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Original Research Article

Impact of Foliar Applied Growth Regulators on Physiological as well as Growth Parameters of Basmati Rice (*Oryza sativa* L.)

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Foliar application, Growth regulators, Basmati rice, Physiological characters

A B S T R A C T

Growth regulators affects physiological characters (Plant height, number of effective tillers per plant, number of leaves per plant, RWC, Chlorophyll Intensity, CGR, RGR, and NAR) of Basmati rice. The plants were foliar sprayed with growth regulators (IAA, Kinetin, CCC, SADH and Ascorbic Acid) at tillering and before anthesis stage. Results showed a conspicuous increase in growth traits in treated plants. Plant height, number of effective tillers per plant, number of leaves per plant, RWC, Chlorophyll Intensity, CGR, RGR, and NAR were significantly improved by the treatment of IAA.

Introduction

Basmati rice is known as king of rice, also the oldest, common progenitor for most types and priced for its characteristic long-grain, subtle aroma and delicious taste. It is one of the major agricultural commodities, the country exports every year to earn foreign exchange. Basmati rice, the world's most sought-after rice, fetching up to 10 times more than common rice in international markets. India occupies total area for the cultivation of basmati rice is of about 2 million ha and is the leading producer and exporter of the Basmati Rice to the global market of the world but low yield is a major cause to prohibit the public demand. It is very important to ensure the constant availability of basmati rice. Therefore, yield boosting agronomic technique such as application of certain Growth Regulators needs due attention. Therefore, an attempt was made to find out how, the certain growth regulating substances with their various concentrations influence physiology of growth of Basmati Rice. So, different levels of exogenous plant growth regulators (IAA, Kinetin, CCC, SADH and Ascorbic Acid) were used at two growth stages of basmati rice (*Oryza sativa* L.) in this investigation.

Materials and Methods

The field experiment was conducted during *Kharif* season, 2015 at Student Instructional Farm, Chandra Shekhar Azad University of agriculture and technology, Kanpur. The concentrations of these growth regulators were; IAA (25,50 ppm), Kinetin (5,10 ppm), CCC (2000,4000 ppm), SADH (1000,3000 ppm), Ascorbic Acid (50,100 ppm). The experiment was conducted in field plots under Randomized Block Design replicated three times.

Results and Discussion

Foliar spray of growth regulators brought about significant changes in plant height. It has been concluded that IAA 25 and 50 ppm and Kinetin 5 and 10 ppm promoted the plant height. While Ascorbic Acid 100 ppm also enhanced the plant height but have lower rate in comparison to IAA and Kinetin. This increment in plant height is mainly due to stimulation of cell division and increase in plasticity of cells. Our finding is also supported by the finding of Pandey *et al.*, (2001) and Taiz and Zeiger (2006).

Number of tillers per plant increased with the advancement of the crop stages in case of all growth regulators against control. More number of tillers per plant was mainly extended by the foliar spray of IAA 50 ppm followed by CCC 2000 ppm. IAA 25 ppm and Ascorbic Acid 50 and 100 ppm has also an uplifting effect on tiller number. Other hormones also supporting this character. Untreated plant possessed less number of tillers per plant in comparison to treated plants. This finding confirmed the view reported earlier by Pandey *et al.,* (2001) in rice crop.

The significant enhancement in number of leaves of Basmati rice crop was accelerated significantly against control after treatment of growth regulators. Extended green leaf area was found by the treatment of IAA 50 ppm followed SADH 1000 ppm, IAA 25 ppm, CCC 2000 and 4000 ppm and Ascorbic Acid 50 and 100 ppm. The most probable reason behind this character is cell division and its elongation. Our results are in favor of finding of Shazia Naseer *et al.,* (2001).

Relative Water Content (%) was significantly enhanced by the treatment of IAA 50 ppm concentration. IAA 25 and 50 ppm had similar effect. IAA followed by Ascorbic Acid 50 and 100 ppm. Kinetin 5 and 10 ppm also had positive response. CCC 2000 and 4000 ppm also had significant superior response individually. SADH also had significant influence on RWC of Basmati rice. This finding was also sustained by Agami (2014).

Chlorophyll intensity, which is a biochemical character and play a key role in photosynthesis, is mainly induced by the use of Kinetin 5 ppm followed by IAA 50 ppm. SADH and CCC failed to enhance chlorophyll intensity. Increment in chlorophyll intensity was due to formation, maintenance and development of chloroplast by the treatment of these hormones. Our statement is also correlated with the observation of Pandey *et al.,* (2001).

Growth parameter trait *i.e.* CGR ($mg/cm^2/day$) was increased between Dough to Maturity. The inclined value of CGR was found in case of IAA 50 ppm followed by its lower dose *i.e.* 25 ppm. SADH is also successful in accelerating CGR level during both the years. Other treatment also had a mounting effect on CGR. The uplifted value of CGR is due to the assimilation of higher biomass and economic yield. Choudhary *et al.,* (1980) supported our debate.

Between Dough to Maturity, the value of RGR ($mg\ g^{-1}day^{-}1$) was mainly insisted by the Kinetin 5 and 10 ppm. The other treatments support this and control plant have lower rate of RGR value. Our debate is also supported by the statement given by Meera Shrivastava (2003).

Between Anthesis to Dough, the greatest value of NAR ($mg\ cm^{-2}\ day^{-}1$) was obtained by the Kinetin 5 ppm followed by IAA 50 ppm. The main cause of increased NAR value is maximum transport of assimilated towards the grain. The view is favoured by finding of Meera Shrivastava (2003) (Table 1 and 2).

Table.1 Influence of various growth regulators on plant height (cm), number of tillers/plant, number of leaves/plant and Relative Water Content (%) of Basmati Rice at maturity

S. No.	Treatments	Plant Height (cm)	Number of Tillers/plant	Number of Leaves/plant	Relative Water Content (%)
1	Control	60.08	6.98	42.61	58.12
2	IAA 25 ppm	73.84	9.89	58.72	63.61
3	IAA 50 ppm	76.90	10.95	60.47	64.89
4	KN 5 ppm	68.76	7.51	51.59	62.57
5	KN 10 ppm	71.56	8.89	53.39	62.35
6	CCC 2000 ppm	60.02	9.53	53.56	60.13
7	CCC 4000 ppm	62.68	8.84	50.39	61.43
8	SADH 1000 ppm	56.50	9.87	57.55	61.28
9	SADH 3000 ppm	58.37	8.53	54.62	61.41
10	Ascorbic Acid 50 ppm	66.13	7.96	52.70	64.62
11	Ascorbic Acid 100 ppm	67.37	9.46	55.04	62.82
	S.E (diff.)	**0.76**	**0.46**	**0.66**	**0.57**
	C.D at 5% P	**1.59**	**0.95**	**1.37**	**1.20**

Table.2 Growth regulators affected the Chlorophyll Intensity (%) CGR(Mg cm^{-2} day^{-1}), RGR(mg $g^{-1}$$day^{-}1$) and NAR (mg cm^{-2} $day^{-}1$) of Basmati Rice

S.No.	Treatments	Chlorophyll intensity (%)	CGR	RGR	NAR
		At Anthesis	In Between Dough to Maturity	In Between Dough to Maturity	In Between Anthesis to Dough
1	Control	34.06	9.43	6.41	30.85
2	IAA 25 ppm	35.10	16.70	7.15	36.55
3	IAA 50 ppm	37.20	18.40	7.18	38.71
4	KN 5 ppm	37.90	16.72	7.44	40.29
5	KN 10 ppm	36.63	16.78	8.04	35.65
6	CCC 2000 ppm	35.20	15.07	7.34	33.70
7	CCC 4000 ppm	34.15	15.10	7.77	32.92
8	SADH 1000 ppm	33.42	14.97	7.82	33.29
9	SADH 3000 ppm	32.65	13.45	7.38	30.96
10	Ascorbic Acid 50 ppm	34.45	14.68	6.68	35.85
11	Ascorbic Acid 100 ppm	35.75	15.07	6.72	33.90
	S.E (diff.)	**0.15**	**0.91**	**0.11**	**0.44**
	C.D at 5% P	**0.32**	**1.90**	**0.22**	**0.91**

According to above outcome of the experiment, it may be concluded that the foliar application of IAA 50 ppm at tillering and pre-anthesis stage appreciated the plant height, number of tillers/plant, number of leaves/plant, RWC and CGR, however, Kinetin 5 ppm reported higher value of chlorophyll intensity, RGR and NAR of Basmati rice. Ascorbic Acid also had positive response over all the characters. However, CCC and SADH reduced the plant height but significantly accelerate the number of tillers and leaves of basmati rice plant.

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