are vegetarian; there is much importance of vegetables in their daily diet. Consumption of vegetables in the diet of Indian people is only 62.79 kg per head per annum, while Korea, China and Japan is 115.92 kg, 114.89 kg and 105.2 kg per head per annum respectively. As compared to these countries the annual consumption of vegetables by Indian people is very low but it is obviously higher than other Asian countries (Wadkar *et al.* 2002) [3].
Among the various vegetable crops, cabbage is much preferred by the growers because of assured yield and transportable capacity. Cabbage is hardy cool season crop when grown for vegetable. It is mostly grown in plains of India. It is also grown as biennial crop for seed production in the hills of Himalayas. The main varieties of cabbage are Pusa Drum head, Golden Acre, Pride of India, Pusa Synthetic etc. West Bengal produces 1.84 million tones and is the largest grower of the cabbage. Orissa and Bihar occupies second and third position respectively. The other major growing states are Assam, Karnataka, Maharashtra and Gujarat. The edible portion which gives economic yield is called head; consist of thick leaves overlapping tightly on growing head. Cabbage is mostly grown for vegetables as annual and used for culinary purpose in curries, pickles etc. Nutritionally it is an important source of minerals, vitamins, proteins, carbohydrates and dietary fibers (Chatfield, 1954). Cabbage having the medicinal properties, the juice is said to be remedy against poisonous mushrooms and used as gargle against hoarseness.
To increase the yield of cabbage, various workers have recommended various doses of major and minor nutrients. Also efforts have been made by scientists to increase yield of cabbage through breeding of high yielding varieties, manorial and cultural trials. Similarly, application of plant growth regulator is also better to increase the yield of vegetable without hampering their quality. Use of plant growth regulators being new possibilities in circumventing environmental limitations and percentage of germination, growth and shoots, roots and finally

yield as well as quality.

Cabbage (*Brassica oleracea* var. *Capitata* L.) belongs to the cruciferae family and is one of the most important leafy vegetables grown in India. A certain taste in cabbage head is due to the glycoside sinigrin that contains sulfur. Cabbage head is a rich source of vitamins A, B, C and contains minerals. It has a cooling effect and helps prevent constipation, increases appetite, speeds up digestion and is very helpful in diabetic patients (Yadav *et al*. 2000) [5]. In India, cabbage is grown on 379.0,000 hectares with an annual production of 8597.0 000 tons at a rate of 22.7 t / ha. in Chhattisgarh, is cultivated on an area of 19.53 hectares with an annual production of 359.58 thousand tons with a production of 18.41 t / ha. (Flower garden in 2015). There is little research work in the above areas under the climatic conditions of the Chhattisgarh plains.

Plant growth controls have brought about a kind of change in horticultural plant growth. Herbicides can be used as seed dressing, root treatment or leaf treatment. The treatment of the seed with a liquid solution or in the form of a powder, has given a better response to much of the research work being done in India and other countries on vegetable crops. The two most important components of the variety of products produced and plant growth resources are very attractive in the modern era of agricultural science. Plant growth is a chemical other than nutrients, which increases, reduces or alters the use of organic and inorganic organisms to improve plant balance. Similarly, growth regulators are best known for their high yields on vegetable crops. Growth controls are organic matter that enhances inhibits or alters plant body processes and thus enhances yields with good quality. They facilitate the synthesis of metabolites and the transport of nutrients and metabolism into various components, ultimately leading to higher recovery. Among the few growth regulators, gibberellins and NAA are the most popular and widely used commercially available in the number of vegetable crops. Plant growth controllers work with very low concentration when used in the active (vegetable) growth stage of the plant.

Among the growth promoters, GA_3 and NAA play a key role in improving plant growth and vegetable harvesting. GA_3 is one of the key growth factors that promote cell division and cell proliferation, thus contributing to the growth and development of many plants. NAA affects body processes, speeds up maturation and improves the quality of vegetables and fruits. The use of crop growth controllers to improve yields and the quality of many vegetable crops was emphasized by a few workers (Tomar *et al*. 2020) [6].

The advantage of crop growth controllers is that they increase the yield of many cabbage varieties, as some of them promote growth. Crop growth controls are helpful and available in the market but their use and focus will still be improved. In India, a few research workers have studied the effects of crop growth on various vegetable crops, especially in seed treatment, seedling treatment and leaf use, but few indications are available for the use of cabbage control leaflets.

Materials and Methods

The experiment was carried out during the *Rabi* season of the years 2020-21. At the Potato & Temperate Fruit Research Station, Mainpat, Surguja (C.G.), under Indira Gandhi Krishi Vishwavidhyalaya, Raipur, Chhattisgarh. Chhattisgarh classified into three Agro-climatic zones, in which Mainpat, under the Northern hills zone of the Chhattisgarh. The two plant growth regulators viz. GA3 @ 25, 50, 100 ppm and NAA @ 25, 50, 100 ppm and GA_3 + NAA (25+25, 50+50 and 100+100 ppm) were tried and compared with control. The spraying was done at 30 and 60 Days after transplanting (DAT). And all the package of practices were followed and applied NPK with the @ 80:60:60 kg/ha. The whole quantity of P_2O_5 and K_2O and half quantity of nitrogen were applied as a basal dose. The remaining half quantity of nitrogen was applied as top dressing after 30 days of transplanting. Yield parameters *viz* head parameter (cm), head weight per plant (kg), head yield per plot (kg), and head yield (t/ha) and economics of crop cultivation were recorded and analysis of variance were done for the data.

Results and Discussion

The result indicated that, head diameter at harvest was found to be statistically. It was influenced significantly by different growth regulators. At harvesting 95 to 100 DAT stage, head diameter ranges were from 40.20 cm to 49.17 cm.

(Table 1)At harvest 95 to 100 DAT, significantly maximum head diameter 49.17 cm was recorded in treatment with GA_3 + NAA @ 50-50 ppm which was at par with GA_3 @ 50 ppm (48.03 cm), NAA @ 50 ppm (47.73 cm), GA_3 @ 100 ppm (47.07 cm), NAA @ 25 ppm (46.40 cm), GA_3 + NAA @ 25-25 ppm (46.07 cm), GA_3 @ 25 ppm and NAA 100 ppm both treatment were same (45.67 cm) followed by treatment GA_3 + NAA @ 100 ppm (40.80 cm).While minimum head diameter was recorded in control (40.20 cm). Similar result is close refers with the finding of Sonam *et al*. (2020) and Roy *et al*. (2011**)** **[9].** Head weight per plant has been shown different plant growth regulator treatments significantly increased the weight of head of cabbage than control. The highest weight was produced by the treatment GA_3 + NAA 50-50 ppm (1.53 kg) which was at par with the treatment GA_3 50 ppm (1.47 kg), NAA 50 ppm (1.38 kg), GA_3 + NAA 100-100 ppm (1.37 kg), GA_3 100 ppm (1.35 kg), NAA 25 ppm (1.14 kg), NAA 100 ppm (1.09 kg) GA_3 @ 25 ppm (1.08 kg). GA_3 + NAA @ 25 ppm (1.03 kg), the significantly lowest head weight (1.00 kg) were produced by the control treatment. Similar result is close refers with the finding of Wishwakarma *et al*. (2017) and Dev *et al*. (2020) [8]. The plant growth regulator treatments significantly influenced the head yield per plot. The maximum yield per plot was recorded in GA_3 + NAA 50-50 ppm (19.13 kg) which was at par with the treatment GA_3 @ 50 ppm (18.60 kg), NAA @ 50 ppm (17.68 kg), GA_3 100 ppm (17.27 kg) followed by treatment GA_3 + NAA @ 25-25 ppm and GA_3 + NAA @ 100-100 ppm both treatments were same (16.93 kg), GA_3 @ 25 ppm (16.71 kg), NAA @ 100 ppm (16.35 kg) and NAA @ 25 ppm (15.61 kg). Significantly lowest head yield per plot (15.10 kg) was recorded in control. Similar result is close refers with the finding of Roy *et al*. (2011) [9] and Dev *et al*. (2020) [8].

The result shows that, yield per hectare of cabbage was found statistically. It was influenced significantly by different growth regulators. Yield per hectare of cabbage ranged from 20.83 t/ha to 32.15 t/ha. Significantly highest yield per hectare of cabbage head was recorded in treatment with GA_3 + NAA @ 50-50 ppm (32.15 t/ha) which was at par with the treatment GA_3 @ 50 ppm (31.00 t/ha), NAA @ 50 ppm (29.47 t/ha), GA_3 + NAA @ 100 ppm (29.33 t/ha), GA_3 @ 100 ppm (28.78 t/ha) and GA_3 + NAA @ 25-25 ppm (28.22 t/ha), followed by treatments GA_3 @ 25 ppm (27.84 t/ha), NAA @ 100 ppm (27.24 t/ha) and NAA @ 25 ppm (26.01 t/ha), while minimum yield per plots was recorded for control (20.83 t/ha). Similar result is close refers with the finding of Nirmal *et al.* (1994)

[10], Kumar *et al*. (1996) [11] and Islam *et al*. (2017) [12]. The details of gross monetary return/gross income, net monetary return/net income and B: C ratio for individual treatment is worked out presented in Table 2. The cost of cultivation of cabbage and other details of cost incurred in treatment application are furnished in figure-4.11. The perusal of data showed that the maximum B: C ratio (2.9) was recorded in the treatment T_8 (GA_3 + NAA @ 50-50ppm) with a gross income of Rs. 321500/- and a net income of Rs. 233771.9/-. However, the minimum B: C ratio was observed in the control (1.63).

Table 1: head diameter (cm), head weight per plant (kg), head yield per plot (kg), head yield (t/ha) their treatment details and results

Treatment	Treatment details	Head diameter (cm)	Head weight per plant (kg)	Head yield per plot (kg)	Head yield (t/ha)
T0	Control	39.17	0.92	12.44	20.72
T1	GA_3 Foliar spray @ 25 ppm	45.67	1.08	16.71	27.84
T2	GA_3 Foliar spray @ 50 ppm	48.03	1.47	18.60	31.00
T3	GA_3 Foliar spray @ 100 ppm	47.07	1.35	17.27	28.78
T4	NAA Foliar spray @ 25 ppm	46.40	1.14	15.61	26.01
T5	NAA Foliar spray @ 50 ppm	47.73	1.38	17.68	29.47
T6	NAA Foliar spray @ 100 ppm	45.67	1.09	16.35	27.24
T7	GA_3 + NAA Foliar spray @ 25-25 ppm	46.07	1.03	16.93	28.22
T8	GA_3 + NAA Foliar spray @ 50-50 ppm	49.17	1.53	19.13	32.15
T9	GA_3 + NAA Foliar spray @ 100-100 ppm	40.80	1.37	16.93	29.33
S.Em±		1.94	0.06	0.70	1.33
CD		5.78	0.19	2.08	3.96

Table 2: Effect of plant growth regulators on economics of cabbage production

Treatment	Common cost (Rs/ha)	Treatment cost (Rs/ha)	Total cost (Rs/ha)	Yield (q/ha)	Gross returns (Rs/ha)	Net returns (Rs/ha)	B:C ratio
T_0	78,678.60	0	78678.60	207.20	207200	128521.4	1.63
T_1	78,678.60	3333.12	82011.72	278.40	278400	196388.3	2.39
T_2	78,678.60	6666.24	85344.84	310.00	310000	224655.2	2.63
T_3	78,678.60	13332.48	92011.08	287.80	287800	195788.9	2.13
T_4	78,678.60	1191.65	79870.25	260.10	260100	180229.8	2.26
T_5	78,678.60	2386.31	81064.91	294.70	294700	213635.1	2.64
T_6	78,678.60	4766.66	83445.26	272.40	272400	188954.7	2.26
T_7	78,678.60	4524.77	83203.37	282.20	282200	198996.6	2.39
T_8	78,678.60	9049.55	87728.15	321.50	321500	233771.9	2.66
T_9	78,678.60	18099.14	96777.74	293.30	293300	196522.3	2.03

Selling price of cabbage: 10 Rs/ha

Conclusion

The results of a study entitled "Effect of plant growth regulators (GA_3 and NAA) on yield of Cabbage (*Brassica oleracea* var *capitata* L.) in hilly regions of Chhattisgarh" confirmed the use of growth controllers to better growth and produce of cabbage. The results of the current study revealed that, in general, growth regulators were successful in increasing cabbage yield. Among the various plant growth controllers, GA_3 + NAA @ 50-50 ppm record high results in terms of, head size, head weight per plant, yield head per plot and head yield per hectare. The B: C rating was very high in the T8 treatment combination (GA_3 + NAA @ 50-50 ppm).

Reference

1. Chauhan OVS. Vegetable production in India. Ram Prasad and sons, India, 1986, 131-140.
2. Rai M, Pandey AK. Meeting strict global standards. The Hindu Survey of lndian Agriculture 2005, 149-153.
3. Wadkar PS, Borkar PG, Talathi IM. Vegetable export. Shetkari 2002;(8, 9):113.
4. Chalfield C. Food composition Tables, mineral and vitamin for international use. FAO, Nutrition, stud. Rome 1954, 11.
5. Yadav RL, Dhaka RS, Fageria MS. Effect of GA_3, NAA and succcinic acid on growth and yield of cabbage cv. Golden Acre. Haryana Journal Horticulture Science, 2000;20(20):269-70.
6. Tomar S, Rajiv, Singh DP, Kumara M. Effect GA_3 and NAA on growth and yield of tomato (*Lycopersicon esculentum* mill.) Department of vegetable science, CSAUA&T, Kanpur (UP) India 2020;(20):71-72.
7. Vishwakarma S, Bala S, Kumar, Prakash N, Kumar V, Singh SS *et al*. Effect of Nitrogen, NAA and GA_3 on growth, yield and quality of broccoli (*Brassica oleracea* var. italica L.) cv. Sante. Journal of Pharmacognosy and Phytochemistry 2017;(1):188-194.
8. Dev R, Singh VK, Raj S, Shukla KC. Effect of plant growth regulators on growth and yield of Cabbage (*Brassica oleraceae* var. capitata L.). Journal of Pharmacognosy and Phytochemistry 2020;9(3):1024-1026.
9. Roy R, Nasiruddin KM. effect of different level of GA_3 on growth and yield of cabbage. Journal of Environmental Science & Natural Resources 2011;4(2):79-82.
10. Nirmal SV, Deore BP, Patil RC. Effect of growth substances on yield and yield contributing traits in onion. Jouurnal of Maharashtra Agricultural University 1994;19(1):136-137.
11. Kumar D, Gujar KD, Paliwal R, Kumar D. Yield and yield attributes of cabbage as influenced by GA_3 and NAA. Crop Research 1996;12(1):120-122.
12. Islam M, Hoque A, Sikder RK, Mehraj H, Jamal AFM. Influence of Different GA Concentrations on Growth and Yield of Broccoli 3 Mamunur Reza, *Uddin* American-Eurasian Journal of Scientific Research 2017;10(5):332-335.