Indian Journal of Fundamental and Applied Life Sciences ISSN: 2231– 6345 (Online)
An Open Access, Online International Journal Available at www.cibtech.org/sp.ed/jls/2014/04/jls.htm
2014 Vol. 4 (S4), pp. 2993-2997/Safdari et al.
Research Article

EVALUATION THE EFFECTS OF DIFFERENT TREATMENTS OF GIBBERLIN HORMONE ON GROWTH CHARACTERS OF ONION

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ABSTRACT
A factorial split plot project with randomized complete block design using three repeats was conducted in Agriculture and Natural Resources Research Center in North Khorasan Province to evaluate the effects of different treatments of gibberellin hormone concentrations (0, 250, 500 and 750 milligrams per liter) and time (0, 6, 12 and 18 hours) on vegetative growth of onion. Independent analysis of data showed that yield was not significantly influenced by the hormonal concentration in onion. However, onion had the highest yield at 500 milligrams per liter concentration of gibberellin. Examining independent effect of time on vegetative traits showed that collar diameter, number of leaves and stem length had no significant differences. However, the effect of time on plant height was significant. The effect of hormonal concentration on stem length, leaf number and plant height was significant. It was shown that 500 milligrams per liter gibberellin had a significant and positive effect on the vegetative traits. In addition, onion had the maximum collar diameter in zero hormonal concentration (control).

Keywords: *Gibberlin, Onion, Growth Characters, Concentration*

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). Onionsoriginates 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).
Several years ago, Japanese farmers observed that certain plants grew taller than other plants when they cultivated rice. Savada (1912) was the first one who stated that rice seedlings elongate since they were stimulated by Bakana fungal roots. Kurasawa (1926) stated that those substances derived from Bakana fungi elongate the cells. After initial report by Houri, it took a series of negotiations to name Bakana Fungi. This issue was addressed by Takahashi (1931). He named incomplete stage (asexual) in Fusarium fungi as monoform while the complete stage (sexual) was called gibberella fujikuroi (Takahashi *et al.*, 1931). Fusaric acid is produced and purified from Bakana fungi. Fusaric acid cannot grow in presence of inhibitory substance. Yabuta isolated an activated crystalline substance from sterilized medium in 1935. This substance is called gibberella fujikuroi (Yabuta, 1935). This substance stimulated growth of roots of rice seedlings, which is called gibberellin. It was the first time gibberellin term was used in literature. English researchers (Bryan *et al.*, 1954) identified regulatory characteristics of vegetative growth of gibberellic acid in products derived from gibberella fujikuroi in 1954. Japanese scientists (Takahashi *et al.*, 1955) found out that gibberellin A contains three distinct compounds called GA_1, GA_2, GA_3 in 1955. Nowadays, it is generally agreed that gibberellin X, GA_3 gibberellic acid are similar compounds. In fact, gibberellic acid and GA_3 are synonymous. Radly identified similar compounds as gibberellic acid in plants in 1956. So far, gibberellin is considered as a common and developed compound in higher plants (Takahashi *et al.*, 1991).
Nowadays, plant growth regulators are used to speed up production time as well as production of high quality and market-friendly products by farmers and manufacturers of agricultural products. Nowadays, plant hormones are used for different purposes. Such hormones as auxin, cytokinin and gibberellin stimulate growth in different areas such as roots, stems, stimulate germination and break dormancy of seeds. Such hormones as abscisic acid inhibit growth while such others as ethylene stimulate dormancy of

seeds. The latter is usually used in fridges and warehouses for maintaining fruit and other plant products in order to increase storage period. Ghibelline was used as a treatment in several studies in order to break dormancy of seeds in several experiments. Takahashi *et al.*, (1957) differed GA_4 compound from gibberella fujikuroi. They showed that the former is similar to gibberellin A, which was discovered by Stodal (1955). However, there are no similarities between GA2, GA4. McMillan and Takahashi (1968) considered certain numbers of gibberellin A_1 to A_X regardless of their origins. This method is also commonly used for more than 90 types of gibberellin (Ertka, 2012). The objectives of this study are as follows: determining the optimal concentration of gibberellic acid (gibberellin) for seed treatment before planting in order to enhance vegetative traits in onions, determining the most appropriate time for seed treatment prior to planting in order to accelerate vegetative traits and increase productivity and consequently maximizing efficiency per unit.

MATERIALS AND METHODS

The project site was located in Kohneland research farm in four kilometers West of Bojnord. This site was located 1050 m above sea level. In addition, average annual rainfall was 263 mm, absolute minimum temperature was -25°C, absolute maximum temperature was 40°C, average temperature was 13°C, altitude (east-west) was 2257 while latitude (north-south was 28 37. This station was located in the alluvial plain physiographic unit, which has a gentle slope and lacks topography, and does not erode. The land has a deep soil with medium surface texture (silty loam) and medium (loam silt) to heavy (clay loam) lower texture. Khosravani seed variety was prepared, which was ready to be planted since it was readily disinfected and winnowed. Germination power of this type of seed was 86%. Different concentrations of gibberellin hormone were prepared as follows.

First, 250 mg concentration of the hormone with 99% purity was weighted using a sensitive scale. Then, it was poured into a beaker containing 100 ml of distilled water. Then, either one or two drops of normal NAOH were added. Then, the compound was mixed to dissolve gibberellin crystals. After complete dissolution of crystals, water volume was reached to 1,000 cc. Then, it was poured into a closed bottle, which was disinfected as already stated above. The solution was covered with an aluminum foil to avoid the sunlight. Then, 500 mg and consequently 750 mg of gibberellin hormone powder were isolated to obtain the required concentrations.

Then, distilled water was added to the powder. Then, water volume was brought to 1000 cc. The solutions were covered with aluminum foils to avoid decomposing effect of sunlight on the obtained solution. Then, 100 ml of each concentration was isolated from labeled containers and added to 5 g of dry seeds weighed with a sensitive scale. Every 15 minutes, the solution containing gibberellin hormones and immersed seeds were blown to prevent smothering of the seeds in the solution. This action was periodically repeated in other containers. The distance between plots was (3 x 3) square meters. The plots were within 1 m from each other. The main plots were within 2 m from each other. The repeats were within 3 meters from each other, so that a worker or a weed removal device could easily remove weeds. As a result, labor costs were reduced. The distance between each row was 20cm while the distance between two rows was 40cm. Thus, planting and maintaining operations such as watering and weeding could easily be conducted in 40cm distance. Drainage irrigation was performed regularly every 7 days. Thinning operation was performed in two stages after germination of all seeds. As a result, the distance between two plants was 10 cm. Then, subsequent measurements were done easily and accurately. Then, weeding operation was carried out in three stages.

The harvest was followed when following situations were observed. The lower leaves were dried. Moreover, aerial stems could no longer hold their own; as a result, they were bent to one side (with respect to the prevailing wind). Thus, two lines one meter above and one meter below the plot were removed. MSTAT-C software was used for statistical analysis in this experiment. Excel software was used to draw graphs and charts. The means were compared using Duncan's multiple range tests at 1 and 5 percent probabilities.

RESULTS AND DISCUSSION

The effect of time on stem length, leaf number and collar diameter was not significant. However, the effect of time on plant height was significant at 1%. The highest plants (60.5) were observed at 12 hours. The effect of different hormonal concentrations on all vegetative traits such as stem length, collar diameter, and the number of leaves was significant at 1% level of significance. At a first rank, the maximum stem length (47.17cm), maximum number of leaves (10.17) and the highest plant (61.33) were observed at 500 milligrams per liter hormonal concentration. At the first rank, maximum collar diameter (2.13 cm) was observed at zero hormonal concentration (control plot). Statistical analysis results showed that the interactive effect of hormonal concentrations led to a significant difference in stem length. Thus, maximum stem length (49.33cm) was observed at 12 hours and 500 milligrams per liter hormonal concentration at the first rank while the minimum stem length (35cm) was observed at 18 hours and zero hormonal concentration. As a result, the difference was equal to 14.33 cm.

Statistical results on the interactive effect of hormonal concentration and time treatment on the number of leaves led to a significant difference at 5% level. At the first rank, the maximum number of leaves per plot (11.53) was observed at 12 hours and 500 milligrams per liter hormonal concentration. At the last rank, the lowest number of leaves with 6 leaves per plot was observed at zero time and zero concentration of the hormone. The difference showed an increase number of 5.5 leaves. Statistical analysis on the interactive effect of different concentrations of hormone and time treatment on plant height showed a significant difference according to ANOVA table. At the first rank, the highest plant (69cm) was observed at 12 hours and 500 milligrams per liter hormonal concentration. At the last rank, the shortest plant (48cm) was observed at 18 hours and 250 mg per liter hormonal dose. This showed a significant difference according to variance table at 1% level of significance. According to ANOVA results, the interactive effect of time treatment and different hormonal concentrations on collar diameter did not show a significant difference (ANOVA table). Mean comparison results indicated that the largest mean collar diameter of 2.63 cm was observed at the first rank with control time treatment and 750 milligrams per liter hormonal dose. This difference was not significant. At the last rank, the minimum collar diameter (1.47) was observed at 6 hours and 500 milligrams per hormonal liter concentration.

Table 1: Analysis of variance for application of Gibberlin on characteristics of onion

S.O.V	df	Collar diameter	Plant height	Number of leaves	Stem length
Replication	2	0.45**	1306.86**	0.008 ns	2.33 ns
Time of application	3	0.14 ns	102.40 **	3.76 ns	8.68 ns
Error a	6	0.036	7.61	0.98	22
Concentration	3	0.16**	149.18**	37.4**	254.8**
A × B	9	0.45*	65.63**	2.85*	20.40 ns
Error B	24	0/019	8.77	1.103	12.166
Total Error	47	2.89	4215/4	181.63	1402/9
CV	-	7	5.17	13.20	8.51

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

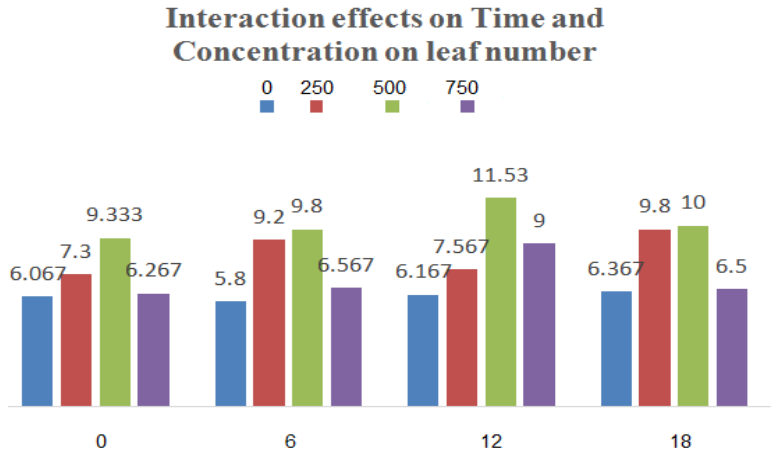

Figure 1: Interaction effects on Time and Concentration on leaf number

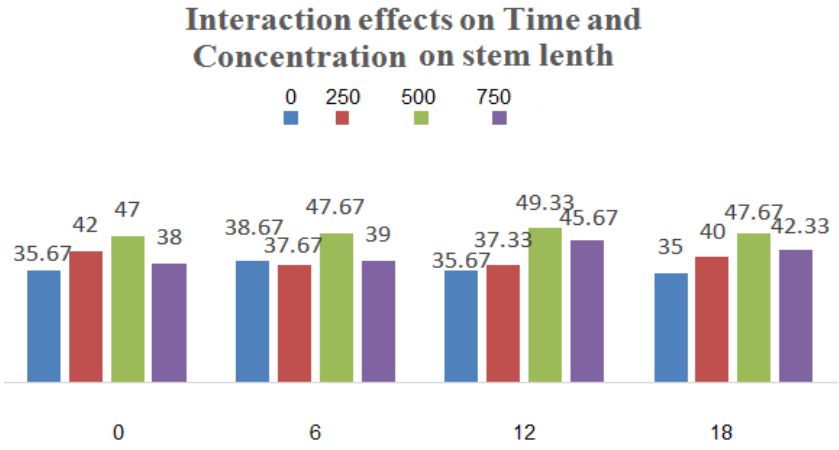

Figure 2: Interaction effects on Time and Concentration on stem length

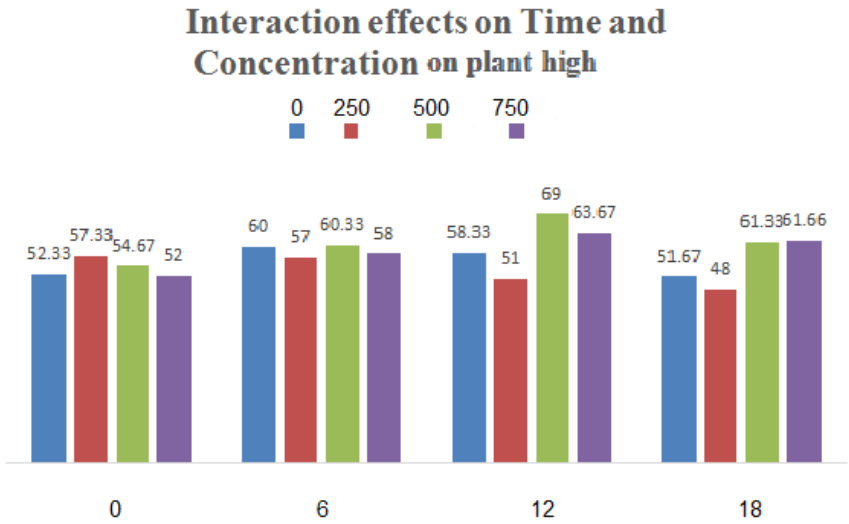

Figure 3: Interaction effects on Time and Concentration on plant high

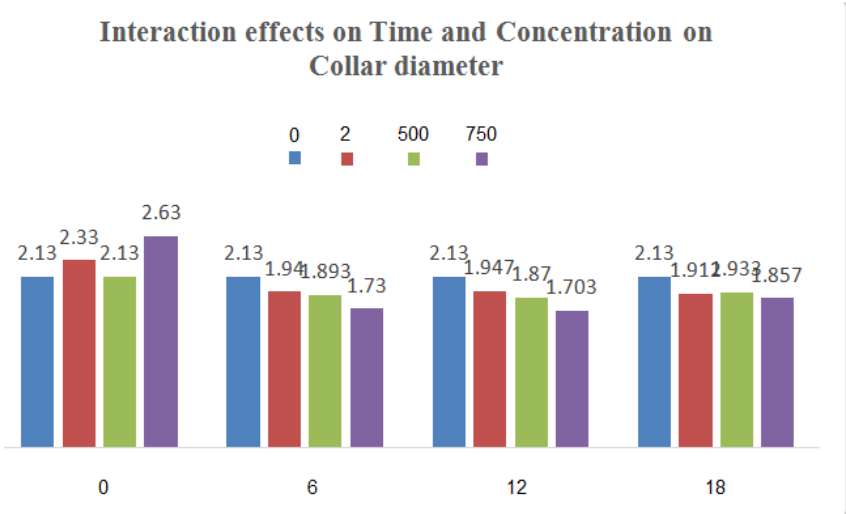

Figure 4: Interaction effects on Time and Concentration on collar diameter

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