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Research Paper

Effect of plant growth regulators and their application methods on growth and yield of onion (*Allium cepa* L.) cv. GUJARAT WHITE ONION-1

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ABSTRACT

An experiment was carried out during *Rabi* season for the years 2007-08 and 2008-09 in sandy loam soils at Horticultural Research Farm, Department of Horticulture, B. A. College of Agriculture, Anand Agricultural University, Anand in Randomized Block Design (Factorial) with three replications. The plant growth regulators like GA_3 and NAA each @ 50, 100 and 150 mg/l were tried as root dipping, foliar spray as well as their combinations and compared with control. The application of GA_3 @ 50 mg/l significantly increased plant height and improved leaf length and number of leaves per plant, on pooled basis as compared to control. While, GA_3 @ 100 mg/l significantly increased weight and volume of bulb as well as equatorial and polar diameter of bulb and finally bulb yield on pooled basis. In case of methods of application, non-significant difference was noticed for yield and yield attributes. Based on monetary return and B.C.R., application of GA_3 @ 50 mg/l as root dipping + foliar spray and NAA @ 100 mg/l as foliar spray gave higher B.C.R. of 1: 3.50 and 1: 3.48 with net realization of Rs.1,73,328 and Rs.1,62,466 per hectare, respectively and more remunerative than the rest of the treatments.

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Key words : Onion, Plant growth regulator, Application method

INTRODUCTION

Onion (*Allium cepa* L.) is one of the important underground bulbous vegetable crops of Alliaceae family. It is successfully grown in tropical, subtropical and temperate parts of the world. Onion is rich in carbohydrates and mineral like phosphorus and calcium (Aykroyd, 1963). The growth and yield of crops plants are mainly influenced by genetically and cultural factors. The first factor deals with the various plant breeding techniques used for the improvement of crop varieties. The second factor deals with supply of adequate nutrition, growth substances and plant protection etc. Plant growth regulators are known to regulate and modify various physiological processes within the plant and thereby they help to increase the yield (Weaver, 1972). The growth regulators are applied as seed treatment, root dipping and foliar application etc. to improve yield and quality of produce. In India very little work has been done in onion crop and, therefore, an attempt has been made to study the effect of plant growth regulators and their methods of application on growth and yield of onion.

MATERIALS AND METHODS

The field experiment was carried out during *Rabi* seasons of the years 2007-08 and 2008-09 in sandy loam soils at Horticultural Research Farm, Department of Horticulture, B.A. College of Agriculture, Anand Agricultural University, Anand in Randomized Block Design (Factorial) with three replications. Two plant growth regulators *viz.,* GA_3 and NAA each @ 50, 100 and 150 mg/l were tried with three methods of application *i.e.* root dipping, foliar spray as well as their combination and compared with control. For root dipping treatments, seedlings were dipped for 8 hours before transplanting while, the foliar spraying treatments were given at 45 days after transplanting. The observations on growth parameters were recorded at 90 days after planting, while yield was recorded at harvest. The economics of the treatments were also worked out on the basis of total cultivation cost and gross realization.

Table 1: Effect of plant growth regulators and their application methods on growth and yield of onion

Treatments	Plant height (cm)			Number of leaves per plant			Length of the longest leaf (cm)			Bulb yield (q/ha)		
	2007-08	2008-09	Pooled	2007-08	2008-09	Pooled	2007-08	2008-09	Pooled	2007-08	2008-09	Pooled
Plant growth regulator (G)												
GA_3 50 mg/l (G_1)	59.62	61.38	60.50	7.98	8.24	8.11	45.93	48.21	47.07	436.85	458.21	447.53
GA_3 100 mg/l (G_2)	57.86	61.69	59.77	7.96	8.07	8.01	45.50	47.93	46.72	435.26	495.41	465.34
GA_3 150 mg/l (G_3)	55.63	58.82	57.23	7.78	7.98	7.88	43.94	46.64	45.29	416.27	441.60	428.93
NAA 50 mg/l (G_4)	56.98	59.56	58.27	7.80	7.93	7.87	43.51	47.31	45.41	420.23	428.14	424.18
NAA 100 mg/l (G_5)	57.53	61.87	59.70	7.96	8.09	8.02	45.28	47.93	46.61	440.01	459.80	449.91
NAA 150 mg/l (G_6)	54.96	58.24	56.60	7.71	8.04	7.88	43.60	46.33	44.97	395.69	413.90	404.80
S.E. ±	1.17	0.96	0.76	0.19	0.16	0.12	0.94	0.87	0.64	9.94	14.85	8.94
C.D. (P=0.05)	NS	2.76	2.13	NS	NS	NS	NS	NS	NS	28.54	42.64	25.15
Method of application (M)												
Root dipping (M_1)	56.39	59.57	57.98	7.74	8.04	7.89	44.16	47.13	45.64	413.50	444.37	428.93
Foliar spraying (M_2)	56.75	60.20	58.48	7.89	8.08	7.98	44.30	47.26	45.78	424.98	450.30	437.64
Root dipping + Foliar spraying (M_3)	58.15	61.01	59.58	7.96	8.06	8.01	45.43	47.80	46.61	433.68	453.86	443.77
S.E. ±	0.83	0.68	0.54	0.13	0.12	0.09	0.66	0.62	0.45	7.03	10.50	6.32
C.D. (P=0.05)	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
All interactions	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Control vs Rest												
Control	52.80	56.73	54.77	7.53	7.67	7.60	41.07	43.20	42.13	370.37	358.50	364.44
Rest	57.10	60.26	58.68	7.86	8.06	7.96	44.63	47.39	46.01	424.05	449.51	436.78
S.E. ±	0.83	0.68	0.93	0.13	0.12	0.15	0.66	0.62	0.79	7.03	10.50	10.97
C.D. (P=0.05)	2.37	1.95	2.61	NS	NS	NS	1.91	1.77	2.21	20.18	30.15	30.88
C. V. %	6.16	4.80	5.49	7.22	6.01	6.63	6.34	5.55	5.94	7.08	10.02	8.76

NS-Non-significant

Table 2 : Economics of different treatments (average of two years)

Treatments	Bulb yield (q/ha)	Gross realization (Rs./ha)	Total cost (Rs./ha)	Net realization (Rs./ha)	B.C.R.
GA_3 50 mg/l RD	413.11	206555	65136	141419	1: 3.17
GA_3 50 mg/l FS	443.97	221985	66927	155058	1: 3.32
GA_3 50 mg/l RD + FS	485.52	242760	69432	173328	1: 3.50
GA_3 100 mg/l RD	462.96	231480	67755	163725	1: 3.42
GA_3 100 mg/l FS	464.15	232075	69399	162676	1: 3.34
GA_3 100 mg/l RD + FS	468.90	234450	72212	162238	1: 3.25
GA_3 150 mg/l RD	436.85	218425	68349	150076	1:3.20
GA_3 150 mg/l FS	429.73	214865	70416	144449	1:3.05
GA_3 150 mg/l RD +FS	420.23	210115	74139	135976	1:2.83
NAA 50 mg/l RD	414.29	207145	63927	143218	1:3.24
NAA 50 mg/l FS	423.79	211895	64527	147368	1:3.28
NAA 50 mg/l RD +FS	434.47	217235	64967	152268	1:3.34
NAA 100 mg/l RD	443.97	221985	64767	157218	1:3.43
NAA 100 mg/l FS	455.84	227920	65454	162466	1: 3.48
NAA 100 mg/l RD +FS	454.65	227325	65626	161699	1: 3.46
NAA 150 mg/l RD	402.42	201210	63707	137503	1: 3.16
NAA 150 mg/l FS	408.36	204180	64260	139920	1: 3.18
NAA 150 mg/l RD +FS	403.61	201805	64386	137419	1: 3.13
Control	364.44	182220	62442	119778	1: 2.92

RD: Root dipping FS: Foliar spraying

Price of onion bulb: Rs. 500/q Total cost: Cultivation cost + Chemical cost + Rental cost + Application cost

RESULTS AND DISCUSSION

The plant height was significantly influenced by the different concentrations of GA_3 and NAA while non-significant differences was observed in respect to number of leaves per plant and leaf length. Whereas, yield was also found significant due to various treatments (Table 1). The results indicated that onion crop has attained full vegetative growth up to 90 DATP. Among the different levels of GA_3 and NAA, the maximum plant height (60.50 cm), number of leaves per plant (8.11) and length of the longest leaf (47.07 cm) were recorded in GA_3 50 mg/l (G_1) on pooled basis. The increase in growth also reflected in yield and it was significantly highest in GA_3 100 mg/l as compared to rest of the treatments except GA_3 @ 50 mg/l and NAA @ 100 mg/l on pooled basis.

In case of methods of application, non-significant differences was noticed for yield and yield parameters during both the years and on pooled basis also. The interaction effects between plant growth regulators and methods of application were found non-significant for all the parameters studied during individual years as well as on pooled basis.

The combined effect of plant growth regulators and their methods of application were found significant for growth, yield and yield attributes over the control. The growth regulator treatments increased the plant height (54.77 to 58.68 cm) and leaf length (42.13 to 46.01 cm) at 90 DATP due to enhanced the cell division, cell enlargement and ultimately plant growth. These results are in agreement with the findings of Shaikh *et al.* (2002), Tiwari *et al.* (2003) and Suseela *et al.* (2005).

The economics are worked out for different treatments (Table 2) revealed that the GA_3 50 mg/l as root dipping + foliar spray (G_1M_3) registered the highest net realization of Rs. 1,73,328/ha with 1:3.50 B.C.R. followed by GA_3 100 mg/l as root dipping (G_2M_1) with net income of Rs. 1,63,725/ha with B.C.R. 1:3.42, GA_3 100 mg/l as foliar spraying (G_2M_2) with net income of Rs. 1,62,676/ha with 1:3.34 B.C.R. and treatment GA_3 100 mg/l as root dipping + foliar spraying (G_2M_3) with net income of Rs. 1,62,238 Rs. /ha with 1:3.25 B.C.R. While treatment NAA 100 mg/l as foliar spraying (G_5M_2) and NAA 100 mg/l as root dipping + foliar spraying (G_5M_3) recorded the highest 1:3.48 and 1: 3.46 B.C.R. with net realization of Rs. 1,62,466 and 1,61,699/ha, respectively as compared to the treatments G_2M_3, G_2M_2 and G_2M_1 and control.

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