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Response of Plant Growth Regulators on Growth, Yield and Quality of Okra cv. Kashi Kranti

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

The present work was conducted to evaluate the response of okra cv. Kashi Kranti to plant growth regulators and micronutrients at the vegetable seed production area, Bihar Agricultural University, Sabour, Bhagalpur, Bihar, India during Kharif season. The experiment was laid out in RBD (Factorial) and replicated thrice. The experiment was framed with two levels of PGRs, GA_3 (100 ppm,150 ppm) and NAA(100 ppm and 150 ppm), sprayed twice, first at twenty days after sowing and second at forty days after sowing. The maximum number of leaves (18.13), number of branches (3.48), plant height (104.17 cm), number of fruit per plant (23.39), fruit fresh weight (17.95g) and fruit yield (130.88q/ha), 1000 seed weight (78.49g) chlorophyll-a (1.84), chlorophyll-b(0.81), zinc content (30.81 ppm), boron (22.55 ppm), copper (18.24 ppm) and germination (85.48%) was observed on application of GA3-100ppm, which was found to be significantly superior in most of the cases. Maximum net return highest benefit cost ratio (2.67) was also obtained on application of $GA_3$100 ppm.

Keywords: Plant growth regulators; okra.

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1. INTRODUCTION

Okra, *Abelmoschus esculentus* (L.) Moench, is grown throughout the tropical and warm temperate regions of the world for its fibrous pods eaten as a vegetable. Plant growth regulators play very important role in crop production These have significant role in crop growth along the increase in longitudinal area, increase number of branches, early flower initiation, fruit set, fruit quality and subsequently contributes towards higher production when applied at various concentration. Although plant growth regulators have great potential for growth improvement but their application has to be planned sensibly in terms of optimal dose, stage of application, crop specificity and seasons. Even the same growth regulator at different doses can bring about different results. These are considered as new generations agrochemicals after fertilizers, insecticides and herbicides. Plant physiologists have recognized five well defined groups of plant growth substances viz., auxins, GA's, cytokinins, inhibitors (abscisic acid) and senescent hormone ethylene. Therefore, the use of plant growth regulators has led to intensive scientific activity for their commercial exploitation. Keeping these points in view, the present study was undertaken to ascertain the most suitable concentration of GA_3 and NAA on growth yield and quality of okra cv. Kashi Kranti.

2. MATERIALS AND METHODS

The investigation was conducted at Bihar Agriculture College Sabour, Bhagalpur, Bihar, India during Kharif season. The treatments included two plant growth regulators at two different concentrations (GA_3 100 ppm, 150 ppm and NAA 100 ppm, 150 ppm). The trial was laid out in factorial Randamized Block Design having n three replications. The plants were sown at a distance of 50 cm either way. Recommended package of practices were followed to raise the crop. Spraying of GA_3 and NAA was done twice, first at twenty days after sowing and second at forty days after sowing. Observations were recorded on the traits namely, number of leaves per plant**,** number of branches per plant**,** plant height (cm)**,** number of days setting first flowering**,** number of fruits per plant, fruit fresh weight (g), average fruit dry weight (g), average fruit diameter (cm), fruit yield (q/ha),1000 seed weight(g), seed yield (g/plant), chlorophyll-a(mg/plant), chlorophyll-b(mg/plant), zinc content(%), boron content(%), copper content(%) and B:C ratio was worked out. The statistical analysis of the data was carried out by the method of analysis of variance as suggested by Panse and Sukhatme [1]. Comparison of the genotypes was made with the help of critical differences (C.D.).

3. RESULTS AND DISCUSSION

Application of plant growth regulators significantly increased growth, yield and quality parameters. Increase in number of leaves (18.13) was noticed with GA_3 100 ppm which was significantly superior to all the treatments followed by $GA_3$150 ppm. The maximum number of branches (3.48) and plant height (104.17) were observed with application of GA_3 100 ppm. The growth regulator GA_3 is recognized as a growth promoter which stimulates the rapid cell elongation in the meristematic zone of vegetative plant organs. Similar findings were reported by Chandiniraj et al. [2], Bhagure and Tambe [3], Patil and Patel [4], Mukesh et al. [5] and Naga et al. [6] in Okra. The plant receiving growth promoter $GA_3$100 ppm took minimum days (41.62) to first flowering which was significantly superior to all other treatments. The growth regulators might have influenced the physiological regulation of flower formation in the plants, possibly influencing the timing of anthesis mechanism [7]. The maximum number of fruits per plant (23.39) and fruit fresh weight (17.95) and thousand seed weight (78.49) was associated with foliar application of GA_3-100ppm and was found to be significantly superior to other treatments. However, minimum was observed in the absence of PGRs in each case. The highest gross income, net income with the maximum benefit: cost ratio of (3.14) was obtained by foliar application of GA_3-100 ppm. (Table 1).The result gained on economic aspect is also in conformity with the result reported earlier by Kumar et al*.* [8]. Comparisons between two growth regulators revealed that GA_3 treatments had more positive influence on growth and yield parameters than NAA. It was obvious from the results that GA_3-100 ppm recorded best performance towards growth and yield attributes among all other treatments. It was also noticed that GA_3 treatments have more pronounced effects on the data recorded in comparison with respective NAA treatments. It might be due to that GA_3 could be involved in many aspects of plant growth and development, such as cell enlargement, internodes elongation, stimulated RNA and protein synthesis and thereby leading to enhanced growth and development, flowering and fruiting [9]. The positive influence of plant growth regulators on growth and

Table 1. Effect of plant growth regulators on growth and yield characters of okra cv. Kashi Kranti

Treatments	No. of leaves/Pl. plant	No. of branches per plant	Pant height at maturity	Days to first Flowering	No. of fruits per plant	Fruit fresh weight	Average fruit diameter	Fruit yield (q/ha)	1000 seed (g)	Seed yield (g/plant)	B:C
Control	15.5	2.69	97.78	43.57	20.23	15.51	1.45	120.81	74.8	62.21	2.47
NAA-100 ppm	16.32	3	99.75	43.14	22.31	17.36	1.52	126.68	76.15	64.67	2.57
NAA-150 ppm	16.43	2.89	100.23	43.67	22.1	17.29	1.54	123.61	76.35	64.69	2.5
GA3-100 ppm	18.13	3.48	104.17	41.62	23.39	17.95	1.66	130.88	78.49	67.33	2.67
GA3-150 ppm	17.3	3.08	103	43.38	21.14	17.37	1.54	123.85	77.26	63.48	2.39
CD	0.71	0.08	3.03	1.35	0.63	0.44	0.045	3.04	0.99	1.95	
CV	10.49	6.35	6.9	7.21	6.6	5.94	6.79	6.68	2.97	6.95	

Table 2. Effect of plant growth regulators on quality characters of okra cv. Kashi Kranti

parameters	Chlorophyll a	Chlorophyll b	Zinc (ppm)	Boron (ppm)	Copper (ppm)	Germination%
Control	1.28	0.77	24.28	15.28	15.1	83.14
NAA-100 ppm	1.69	0.78	29.14	21.72	16.05	83.67
NAA-150 ppm	1.57	0.79	28.52	20.3	15.67	84.38
GA3-100 ppm	1.81	0.81	30.81	22.55	18.24	85.48
GA3-150 ppm	1.84	0.8	27.1	21.2	16.05	84.57
CD	0.33	0.01	1.31	0.58	0.79	1.17
CV	8.87	9.41	10.83	6.66	11.22	4.04

yield of okra was in agreement of Kokare et al., [10] and Nawalkar et al., [11]. The results of increased seed yield by GA_3were in accordance of Singh et al., [12] and Sanganagoud et al., [13]. Marie et al., [14] has also reported an increase in number of seeds per fruit under GA_3 treatment.

As for the quality characters, maximum chlorophyll-a (1.84) was associated with foliar application of GA_3-150 ppm and which was at par with other levels of different PGRs under study. However, it was significantly superior over the control. These results supported by Kumar et al. [15] and Yadav et al. [16]. Application of plant growth regulators significantly enhanced zinc content in fruit of okra over the other treatments. The foliar application of $GA_3$100 ppm registered the highest zinc content giving (30.81) in fruit. The increase in zinc content might be due to the fact that GA_3 must have accelerated the physiological process like synthesis of carbohydrate resulting in increase in zinc content. Boron (22.55) and copper (18.24) content showed significant variation on application of different levels of PGRs being maximum with foliar application of $GA_3$100 ppm which in turn was found to be significantly superior to other treatments. The foliar application of GA_3-100 ppm significantly induced highest germination percentage (85.48) which was significantly superior to all other levels (Table 2). This might be due to the fact that GA_3 must have induced production of reducing sugar from the starch as a result of increase in water soluble amylotytic activity of endosperm and enhanced some metabolic activities in embryo seeds which have caused quicker germination and early establishment in plant. These results are is supported by Bhagure and Tamba [17] and Singh [18]. Maity et al. [19] have reported that gibberellins (GA_3) and auxins (IBA) have significant effect in increasing growth and development and yield of okra with increasing concentration of both. However, GA3 is found to be a superior growth regulator as compared to respective doses aunins.

4. CONCLUSION

Thus it is concluded that gibberellic acid and NAA have significant effect in increasing growth and development and yield of okra with increasing concentration of both. However, GA_3 is found to be a superior growth regulator as compared to respective doses of NAA. GA_3-100 was responsible for overall in growth, yield and quality of okra. The highest gross income, net income with the maximum benefit: cost ratio of was also obtained by foliar application of GA_3-100 ppm.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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