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Influence of plant growth regulators on growth, yield and quality of onion (*Allium cepa* L.)

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Abstract

The experiment consisted of nine treatments viz. GA₃ @ 80 ppm, GA₃ @ 160 ppm, IAA @ 80 ppm, IAA @ 160 ppm, NAA @ 80 ppm, NAA @ 160 ppm, Ethrel @ 400 ppm, Ethrel @ 800 ppm and control. The results revealed that application of Ethrel @ 400 ppm increase the maximum height of plant, polar diameter, equatorial diameter, average weight of bulb, average yield per plot except number of leaves per plant and total soluble solids (TSS) in treatments IAA @ 160 ppm and collar length in treatments NAA @ 160 ppm under Lucknow conditions.

Keywords: Garlic, GA₃, NAA, Ethrel, growth, yield and quality

Introduction

Onion (*Allium cepa* L.) is most important bulbous vegetable crop. It is belong to family Alliaceae order *Aspergales* composed of 795 species in genera. Its chromosome number is 2n=16. It is an important vegetable crop grown in India. India exports 12 per cent of total world export of onion. It is more than 75% of foreign exchange that comes from export of fresh vegetables. Onion is grown throughout the entire world with some major producing countries like China, India, USA, Turkey, Pakistan, Iran, Japan, Spain and Brazil. India ranks second in area and production in the world after China and third in export after Netherlands and Spain. Export of onion from India during 2015 was 17.00 lakh tones. Indian Onion are famous for their pungency and are available round the year. Maharashtra, Karnataka, Gujarat, Orissa, Andhra Pradesh, Uttar Pradesh, Tamil Nadu, Rajasthan and Bihar are the major onion producing states in India. The area under onion cultivation is 1306 thousand hectares and 22427 thousand metric tons an annual production. Maharashtra, however, is the leading state with 471.66 thousand hectare area and 6773.08 thousand metric tons production followed by Karnataka (195.54 thousand hectare area and 2767.98 thousand metric tons production). Uttar Pradesh covers 4.08 thousand hectare area and 41.61 thousand metric tons production (Anonymous, 2017) [1]. Onion is a cool season crop and it grows well in climate with extremes of high or low temperatures. For good vegetative growth lower temperatures, (daily mean 13-21 °C) and short photoperiod are required while for bulb development high temperatures (daily mean 15-25 °C) and long photoperiod are required. Rabi onion varieties require day length of 10-11 hours while, rabi onion varieties require day length of 12-13 hours. Long day varieties do not bulb under short day condition, where as short day varieties if planted under long day conditions will develop bulb early. Seed rate of onion per hectare is 12-15 kg for Rabi season and 10-12 kg for Rabi season. Plant growth regulators are organic compounds other than nutrients which in small amount promotes inhibit or otherwise modify any physiological response in plant. (Purohit, 2007) [8]. Therefore, an attempt has been made to study the effect of plant growth regulators on growth, yield and quality of onion (*Allium cepa* L.) under the Lucknow conditions.

Materials and Methods

The present investigation “Effect of plant growth regulators on growth, yield and quality of onion (*Allium cepa* L.)” as conduct at the Horticultural research farm of Department of Horticulture, Babasaheb Bhimrao Ambedkar University (A Central University) Vidya Vihar, Rae Bareilly Road, Lucknow Uttar Pradesh during Rabi season (2018-19). Onion seed Bhima kiran were sown on nursery beds of Horticulture Research farm, BBAU, Lucknow, 26th Nov 2018 broadcasting methods on raised bed about 5-6 meter long, one meter width and 10 cm above ground level, was prepared. The seed beds were cover with compost.

Mulches and that attached with polythene paper above the bed to protect the young seedling from adverse climate condition 45 days after sowing, bulb lets were ready for transplanting. This healthy bulb let uniform shapes and size was selected and transplanting is prepared. The observations on height of plant (cm), number of leaves per plants, collar length (cm), polar diameter (cm), equatorial diameter (cm) average weight of bulb, average yield (kg/plot) and T.S.S. Onset of the Rabi season these healthy bulb uniform shape and size were selected and transplanted well prepared field Statistical analysis of the data obtained in different set of experiments was calculated following the standard procedure as stated by (Panse and Sukhatme, 1979) [7].

Results and discussion

Growth characters

Plant height (cm): The maximum plant height (49.42 cm) was shown constantly by the treatment T7 by application of ethrel 100% At 90 DAT. Followed by T1 GA₃ @ 80 ppm showed maximum plant height (48.65 cm.). (Salah *et al.*, 1989) [11] evaluated the effects of GA₃ and NAA (50,100 and 150 ppm). Both the hormones were effective for increasing vegetative growth of onion plant. The plant height, leaf length, number of leaves plant, plant fresh weight and percentage dry matter, total yield, average bulb weight and total soluble solids contents. NAA and GA₃ at 150 ppm found most effective in the trait. (Singh *et al.*, 2002) [13] Evaluated the effects of growth regulators on onion cv. Kalyanpur Red Round at Uttar Pradesh during Rabi season. The plants treated with GA₃ (10 ppm) recorded the highest plant height (44.40 cm), number of leaves per plant, bulb diameter (4.36 cm) and bulb yield (120.69 quintal/ha).

Number of leaves per plant: Number of leaves per plant was observed maximum (9.59) under the treatment T4 IAA 100% at 90 DAT. followed by recorded in (8.40) T1 GA₃ @ 80 ppm and minimum number of leaves (3.55) was recorded in T5 NAA @ 80 ppm. (Salah *et al.*, 1989) [11] evaluated the effects of GA₃ and NAA (50,100 and 150 ppm). Both the hormones were effective for increasing vegetative growth of onion plant. The plant height, leaf length, number of leaves per plant, plant fresh weight and percentage dry matter, total yield, average bulb weight and total soluble solids contents. NAA and GA₃ at 150 ppm found most effective in the trait.

Length of leaf (cm): When leaf growth was studied, T8 ethrel @ 800 ppm showed the maximum leaf length (52.39 cm). The treatment T4 IAA @ 800 ppm showed the minimum leaf length, (20 cm) at 30 days. Significantly increase the length of leaf spray of ether. Investigated the effect of 24 hours before planting root dipping of six weeks old onion plant growth regulators, IAA, IBA, NAA and GA₃ at 0, 20, 30 and 40 ppm. GA₃ at 40 ppm was most effective for increasing number, length and weight of leaves and number of roots per plant, the size and weight of bulbs, number of bulbs scales and percentage of grade A (diameter more than 4.5 cm) bulbs were also significantly increased.

Collar length (cm): The maximum collar length (3.75 cm) was point out under treatment T6 NAA @ 160 ppm at 90 days followed by 3.74 cm T9 Control. However minimum collar length (1.70 cm) was obtained in T1 at 30 days. (Mondal and Shukla, 2005) [5] reported that collar length was ranges from 6.10 to 6.97 cm. maximum collar length was obtained in GA₃

at 60 ppm, at later stage all the growth regulator perform similarly for enlarging collar length.

Yield characters

Average Weight of Bulb (gm): The differences in respect of net Bulb weight among various treatments were found significant. Maximum average weight of bulb 86.36 g was revealed that T7 ethrel @ 400 ppm followed by 83.36 under treatment T4 IAA @ 160 ppm. Whereas minimum weight of bulb 63.51 g was obtained in T1 GA₃ @ 80 ppm. (Arvin and Banakar, 2000) [2] Studied the effect of growth regulators on storage behavior of onion bulb. They found at harvest time Paclobutrazol reduced bolting, reducing sugars, soluble proteins and shoot length but increased leaf chlorophylls, proteins, sugars and bulb weight with no effect on shoot dry weight. Although ethephon reduced bolting, shooy growth, sugars, proteins and leaf chlorophyll and increased maturity index, sugars and proteins in bulbs, it had no effect on bulb yield. Cycocel increased bolting, sugars, proteins, chlorophyll, sugars and protein in roots and bulb weight.

Polar diameter (cm): The result indicated that significantly maximum polar diameter 4.47 cm was founded in ethrel @ 400 ppm under treatment T7 followed by 4.37 cm in T6. However minimum polar diameter 3.38 cm in T2 GA₃ @ 160 ppm. (Singh *et al.*, 2003) [12] conducted an experiment in Maharashtra during kharif 1999, 2001 and 2002 to investigate the effect of commonly available growth regulators (Cycocel, Cytozme (containing bacterial enzymes and chelated trace elements) and ethephon), alone or in combination, on onion cv. Agrifound Dark Red. The 3 years pooled date revealed that the use of growth regulators improved almost all the parameters studied significantly over the control. Significantly highest plant height, bulb diameter, bulb size index, weight of 20 bulbs, gross yield (156.63 q/ha), marketable yield (117.32 q/ha) and net return (Rs 26084/ha) were recorded in Cytozime at 0.2% root dip spray at 15, 45 and 75 DAP.

Equatorial diameter (cm): The significantly maximum equatorial bulb diameter was obtained in T7 ethrel 6.31 cm followed by 6.03 cm under treatment T4 IAA. However minimum equatorial bulb diameter 5.36 cm was founded in T1 GA₃. (Patel *et al.*, 2010) [6] Observed significant difference in equatorial diameter of onion by PGR application. They reported the equatorial diameter varies from 5.24 cm to 6.16 cm. equatorial diameter of bulb significantly increased with GA₃ application compare to control.

Average yield kg per plot: The significantly maximum average yield kg per plot 2.60 kg was designated in T7 ethrel @ 400 ppm followed by 2.6 kg IAA. Minimum average yield kg per plot was revealed in T5 NAA. Patel *et al.*, (2010) [6] examined significant differences in average bulb weight of different onion treatments range from 68.83 gram to 89.67 gram. The significantly maximum average bulb weight was noted in GA₃ 100 ppm.

Quality characters

Total soluble solids (%): TSS of different treatments was differed non-significantly however. Maximum TSS % was observed in T4 IAA @ 160 ppm (11.67%). It was followed by 11.36% in T7 ethrel and minimum TSS was obtained in T2 GA₃ (9.9%).

Conclusion

Based on the above results, it is recommended that Ethrel @400 ppm more effective in enhancing vegetative growth, yield & yield attributing and qualitative parameters of onion except number of leaves per plant and total soluble solids (TSS) in treatments IAA @ 160 ppm and collar length in treatments NAA @ 160 ppm under Lucknow conditions. However, since this is based on experiment, further trials may be needed to substantiate the results in onion.

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