

## Effect of plant growth regulators on growth and quality of onion (*Allium cepa* L.)

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### ABSTRACT

A field experiment was conducted at the instructional Farm, AKS University, Sherganj, Satna (M.P.) for season 2022-2023. To study the effect of plant growth regulators on growth and quality of onion (*Allium cepa* L.). The trial was laid down in randomized block design (RBD) with three replications and twelve treatments viz. T<sub>0</sub>- Control, T<sub>1</sub>- NAA 100 ppm, T<sub>2</sub>- NAA 150 ppm, T<sub>3</sub> - NAA 200 ppm, T<sub>4</sub> - NAA 300 ppm, T<sub>5</sub>- Ethrel 100 ppm, T<sub>6</sub>- Ethrel 200 ppm, T<sub>7</sub> - Ethrel 300 ppm, T<sub>8</sub> - GA<sub>3</sub> 100 ppm, T<sub>9</sub> - GA<sub>3</sub> 150 ppm, T<sub>10</sub> - GA<sub>3</sub> 200 ppm and T<sub>11</sub> – GA<sub>3</sub> 300 ppm. Study results revealed that, the application of T<sub>11</sub> (GA<sub>3</sub> 300 ppm) registered highest plant height, leaves/plant, neck diameter, bolting percentage, Length of bulb, Diameter of bulb and Bulb yield (t/ha). Maximum plant height (44.57 cm at 90 DAT), Number of leaves per plant (9.92 at 90 DAT), neck diameter (2.30 cm at 90 DAT) and bolting percentage (1.55 % at 90 DAT), Length of bulb (7.67 cm) Diameter of bulb (6.44 cm) and bulb and Bulb yield (t/ha) (44.71 t/ha).

**Keywords:** Growth, yield, Bolting, GA<sub>3</sub>, Ethrel, NAA

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### INTRODUCTION

Onion is known as “Queen of the Kitchen” selvaraj (1976) is one of the most important vegetable grown in India. Onion is one of the oldest bulb crop consumed worldwide. It is consumed as a vegetable and condiment. Green leaves, immature or mature bulbs of onion are eaten as green vegetable. Onion is highly nutrient responsive crop. The major onion producing district of Madhya Pradesh are Indore, sagar, Shajpur, Khandwa, Ujjain, Dewas, Ratlam, Shivpuri, Agar Malwa, Raigarh, Dhar, Satna, Khargone and chhindwara.

In India particularly in Maharashtra and Gujarat, the crop has gained importance of cash crop rather than a vegetable crop because of its very high export potential. Onion contains many bioactive compounds and its nutritive value 100 g of edible portion is moisture (86.8%), Carbohydrates (11.0 g), protein (1.2 g), fiber (0.6 g), mineral (0.4 g), thiamine (0.08 mg), vitamin (11 mg), calcium (180 mg), phosphorus (50 mg), iron (0.7 mg), nicotinic acid (0.4 mg) and riboflavin (0.01 mg) (Mishra, 1963). Onion is characterized by their rich content of odoriferous sulfur compounds such as thiosulfinates, sulfides and sulfoxides etc. The eyeirritating chemicals that cause lacrimation and the compound thiosulfinates of cysteine sulfoxides, which create the onion taste and it have antimicrobial qualities. The pungency in onion is caused by a volatile substance known as allyl propyl disulphide, which is useful against many disease causing pathogens such as *Bacillus subtilis*, *Salmonella sp.*, and *E. coli*. Onion is well known for its medicinal properties and it plays an important role in preventing heart diseases and other ailments.

Plant growth regulators are known to regulate and modify various physiological processes in plant and they exhibit their effect on morphological characters and yield. The production and distribution of photosynthates is related to various physiological and biological processes, which are influenced by the plant growth regulators. Plant growth regulators are effectively utilize in vegetable crops for improving seed germination, breaking dormancy, flower induction, increasing fruit setting and yield, fruit ripening, sex expression, hybrid seed production, gametocidal action and in male sterility (Bajracharya *et al.* 1979 Kallou, 1974). Number of techniques is used for application of plant growth substances have been investigated on various vegetables crops. The methods adopted successfully are seed treatment, seedling treatment and foliar application for higher production, whereas post-harvest treatment for increasing shelf-life in various vegetables. Different growth regulators like auxins, gibberellins have been used in onion.

## MATERIALS AND METHODS

A field experiment was conducted at the instructional Farm, AKS University, Sherganj, Satna (M.P.) for season 2022-2023. To study the effect of plant growth regulators on growth and quality of onion (*Allium cepa* L.).

The trial was laid down in randomized block design (RBD) with three replications and twelve treatments viz. T<sub>0</sub>- Control, T<sub>1</sub>- NAA 100 ppm, T<sub>2</sub>- NAA 150 ppm, T<sub>3</sub> - NAA 200

ppm, T<sub>4</sub> - NAA 300 ppm, T<sub>5</sub>- Ethrel 100 ppm, T<sub>6</sub>- Ethrel 200 ppm, T<sub>7</sub> - Ethrel 300 ppm, T<sub>8</sub> - GA<sub>3</sub> 100 ppm, T<sub>9</sub> - GA<sub>3</sub> 150 ppm, T<sub>10</sub> - GA<sub>3</sub> 200 ppm and T<sub>11</sub> – GA<sub>3</sub> 300 ppm. Study results revealed that, registered highest plant height, leaves/plant, neck diameter, bolting percentage, Length of bulb, Diameter of bulb and Bulb yield (t/ha). The crop was raised at spacing of 15 cm x 10 cm and plot size of 2m x 1m = 2m<sup>2</sup>. Standard culture practices recommended for onion was followed uniformly in all experimental plots.

## Results and Discussion

### Growth Parameters

#### Effect of plant growth regulators on growth parameters

The data pertaining to growth parameters of onion as affected by different Plant growth regulators treatments were collected and subjected to statistical analysis and presented in Table 1.

The different plant growth regulators and their levels on plant height did differ significantly at 90 DAT on analysis. Whereas, maximum plant height (44.57 cm) was recorded under T<sub>11</sub> (GA<sub>3</sub> 300 ppm), closely followed by T<sub>9</sub> (GA<sub>3</sub> 150 ppm) and T<sub>10</sub> (GA<sub>3</sub> 200 ppm) (42.38 cm and 39.48 cm) respectively. The results showed that T<sub>11</sub> (GA<sub>3</sub> 300 ppm) and T<sub>9</sub> (GA<sub>3</sub> 150 ppm) was found effective for increasing the plant height of onion.

Among different levels of plant growth regulators, the maximum number of leaves per plant (9.92) was obtained under T<sub>11</sub> (GA<sub>3</sub> 300 ppm) at 90 DAT, followed by (9.36) in T<sub>9</sub> (GA<sub>3</sub> 150 ppm).

Similarly, the plant growth regulators and their levels showed a significant effect on the neck diameter and bolting percentage 90 DAT among different levels of plant growth regulators, the maximum neck diameter and bolting percentage (2.30 cm and 1.55 %) was obtained under T<sub>11</sub> (GA<sub>3</sub> 300 ppm) at 90 DAT, followed by (2.09 cm and 1.48 %) in T<sub>9</sub> (GA<sub>3</sub> 150 ppm).

The beneficial effect of Plant Growth Regulators on vegetative growth parameters of onion and other vegetable crops have been reported by many workers Helaly *et al.* (2016),

Singh *et al.* (2018), Yadagiri *et al.* (2017), Devi *et al.* (2018), Thakur *et al.* (2018) and Mohamed *et al.* (2019).

### Effect of plant growth regulators on yield parameters

The data pertaining to yield parameters of onion as affected by different Plant growth regulators treatments were collected and subjected to statistical analysis and presented in Table 2.

The Length of bulb and Diameter of bulb was affected by various concentrations of plant growth regulators. The maximum Length of bulb and Diameter of bulb (7.67 cm and 6.44 cm) was obtained under T<sub>11</sub> (GA<sub>3</sub> 300 ppm) at maturity, followed by (7.56 cm and 6.32 cm) in T<sub>9</sub> (GA<sub>3</sub> 150 ppm).

The different plant growth regulators and their levels on Bulb yield (t/ha) did differ significantly at harvest on analysis. Whereas, maximum Bulb yield (44.71 t/ha) was recorded under T<sub>11</sub> (GA<sub>3</sub> 300 ppm), closely followed by T<sub>9</sub> (GA<sub>3</sub> 150 ppm) and T<sub>10</sub> (GA<sub>3</sub> 200 ppm) (44.12 t/ha and 42.75 t/ha) respectively. The results showed that T<sub>11</sub> (GA<sub>3</sub> 300 ppm) and T<sub>9</sub> (GA<sub>3</sub> 150 ppm) was found effective for increasing the Bulb yield of onion.

The results corroborate the findings of many researchers Singh *et al.* (2018), Dwivedi *et al.* (2019), Dwivedi and Asati (2019) and Bista *et al.* (2022).

### CONCLUSION

Based on one year experimental data, it is concluded that among the treatments, GA<sub>3</sub> 300 ppm (T<sub>11</sub>) recorded significantly higher diameter and length of bulb (6.44 and 7.67 cm, respectively), bulb yield (42.31 t/ha) from onion var. Agrifound Light Red, which was found beneficial under the existing agro-climatic conditions of Satna district of Madhya Pradesh.

Table.1 Effect of plant growth regulators on growth parameters of onion

Treatment	Plant height (cm) at 90 DAT	Number of leaves/plant at 90 DAT	Neck diameter at 90 DAT	Bolting percentage at 90 DAT
T <sub>0</sub>	27.33	6.20	1.23	0.82
T <sub>1</sub>	30.70	6.68	1.36	0.87
T <sub>2</sub>	33.64	7.35	1.62	0.95
T <sub>3</sub>	32.28	7.10	1.45	0.92
T <sub>4</sub>	34.75	7.38	1.69	1.12
T <sub>5</sub>	36.56	7.78	1.80	1.24
T <sub>6</sub>	38.99	8.46	1.92	1.36
T <sub>7</sub>	37.66	8.12	1.84	1.31
T <sub>8</sub>	35.54	7.53	1.75	1.20
T <sub>9</sub>	42.38	9.36	2.09	1.48
T <sub>10</sub>	39.78	8.95	1.95	1.42
T <sub>11</sub>	44.57	9.92	2.30	1.55
S.E.(m) ±	1.58	0.35	0.17	0.08
C.D. (5%)	4.61	1.01	0.49	0.49

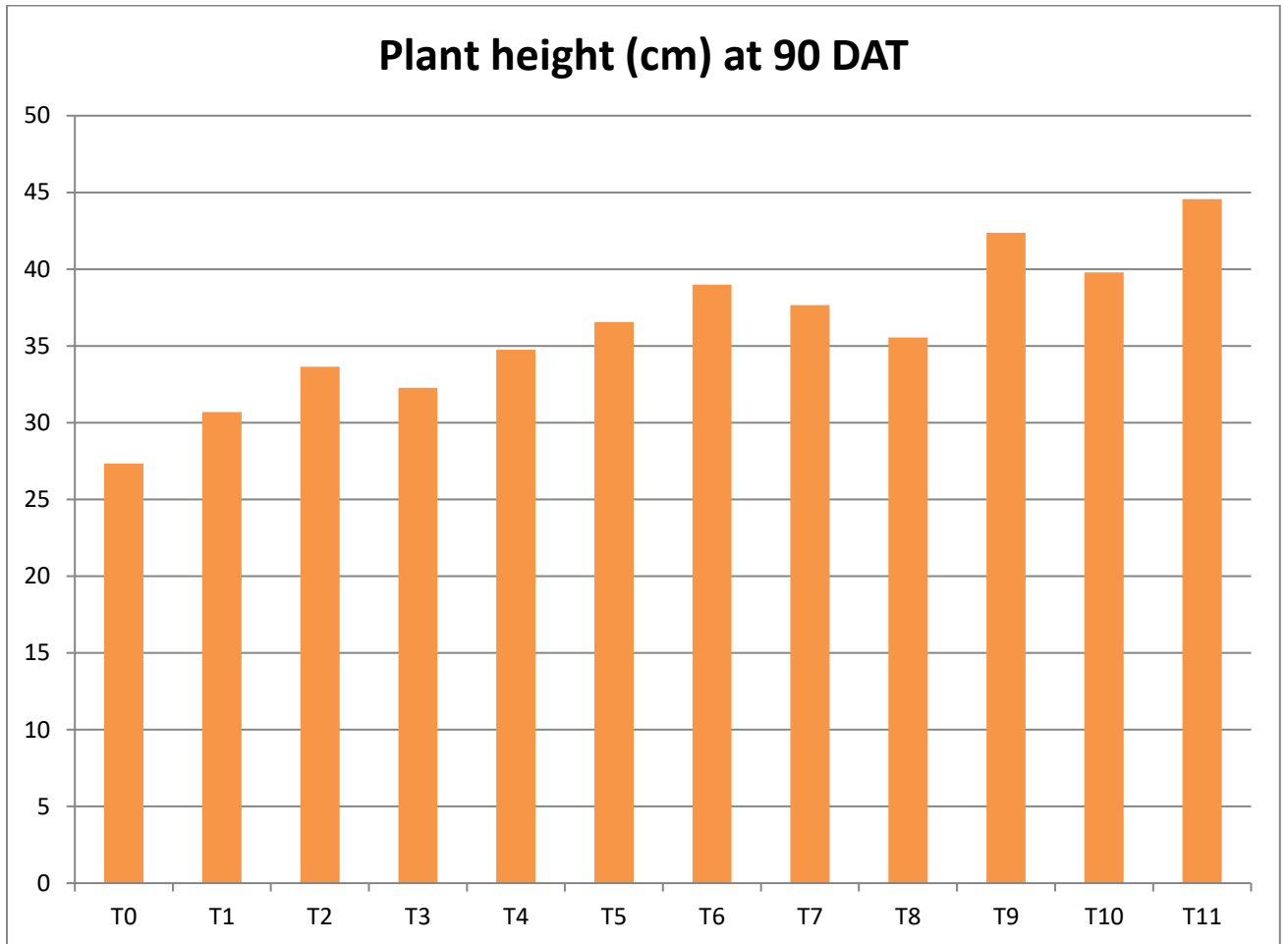
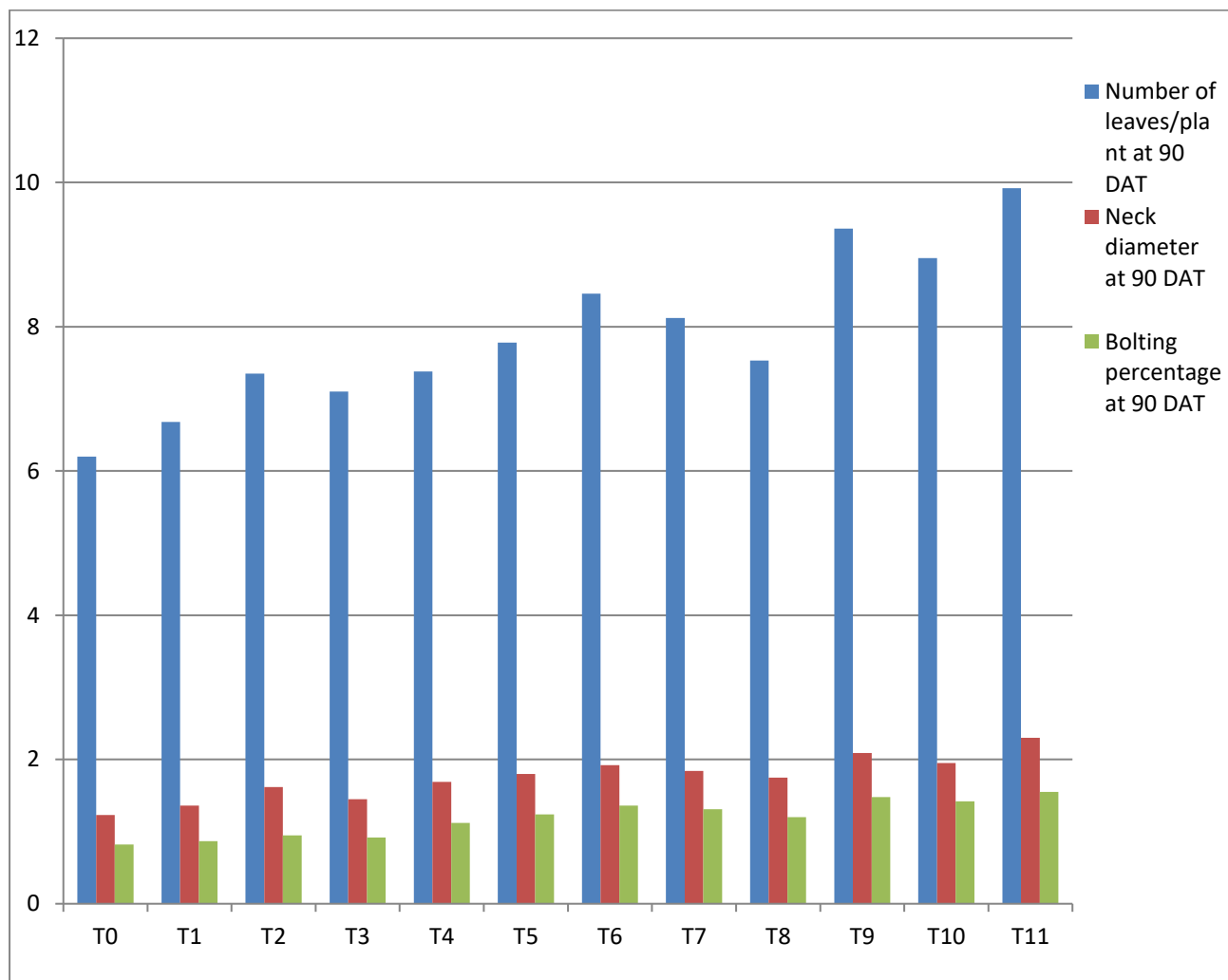


Fig 1. Effect of plant growth regulators on Plant height (cm) at 90 DAT of onion



**Fig 2. Effect of plant growth regulators on Ntage at 90 DAT of onion**

**ble.2 Effect of plant growth regulators on yield parameters of onion**

Treatment	Length of bulb	Diameter of bulb	Bulb yield (t/ha)
T <sub>0</sub>	6.23	5.33	25.45
T <sub>1</sub>	6.35	5.53	28.28
T <sub>2</sub>	6.63	5.73	30.00

<b>T<sub>3</sub></b>	6.49	5.63	32.40
<b>T<sub>4</sub></b>	6.84	5.98	34.50
<b>T<sub>5</sub></b>	7.11	6.10	38.07
<b>T<sub>6</sub></b>	7.38	6.21	41.27
<b>T<sub>7</sub></b>	7.23	6.13	39.61
<b>T<sub>8</sub></b>	6.99	6.02	35.41
<b>T<sub>9</sub></b>	7.56	6.32	44.12
<b>T<sub>10</sub></b>	7.43	6.24	42.75
<b>T<sub>11</sub></b>	7.67	6.44	44.71
<b>S.E.(m) ±</b>	0.17	0.16	1.75
<b>C.D. (5%)</b>	0.50	0.49	5.10



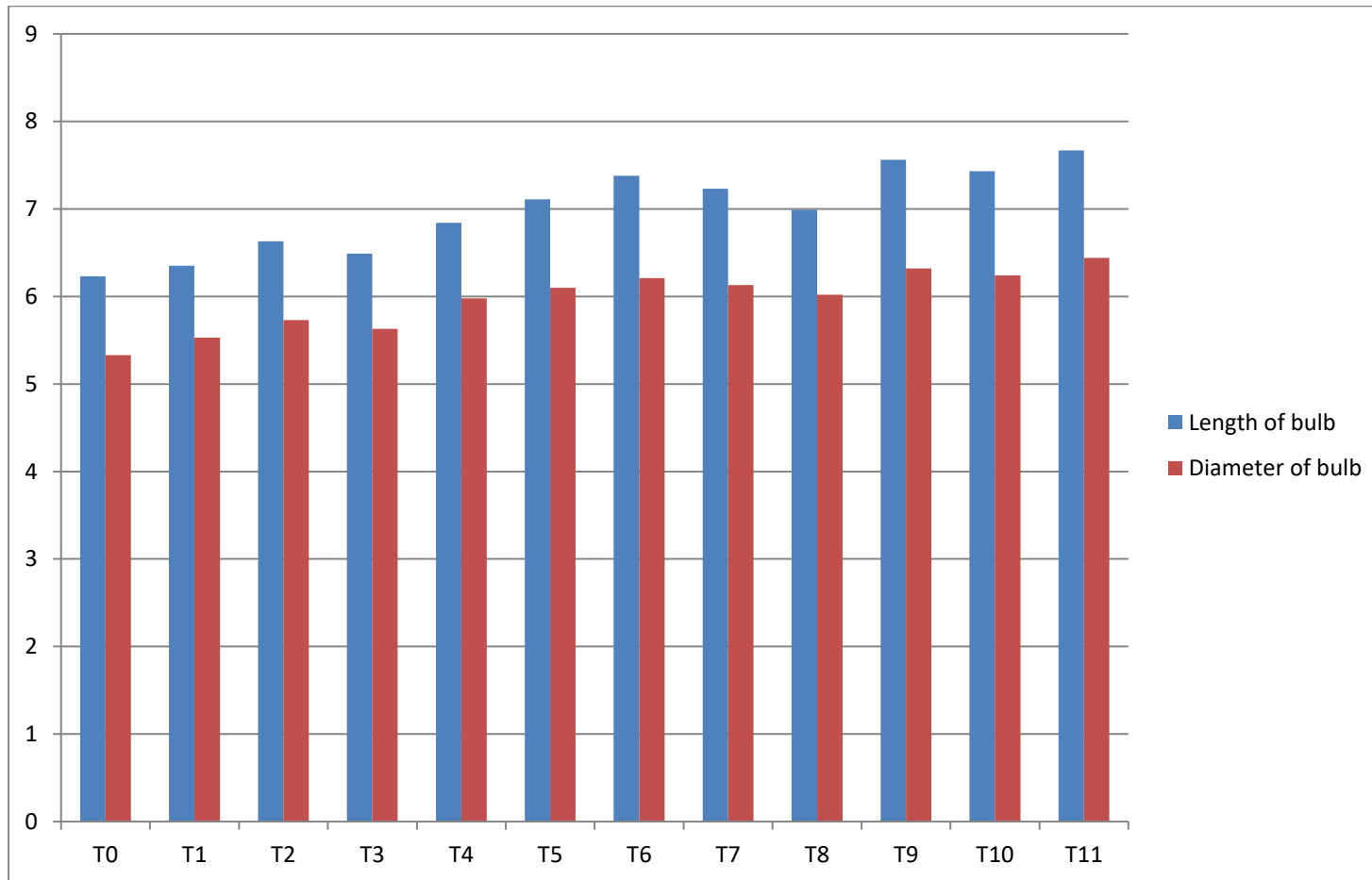


Fig 3. Effect of plant growth regulators on Length of bulb and Diameter of bulb at maturity of onion

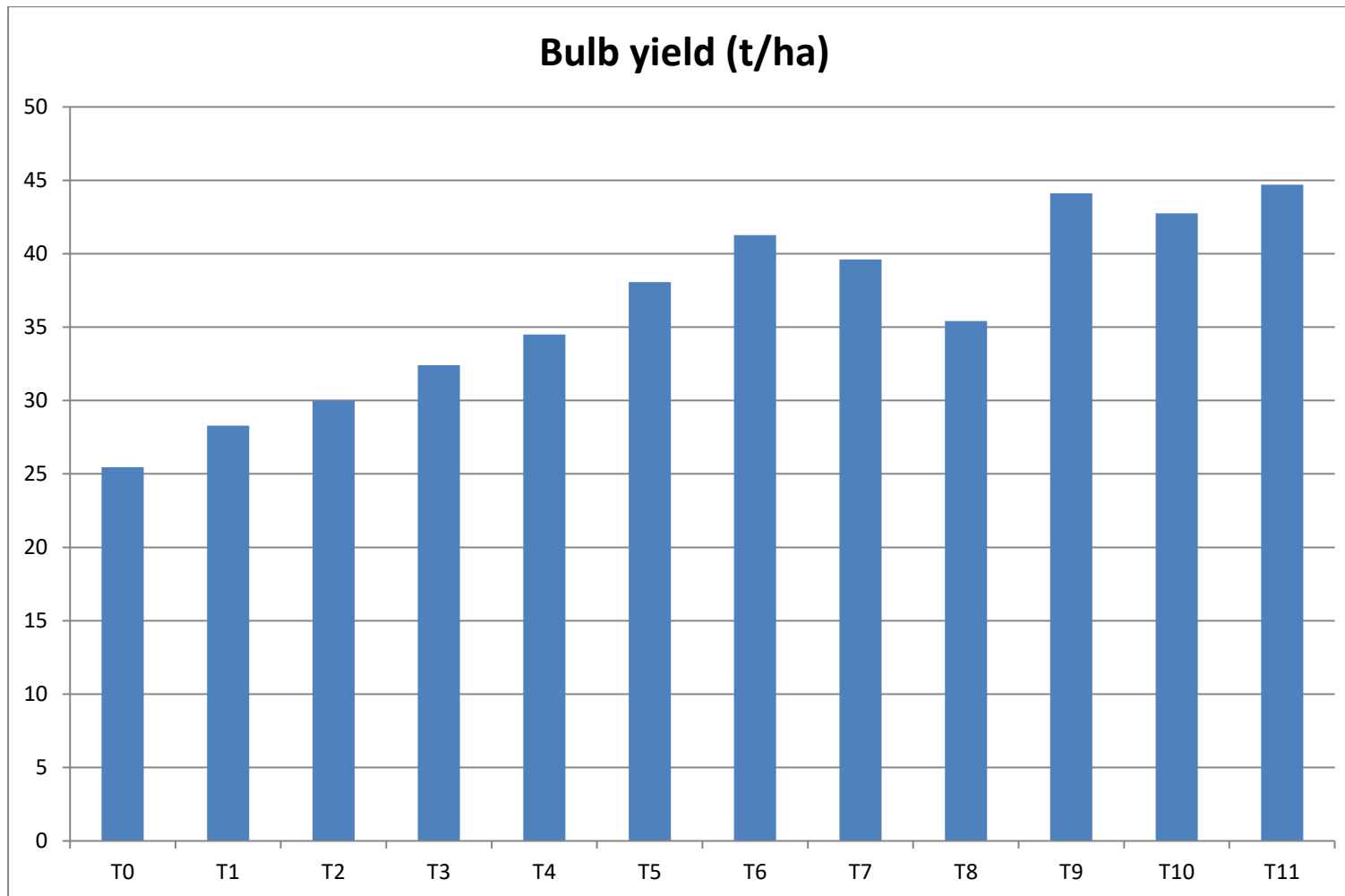


Fig 4. Effect of plant

growth regulators on Bulb yield (t/ha) of onion

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