Plant Archives Vol. 18 No. 1, 2018 pp. 561-565 *ISSN 0972-5210*

INFLUENCE OF PRUNING AND GA FOR YIELD IMPROVEMENT IN *RABI* ONION (*ALLIUM CEPA* L.)

Omesh Thakur*, Vijay Kumar and Jitendra Singh

Department of Vegetable Science, Indira Gandhi Krishi Vishwavidyalaya, Raipur-492012 (Chhattisgarh) India

Abstract

A field trial on Pruning and Gibberellic acid on the yield of onion cv. Agrifond Light Red during *Rabi* season of 2015-16. The treatments included: three levels of pruning (Root pruning, leaf pruning, leaf and root pruning) and six levels of GA_3 and its application method (50, 100, 150 ppm as root dip and foliar spray) along with control. It was found that there was a linear increase in yield parameter like number of leaves per plant, dry weight of bulb and leaves, root length, number of roots, bulb weight and yield. The bulb yield (6.75 kg/plot) was recorded maximum in P_2G_6 *i.e.* leaf pruning along with GA 150 ppm foliar spray as compared to control treatment. The bulb yield (6.75 kg/plot) was recorded minimum in P_0G_0 (control) *i.e.* without leaf and root pruning and no GA control treatment.

Key Words : Onion, Pruning, Gibberellic acid, Methods of application, yield

Introduction

Onion (*Allium cepa* L.) is one of the oldest bulb crops, known to mankind and consumed worldwide. It is one of the most important commercial vegetable crop grown in India and believed to be originated in Central Asia. It is valued for its distinct pungent flavour and is an essential ingredient for the cuisine of many regions. Onion is an integral part of our daily diet and its use is very common in almost all food preparations (Hossain and Islam 1994). It is also used as preservative and medicine (Vohra *et al.* 1994).

Gibberellic acid has the pronounced effect on metabolic and enzymic activities of the plants and it has also been reported to influence the cell division and cell elongation process, which ultimately results in more plant height and photo synthesis in plants. Gibberellic acid is a growth promoting hormone and induces a capacity in the plants to grow more vigorously giving higher number of leaves. Gibberellic acid is an important growth regulator that may have many uses to modify the growth, yield and yield contributing characters of plant (Rafeekher *et al.*, 2002).

Pruning is done mainly for balancing and influencing the nutrients and hormones. As a result of pruning the existing plant face less competition for nutrients and hormones. More nutrients and hormones are transported to the plant and they produce bigger, heavier and healthy bulb and seeds .Pruning associated with proper age of seedling is an important factor for successful onion production.

Considering the facts, the research work was carried out to find out suitable pruning operation on the growth and yield of onion.

Materials and Methods

The field experiment was conducted in Indira Gandhi Krishi Vishwavidyalaya, Raipur (C.G.) to find out the effect of seedling pruning and Gibberellic Acid (GA_3) and its application method on growth and yield of onion cv. Agrifond Light Red. The onion variety Agrifond Light Red was used in the experiment. It was a high yielding, grown in Rabi season. The experiment was laid out in factorial Randomize Block Design (RBD), with three replications. The treatments included: three levels of pruning (Root pruning, leaf pruning, leaf and root pruning) and 6 levels of GA_3 and its application method (50, 100, 150 ppm as root dip and foliar spray) along with control. For root dipping treatments, seedlings were dipped for overnight hours before transplanting .Spraying with GA_3 was done 30 days after transplanting.

***Author for correspondence :** E-mail : omithakur10@gmail.com

Preparation and application of GA_3:

50 ppm solution of GA_3 was prepared by dissolving 50 mg of it with distilled water. Then distilled water was added to make the volume 1 litre 50 ppm solution. In similar way 100 ppm and 150 ppm concentration were made. Five plants were selected at random and uprooted carefully at the time of collecting data of root from each plot. The data in respect of growth and yield components were statistically analyzed to find out the significance of the experimental results. The means of all the treatments were calculated and the analysis of variance for each of the characters.

Data collection the data on the yield characters *viz*., Number of leaves, fresh weight of leaves, Dry weight of leaves, number of root, root length, bulb weight, bulb yield as influenced by pruning and GA and its application methods are presented in tables 1 a & b Each of the parameters was measured as indicated below:

A. Number of leaves per plant

Total number of green leaves of five randomly selected plants in each treatment was counted and the average was calculated.

B. Fresh weight of leaf (g per plant)

This observation was recorded on randomly selected three competitive plants from each plots measured i.e. a part of the leaf which was above ground level was separated from the plant with the help of blade and it was weighed and noted as fresh weight of plants.

C. Dry weight of leaf (g per plant)

After recording the fresh weight of leaf per plant the separate at an interval of 30, 60, 90 DAS and at harvest plant material was kept in the sundried for natural drying till 7-10 days. The sample was kept in the hot air oven for 12 to 24 hours at 60^0C till constant weight has been achieved and weighed on digital balance.

$$DM\ (\%) = \frac{\text{Dry weight of leaf}}{\text{Fresh weight of leaf}} \times 100$$

D. Root number per plant

Number of roots per plant was counted at 15days interval starting from 45 days after transplanting up to harvest.

E. Root length (cm per plant)

The average root length per plant was estimated and mean value was estimated.

F. Average bulb weight (g)

Weight of ten bulbs from randomly selected plants was recorded by weighing balance and average was calculated.

G. Bulb fresh weight (Kg/plot)

The crop was dug out at as per maturity under different treatments. The foliage was removed and fresh weight of bulbs was recorded in each plot under all the treatments.

Statistical analysis was done for all parameters by adopting the procedures of Gomez and Gomez (1984).

Results

Effects of pruning

Leaf characters: Leaf is considered as an important functional unit of plant which contributes to yield through its photosynthetic activity. Pruning showed influence on the leaf character of onion cv. Agrifond light Red. The maximum number of leaves per plant (8.95), fresh weight of leaves (91.27 g), dry weight of leaves (14.07 g) were recorded from P_2 *i.e* leaf pruning respectively, while the minimum number of leaves per plant (7.71), fresh weight of leaves (87.83 g), dry weight of leaves (11.99 g) were obtained from the P_3 *i.e* leaf and root pruning (table 1). The results indicated that maximum number of leaves was produced in the onion with pruning practices. It may be due to the pruning enhance to producing more number of leaves.

Root character: Pruning showed influence on the root character of onion. Root number per plant, root length was found to be varied significantly under different treatments which has been observed. Root number per plant (38.29), root length (8.39 cm) to be higher in P_2 *i.e* leaf pruning followed by P_1 *i.e* root pruning, P_3 *i.e* root along with root pruning. The lowest root number (30.50) and root length (6.93 cm) was associated with treatment P_3 *i.e* leaf along with root pruning.

Bulb characters: data presented in the Table 1 revealed that the bulb weight, dry weight of bulb and bulb yield were significantly influenced by different treatments. Bulb weight (82.94 g), dry weight of bulb (12.17 g) and bulb yield (12.32 kg/plot) was recorded maximum in P_2 *i.e* leaf pruning and this trend was followed by P_1 *i.e* root pruning, P_3 *i.e* root along with root pruning. The minimum bulb weight (58.23 g), dry weight of bulb (10.21 g) and bulb yield (9.61 kg/polt) was associated with treatment P_3 *i.e* leaf along with root pruning.

Effects of GA_3 and its application methods

Leaf characters: data presented in the table 1 revealed that average number of leaves per plant (8.67), fresh weight of leaves (90.74 g), dry weight of leaves

Table 1(a): Effect of pruning and Gibberellic acid along with its application methods on leaf character of onion.

Treatment	No. of leaves	Fresh weight of leaves (g)	Dry weight of leaves (g)	Root number
Pruning method				
P_1(RP)	8.36	90.65	13.11	**33.49**
P_2 (LP)	8.95	91.27	14.07	**38.29**
P_3 (RP+LP)	7.71	87.83	11.99	**30.50**
SEm±	**0.07**	**0.40**	**0.31**	**0.79**
CD (5%)	**0.14**	**0.83**	**0.65**	**1.63**
GA_3 and its application method				
G_1 (50 ppm as RD)	8.13	88.94	12.76	32.31
G_2 (50 ppm as RD)	8.46	89.95	13.09	34.77
G_3 (100 ppm as RD)	8.16	89.55	12.56	32.51
G_4 (100 ppm as FS)	8.64	90.68	13.56	36.13
G_5 (150 ppm as RD)	8.42	89.74	12.72	32.60
G_6 (150 ppm as FS)	8.67	90.74	13.66	36.23
SEm±	**0.10**	**0.52**	**0.41**	**1.12**
CD (5%)	**0.21**	**1.07**	**0.84**	**2.30**

P_1 = RP (Root pruning), P_2 = LP (Leaf pruning), P_3 = LP + RP (Leaf + Root pruning), GA = Gibberellic acid, RD =Root dip , FS = Foliar spray

(13.66 g) were recorded G_6 *i.e.* 150 ppm as Foliar spray followed by G_4 *i.e* 100 ppm as foliar spray, G_2 *i.e* 50 ppm as foliar spray was statistically at par with each other. while the minimum number of leaves per plant (8.13), fresh weight of leaves (88.55g), dry weight of leaves (12.76 g) were obtained from G_1 *i.e* 50 ppm as root dip.

Root character: Root number per plant, root length was found to be varied significantly under different treatments which has been observed to be higher in G_6 150 ppm as FS (36.23) followed by G_4 *i.e* 100 ppm as foliar spray, G_2 *i.e* 50 ppm as foliar spray was statistically at par with each other. The lowest root number was associated with treatment G_1 *i.e* 50 ppm as root dip (32.31). The root length was noticed higher in G_6 150 ppm as FS (7.92 cm) and this trend was followed by similar treatment applied at lower doses *i.e.* 100 and 50 ppm and The lowest root length was associated with treatment G_1 *i.e* 50 ppm as root dip (7.22 cm).

Bulb characters: Data presented in the table 1 revealed that the bulb weight, dry weight of bulb and bulb yield were significantly influenced by different treatments. Bulb weight (77.62 g), dry weight of bulb (11.89 g) and bulb yield (11.86 kg/plot) was recorded maximum in G_6 150 ppm as FS and this trend was followed by similar treatment applied at lower doses *i.e.* 100 and 50 ppm and The minimum bulb weight (64.57 g), and

Table 1(b): Interaction effect of pruning and Gibberellic acid along with its application methods on leaf character of onion.

Treatment	No. of leaves	Fresh weight of leaves (g)	Dry weight of leaves (g)	Root number
P_1G_1	8.53	90.25	12.52	30.20
P_1G_2	8.37	90.66	13.45	34.76
P_1G_3	8.37	90.65	12.95	33.56
P_1G_4	8.63	90.88	13.85	37.15
P_1G_5	7.83	89.85	12.13	29.65
P_1G_6	8.40	91.62	13.78	35.64
P_2G_1	8.30	90.31	13.20	33.28
P_2G_2	9.37	91.64	14.22	40.20
P_2G_3	8.37	90.64	13.35	34.41
P_2G_4	9.57	91.97	14.75	41.36
P_2G_5	8.40	90.65	13.95	38.27
P_2G_6	9.70	92.42	14.96	42.20
P_3G_1	7.57	86.25	12.56	33.45
P_3G_2	7.62	87.25	11.61	29.36
P_3G_3	7.73	87.37	11.39	29.57
P_3G_4	8.27	88.38	12.73	33.56
P_3G_5	7.72	88.73	12.07	29.89
P_3G_6	7.90	88.63	12.25	30.85
P_0G_0	7.50	80.40	10.95	28.06
SE±	0.17	0.91	0.71	1.94
CD (5%)	0.36	1.86	1.45	3.98
Control vs rest				
SE±	0.12	0.66	0.51	1.14
CD (5%)	0.26	1.35	1.05	2.89

P_1 = RP (Root pruning), P_2 = LP (Leaf pruning), P_3 = LP + RP (Leaf + Root pruning), GA = Gibberellic acid, RD =Root dip , FS = Foliar spray

bulb yield (10.38 kg/plot) was associated with treatment G_1 *i.e* 50 ppm as root dip. Yield attributing characters are the real cause of improvement for the highest per hectare yield of any crop. Here these characters *viz,*, diameter of bulb and weight per bulb also significantly increased due to increasing concentrations of GA_3.

Interaction effect of pruning GA_3 and its application methods:

The interaction studies between pruning and Gibberellic acid treatment exihibited significant impact on yield in comparsion to control treatment *i.e* without pruning and gibberellic acid treatment. It was observed that P_2G_6 *i.e*. leaf pruning along with GA 150 ppm foliar spray produced maximum number of leaves per plant (9.70), fresh weight of leaves (92.42 g), dry weight of leaves (14.96 g) while the minimum number of leaves

Table 2(a): Effect of pruning and Gibberellic acid along with its application methods on leaf character of onion.

Treatment	Root length (cm)	Bulb weight (g)	Bulb yield (kg/plot)
Pruning method			
P_1(RP)	7.38	70.59	11.01
P_2 (LP)	8.39	82.94	12.32
P_3 (RP+LP)	6.93	58.23	9.61
SEm±	0.17	1.21	0.27
CD (5%)	0.35	2.49	0.55
GA_3 and its application method			
G_1 (50 ppm as RD)	7.22	64.57	10.38
G_2 (50 ppm as RD)	7.71	72.12	10.92
G_3 (100 ppm as RD)	7.29	64.86	10.56
G_4(100 ppm as FS)	7.94	77.54	11.54
G_5 (150 ppm as RD)	7.30	66.82	10.62
G_6 (150 ppm as FS)	7.92	77.62	11.86
SEm±	0.24	1.56	0.35
CD (5%)	0.50	3.21	0.71

P_1 = RP (Root pruning), P_2 = LP (Leaf pruning), P_3 = LP + RP (Leaf + Root pruning), GA = Gibberellic acid, RD =Root dip , FS = Foliar spray

per plant (7.50), fresh weight of leaves (80.40g), dry weight of leaves (10.95g) were obtained from control.

The perusal of data indicated in the Table 2 revealed that root number per plant (42.20), root length (9.28 cm) observed to be higher in P_2G_6 *i.e.* leaf pruning along with GA 150 ppm foliar spray while the lower root number per plant (5.73), root length (44.33 cm) observed from control. The significant improvement in root number per plant, root length under different treatment combinations were noticed over control treatment *i.e.* when no pruning and GA_3 application was done.

Data Presented in the table 1&3 revealed that the bulb weight (94.35 g), dry weight of bulb (12.58g) and bulb yield (13.84 kg/plot) were significantly influenced by different treatments. Bulb weight (44.33 g), dry weight of bulb (9.07 g) and bulb yield (13.84 kg/plot) was recorded maximum in P_2G_6 *i.e.* leaf pruning along with GA 150 ppm foliar spray while the lower root number per plant, root length observed from control. All the treatments have significant influence on the yield parameters as compared to the control.

Discussion

The interaction shows that leaf pruning along with GA 150 ppm foliar spray found to increase number of leaves, bulb weight and yield in this study. The results indicated that maximum number of leaves was produced

Table 2(b): Interaction effect of pruning and Gibberellic acid along with its application methods on leaf character of onion.

Treatment	Root length (cm)	Bulb weight (g)	Bulb yield (kg/plot)
P_1G_1	7.02	62.77	10.10
P_1G_2	7.64	74.22	11.52
P_1G_3	7.55	68.28	11.09
P_1G_4	7.70	81.88	11.88
P_1G_5	6.71	58.80	9.80
P_1G_6	7.64	77.58	11.68
P_2G_1	7.40	68.05	10.85
P_2G_2	8.94	87.34	12.90
P_2G_3	7.68	68.95	11.13
P_2G_4	8.97	94.02	12.95
P_2G_5	8.04	84.94	12.27
P_2G_6	9.28	94.35	13.84
P_3G_1	7.23	62.89	10.20
P_3G_2	6.56	54.79	8.35
P_3G_3	6.64	57.33	9.45
P_3G_4	6.99	64.12	10.74
P_3G_5	7.14	56.73	9.79
P_3G_6	6.85	60.92	10.07
P_0G_0	5.73	44.33	6.75
SE±	0.42	2.71	0.60
CD (5%)	0.86	5.56	1.24
Control vs rest			
SE±	0.30	1.97	0.43
CD (5%)	0.62	4.04	0.89

P_1 = RP (Root pruning), P_2 = LP (Leaf pruning), P_3 = LP + RP (Leaf + Root pruning), GA = Gibberellic acid, RD =Root dip , FS = Foliar spray

in the onion with leaf pruning practices. It may be due to the pruning enhance to producing more number of leaves (Nahar, 2007). The increased bulb diameter might be due to rapid cell pruning division and elongation of cell enhanced by pruning. As pruning orients the plant to their light supply and enable the plant to produce more food materials and store (Nahar, 2007). Maiti and Sen (1968) reported that leaf pruning of seedling at the time of transplanting augmented the start of onion and increase the size of bulb.

Yield is an important character which is responsible for the commercial feasibility of a crop variety and is also one of the most essential traits attaining highest consideration in a research programme. The increase in the vegetative characters may be due to enhanced cell division and quick cell multiplication while, the higher yield may be due to better carbon assimilation and better accumulation of carbohydrates in the plants. The present

finding is in accordance with Bodlaender *et al.* (1989) and Bhatia *et al.* (1992). The present studies are in congruent with Memane *et al.* (2008) who reported that increased vegetative and bulb growth observed in large sized clove due to more reserve food materials might had helped in increasing the overall yield of garlic. Singh *et al.,* (1995) have reported that application of growth regulators increase the accumulation of food materials and bulb yield in onion. It can be concluded the GA was found most effective in enhancing the bulb yield. The significant increase in yield-attributes may be due to the significant increase in number of leaves/plants, dry weight of leaves, root number. Considerably, GA can only modify the attributes corroborating to the findings of researchers (Anand Bahadur, 2001 and Singh *et al.*, 2003).

Conclusion

In the view of the results obtained from this investigation, it could be concluded that for securing the higher growth, bulb yield as well as average weight of bulb, leaf pruning along with GA 150 ppm foliar can be applied for yield improvement in rabi onion.

References

Bhatia, A.K., M.L. Pandita and S.C. Khurana (1992). Plant growth substances and sprouting conditions. II Effect of tuber yield and multiplication rate in seed potato production. *J. Indian Potato Assoc.,* **19(3-4)**: 154-156.

Bodlaender, K.B., M. Waart and Vande (1989). Influence of gibberrelic acid app1ied to the crop on growth, yield and tuber size distribution of seed potato. *Netherland J. Agric. Sci.,* **37(3)**: 185-196. (Fide: *Potato Abstr.,* **15(1)** : 224).

Gomez, K.A. and A.A. Gomez (1984). Statistical procedures for agricultural research. John Willey and Sons, New York.

Hossain, A.K.M.A. and J. Islam (1994). Status of *Allium* Production in Bangladesh. *Acta Hort.,* **358**: 33-36.

King, R.W. and L.T. Evans (2003). Gibberellins and flowering of grasses and cereals: Prizing open the lid of the florigen black box. *Annu. Rev. Plant Biol.,* **54**: 307-328.

Maiti, S.C. and P.R. Sen (1968). *Curr. Sc.*, **37**:566-568. (Cited from T.K. Bose and M.G. Som (1990). Vegetable crops in India. Naya Prakash, 206 Bidhan Sarani, Calcutta, India).

Mukherjee, R.K. and B.S. Prabhakar (1980). Effect of gibberellin on rice yield response to nitrogen applied at heading and quality of seeds. *Plant Soil,* **55**: 153-156.

Rafeeker M., S.A. Nair, P.N. Sorte, G.P. Hatwal and P.N. Chandhan (2002). Effevt of growth regulators on growth and yield of summer cucumber. *J. Soils Crops,* **12(1)**:108-110.

Vohra, S.B., M. Rizaman and J.A. Khan (1994). Medical uses of common Indian vegetables. *Planta Medea.,***23(4)**: 381-393.