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Research Article

GIBBERELLIC ACID AND STEM LENGTH UNIFORMITY, FLOWERING TIME, AND SEED YIELD INCREASE IN AZARSHAHR ONIONS

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ABSTRACT
In this research, the effects of various gibberellic acid concentrations (0, 25, 50, 150, and 450 ppm) on stem length uniformity, umbel maturity, and seed quality and quantity of the onion cultivar Azarshahr were studied. The treatments were applied when the first flowering stems emerged. Results of ANOVA indicated that this growth regulator had its greatest effects on the mentioned characteristics at 50 and 150 ppm, and that seed yield increased by about 25% through application of gibberellic acid at 50 ppm. However, in all, concentrations of 50, 150, and 450 ppm had the same level of effects. The effects of these treatments on the average number and length of emerged stems and on the time of umbel maturity were not significant, but the treatments had significant effects on seed quality and treated plants had higher percentages of normal seedlings and greater dry weights.

Keywords: *Gibberellic Acid*

INTRODUCTION
Onion with *Allium cepa* L scientific name and Alliaceae family is a perennial plant, which is mainly cultivated for two years (Amin *et al.*, 2004). Onions originates from Asia and the Middle East. Onions were grown and consumed by different tribal cultures in Asia from ancient times. Onion primarily originates from Southwest Asia (Naderi, 2011).
Waghmode *et al.,* (2010) Showed gibberellic acid, can play an effective role in improving these characteristics. Several classes of plant growth regulators affect physiological activities of the onion plant. Abscisic acid has been reported to in duce senescence on onion plants and prolongs bulb dormancy (Rahman and Isenberg, 1974). Gibberellic acid has been proposed as the anti-bulbing hormone (Shibaoka, 1991). Pogroszewska *et al.,* 2007 focused on the effect of GA3 and BA on the yield of Allium karataviense 'Ivory Queen'. The substances in concentration of 500 mg_dm-3 were applied in the form of a 60-minute bulb soaking prior to planting or plant spraying in the green bud phase. That discovered that GA3 applied in the both forms causes the inflorescence shoot elongation and the increased number of flowers in inflorescence, and increases the total yield expressed in the bulb weight. When applied in the form of plant spraying, it increases the number of bulbs in the total yield.
GA_3 has a strong influence on the sex expression of cucumber (Peterson & Anhder, 1960). This is also true for tomato (KuaI and Potaczek, 1972). A gametocidal effect of GA 3 was observed in sweet corn (Wittwer and Bukovac, 1957; Nelson and Rossman, 1958). Naumny *et al.,* (1980) reported onions treated with different concentrations of gibberellic acid in Occupied Palestine had more uniform stem height and time of umbel maturity and higher seed yields (with the 50-ppm treatment having the greatest effects). Rizk *et al.,* (1996) obtained the best result in the treatment of applying 50-ppm gibberellic acid and 100-ppm auxin, and reported that treated plants a larger average number of flowering stems and their yield was about 80% higher. In India, Singh *et al.,* (1995) soaked onion seeds in 150, 300, and 450-ppm gibberellic acid and obtained the highest seed yield in the 300-ppm treatment. Wagh and Deore (1995) sprayed onion plants with 25 and 50-ppm gibberellic acid at the time the first flowering stems emerged and observed the maximum seed yield (with the minimum percentage of sterile seeds) in the 50 ppm treatment. In all, gibberellic acid has greater effects on the characteristics of stem height uniformity and seed yield under unfavorable conditions and, if the environmental conditions are favorable, the treated plants may not show significant differences with the control plants.

MATERIALS AND METHODS

After land preparation and application of the base fertilizers, 2.5 by 3 meter plots were prepared and leveled when environmental conditions became favorable. Seeds of the Azarshahr cultivar with approximate diameters of 50-55 mm were planted at suitable depths with seeds and rows 45 cm apart. On each side, one row was allocated as the border. Berelex tablets were used to prepare various gibberellic acid concentrations. Before preparing the solutions for the treatments, a 50-ppm solution was sprayed on a few tomato seedlings and these seedlings were compared with the control to determine how effective the tablets were. Before applying the treatments, the volume of the solution required for each treatment was determined and the stock solution prepared accordingly. One day before spraying, the needed volumes were transferred from the stock solutions to containers with distilled water to prepare the desired concentrations, and all the prepared solutions were put in a refrigerator. The randomized block design (RCBD) was employed using gibberellic acid concentrations of 0, 25, 50, 150, and 450-ppm with 4 replications. Sprays were applied on onion plants and completely wetted them early in the morning when the air was not warm yet. The control plants were sprayed with equal volumes of distilled water. During the growing period and up to umbel maturity, the average numbers of emerged stems were counted several times. Umbel diameters and stem heights were measured before umbel maturity. After 5-10% of the capsules in each umbel split open, the umbels were harvested separately and put in paper envelopes prepared for each treatment. After harvest, stem heights were also measured. The umbels were dried under laboratory conditions and hand threshed, the waste was removed with a sieve and an air current, and the seed envelopes were separately weighed. In this experiment, the 1000-seed weight was also measured, wet paper towels were used to study qualitative characteristics, and percentage of normal plants, dry weight of seedlings, and germination rate in a germinator were determined.

RESULTS AND DISCUSSION

Results of ANOVA (Tables 1) indicated that, of the characteristics measured in the field, yield per umbel and umbel diameter, yield from a single plant, and yield per hectare of plants treated with gibberellic acid showed significant differences with the control. However, there were no significant differences between the treatments and the control regarding the uniformity-related characteristics (that is, average stem height, the required time for emergence of 50% of flowering stems, the needed time for umbel maturity, and the number of emerged stems). Results of comparison of the means (Table 2) showed that, of the characteristics measured in this experiment, there were no significant differences between the treatments and the control in the number of emerged stems and their heights, and in the percentage of stems shorter than 70 cm and higher than 100 cm. However, treated plants had a better condition than control plants with regard to the diameter and yield of umbels (Table 1). The 50 and 150- ppm gibberellic acid treatments had considerably greater effects on these characteristics and were at a higher level compared to the other treatments in this experiment. When gibberellic acid concentration was raised to 450 ppm, its positive effects on these two characteristics declined, and this treatment was at a lower level compared to the others. Gibberellic acid did not have considerable effects at low concentrations (25 ppm) either, and treated plants did not exhibit significant differences with control plants. This was in agreement with report of Naumny *et al.,* (1980). Table (2) shows that flowering percentage, flowering index, and days required for 50% flowering were not significantly different between the treatments, probably because of the relative suitability of environmental conditions for the emergence and growth and development of flowering stems. Naumny *et al.,* (1980) also reported that in years when environmental conditions were suitable for the emergence of flowering stems, gibberellic acid treatments did not have any considerable effects on the average number of emerged stems and on the flowering percentage. However, in years when the environmental conditions were not favorable, the differences between treated plants and control plants were significant. In our experiment, flowering index did not reach 100% in any of the treatments, which shows not all flowering stems succeeded in producing seeds (Table 2). The effects of gibberellic acid treatments on seed yield related characteristics were considerable and treated plants showed significant differences with control plants in yield from a single plant in the experimental unit, and in seed

yield per hectare (Table 2). This yield increase can be attributed to the effects of gibberellic acid on umbel diameter and yield per umbel and, to some extent, to the increase in the number of emerged stems. As for the effects of the treatments on seed yield, the 50, 150, and 450-ppm treatments were at the same level, but the 25- ppm treatment had a smaller impact and was at a lower level. Since the 50, 150, and 450-ppm treatments were at the same level, and considering the prominent effects of the 50-ppm treatment, this treatment is recommended as the more cost-effective one.

Table (2) show that the 50-ppm treatment increased seed yield by about 25%, which is in agreement Naumny *et al.,* (1980) report. However, Rizk *et al.,* (1996) reported that yield increased by about 80% with the application of 50-ppm gibberellic acid, and Singh *et al.,* (1995) reported that applying gibberellic acid at 300 ppm increased yield by approximately 11.5%.

Gibberellic acid somewhat, but not significantly, improved the qualitative characteristics of 1000-seed weight, of the percentage viable seeds, and of germination rate. However, seedling, rootlet, and seedling dry weights in the treatments and in the control exhibited very significant differences, with the 150-ppm treatment more effective and at a higher level compared to the other treatments.

Table 1: Analysis of variance for characteristics of Onion (*var Azar shahr*)

SOV	df	Steam number	Steam length	Flower diameter	Flower Yield	Seed yield in bush	Seed yield in ha
Replication	3	883**	380.695**	1101.558**	0.619*	27.333**	58337.129**
Treatment	4	36.8ns	2.254ns	263.385*	0.599*	10.963*	5379.324*
Error	11	95	5.224	79.937	0.173	2.936	1637.45
CV	-	16.16	3.11	12.36	12.27	13.85	10.21

**, ** significantly at the 1% and 5% levels of probability respectively and ns (non significant)*

Table 2: Mean comparison of the effects gibberllin on yield and characters of Onion (*Var Azar shahr*)

GA Concentration (ppm)	Steam length	Steam number	Seed yield in ha	Seed yield in bush	Flower Yield	Flower diameter
0	73.037 a	56.75 a	341.095 c	9.735 c	2.988 c	58.954 c
25	73.732 a	58.25 a	380.365 b	11.827 b	3.004 c	71.279 b
50	72.658 a	62.75 a	429.653 a	13.852 a	3.801 a	77.811 a
150	71.505 a	64 a	425.989 a	13.43 a	3.730 a	79.349 a
504	74.045 a	59.75 a	405.471 a	13.01 a	3.45 b	74.442

Mean fallowed by similar letters in each column, are not significantly at the 5% level of probability

REFERENCES

Abdel-Rahman M and Isenberg FMR (1974). The role of exogenous plant regulators in the dormancy of onion bulbs. *Journal of Agricultural Science* **82** 113-116.

Aminpoure R and Jafari A (1999). Fundamental of onion seed production. Isfahan Agriculture Ministry 60.

Kaul CL and Singh SP (1967). Induction of male sterility in Allium cepa L. *Current Science* **36** 676-677.

Loper GM and Weller GD (1982). GA3 increased bolting and seed production in Late planted onions. *Horticultural Science* **17**(6) 922- 923.

Naderi R (2011). Jeneral HorticultureT Tehran, Payam Noor University Publication, (in Persian).

Naumny F, Rabinowitch HD and Kedar N (1980). The effects of GA3 applications on flowering and seed production in onion. *Journal of American Society for Horticultural Science* **105** 164- 167.

Nelson PM and Rossman EC (1958). Chemical induction of male sterility in inbred maize by use of gibberelins. *Science* **127** 1500-1501.

Peterson CE and Anhder LD (1960). Induction of staminate flowers on gynoecious cucumbers with gibberellin A 3. *Science* **131** 1673-1674.
Pogroszewska E, Laskowska H and Durlak W (2007). The effect of gibberllic acid and benzyladenin on the yield of (Allium karataviense Regel.) Ivory Queen. *Acta Scientiarum Polonorum Hortorum Cultus* **6**(1) 15-19.
Rizk FA, Shaheen AM and El-Habbasha KM (1996). Flowering and seed yield of onion (Allium cepa L.) plants as affected by dates of planting and some growth regulators. *Egyptian Journal of Horticulture* **23**(1) 113-127.
Shibakoa H (1991). The role of gibberllin in the formation of bulbs. In: *Gibberllins*, edited by Takahashi N, Phinney BO and MacMillan J (Springer-Verlag, Berlin, Heidelerg, New York) 220-228.
Singh S, Singh K and Singh SP (1995). Effect of hormones on growth and yield characters of seed crop of kharif onion (Allium cepa L.). *Indian Journal of Plant Physiology* **38**(3) 193- 196.
Wagh RS and Deore BP (1995). Effects of growth substances on seed yield and quality of onion. *Journal of Maharashtra Agricultural University* **20**(1) 144.
Waghmode HS, Patil RS and Pandure BS (2010). Effect of biofertilizer and gibberellic acid on yield contributing character of onion. *International Journal of Agricultural Sciences* **6**(2) 392-394.
Wittwer SH and Bukovac MJ (1957). Gibberellin and higher plants. Field observations with certain vegetable crops. *Bulletin of Michigan State University of Agricultural Experiment Station, East Lansing* 352-364.