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Effect of different concentrations of gibberellic acid on seeds germination and growth in different turf grass genera

*Berivan Sadiq Abdullah Yousif Ali Abdulrahman

Horticulture Department, College of Agriculture, Duhok University, Duhok, Republic of Iraq.

Abstract

This study was carried out from 15 March 2013 to 15 October 2013. The aim was to study the effect of five concentrations (0, 50, 100, 200 and 400 $mg.l^{-1}$) of gibberellic acid (GA_3) on the germination and growth performance of four turf grass seeds genera including Bermuda grass (*Cynodon dactylon* L. var. cd4), Tall fescue grass (*Festuca arrundaceae* L. var. Barleroy), Kentucky blue grass (*Poa pratensis* L. var. Baron) and Perennial Rye grass (*Lolium perenne* L. var. Barlennium). Hence, two factorial experiments were conducted by using the Completely Randomized Block Design. The results were summarized as an increased GA_3 concentration to 400 $mg.l^{-1}$ caused significant increase in all the studied characteristics in this experiment, (germination percentage 63.72%, plant height 5.99 cm, number of tillers 6.25, fresh and dry weight of vegetative growth 6.46 and 2.61 g, fresh and dry weight of roots 3.24 and 1.66 g respectively) in comparison with other concentrations. Rye grass seeds were superior significantly to others genera in all the studied characteristics except in number of tillers which Bermuda grass (7.29) was significantly superior to other turf grass genera.

Keyword*:* GA_3 concentrations, Turf grass seeds genera.

(*Part of M.Sc. thesis of the first author)

Introduction

Turf grasses are the main element of landscape art. They are defined as any grass that can be cut and made up thick vegetation that cover the soil surface or those spaces which are planted by a group of adjacent and convergent herbal plants. When cutting its creeping branches grow profusely to cover the distance between the cultured plants and its growth when integration gives attractive form as green carpet (2). It occupied about 70-80% of the land area in gardens (7 and 9) Christian. Western civilization may adapt the wild grass for their characteristics and this adaptation returned to eighteenth century (5). Turf and turf grasses are also fundamental agents for safeguarding the environment by different techniques, like controlling erosion in roadsides, rivers, grazing lands and problematic agricultural areas (20). Most of the plants that used for planting as turf grass followed Gramineae family which differs in being annual or creeping perennial and other characters. The production of turf grass is one of the most important economic sectors for some countries like America, British and Netherlands (2, 6 16 and 21)

Gibberellic Acid (GA_3) is the most important growth regulator, which breaks seed dormancy, promotes germination, internodal length, hypocotyls growth and cell division in cambial zone and increases the size of leaves. GA_3 stimulates hydrolytic enzymes that are needed for the degradation of the cells surrounding the radicle and thus speeds germination by promoting seedling elongation growth of cereal seeds (15). However, the stimulating effects of GA_3 on seed germination are not similar in all crop species(4). The objective of this study was investigate the effect of different concentrations of gibberellic acid (GA_3) on the germination and seedling growth of different turf grass genera in order to accelerate

the seed germination and improve their growth.

Materials and Methods

The experiment was performed from the period 15\03\2013 to 1\06\2013. The experiment was conducted to study the effect of five concentrations of gibberellic acid (GA_3) 0, 50, 100, 200 and 400 $mg.L^{-1}$ (the seeds were soaked for 24 hours) on the germination and growth performance of four turf grass seeds genera: Bermuda grass (*Cynodon dactylon* L. var. cd4), Tall fescue grass (*Festuca arrundaceae* L. var. Barleroy), Kentucky blue grass (*Poa pratensis* L. var. Baron) and Perennial Rye grass (*Lolium perenne* L. var. Barlennium). Pots with diameter of 15cm were filled with media and then seeds were sown at rate of 50 seeds. $Pots^{-1}$. A factorial experiment with two factors (5×4) was conducted by Completely Randomized Block Design. Each treatment was replicated three times with one pot for each replicate.

Measurements

2.1. Germination percentage (%). Which was calculated as follows (the number of germinating seeds\ number of seeds planted (total) x 100) by Yang *et al*. (24).

2.2. Germination rate (days). Calculated as follows Mohammed (11):

$$G.R = \frac{A1 * T1 + A2 * T2 \ldots AX\ TX}{A1 + A2 + \ldots\ldots\ldots\ldots AX}$$

A= number of germination seedling in day.

T= number of day from beginning of the experiment

2.3. Plant height (cm).

2.4. Number of tillers \ plant.

2.5. The fresh weight of vegetative growth ($g.\ pot^{-1}$)

2.6. The dry weight of vegetative growth ($g.\ pot^{-1}$) Dried at temperature of 70 °C for 48 hours.

2.7. The fresh weight of roots (g) \ pot.

2.8. The dry weight of roots (g) \ pot. After taking the weight of the fresh roots then were put in the oven for 48 h at 70 °C, lastly weight them by using sensible balance as it has been mentioned by Al-Sahaf (3).

Results and Discussions

Germination Percentage (%):

The data in Table 1 showed that the soaking of seeds in GA_3 with different concentrations leads to increasing the germination percentage and the highest value (63.72) and (63.22%) was found in seeds that soaked in 400 and 100 $mg.l^{-1}$ of GA_3 respectively, while the lowest value (58.94%) was found in untreated seeds (control). In addition, the seeds of Rye grass genera showed significant increase in germination percentage (76.18%) than other genera including Bermuda (57.11%), Kentucky blue (56.58%) and Fescue (56.22%). The interaction of GA_3 concentrations and turf grass genera seeds shows that the soaking of Rye seeds with 100 $mg.l^{-1}$ of GA_3 gave the highest germination percentage value (82.44%), whereas soaking Fescue seeds in 50 $mg.L^{-1}$ of GA_3 gave the lowest percentage (46.89%).

Germination Rate (Days):

The data in Table 2 refers that the germination rate of different turf grass genera seeds was significantly affected by different concentrations of GA_3, the high concentrations of GA_3 100, 200 and 400 $mg.l^{-1}$ accelerates seeds germination which require (16.72, 16.94 and 16.86 days) respectively which significantly differed from low concentration 50 $mg.l^{-1}$ and control which delayed germination of seeds to (18.11 and 18.18days) respectively. But for genera seeds the faster germination was obtained in Rye genera seeds

Table (1). Effect of different concentrations of GA_3 on the Germination percentage (%) of turf grasses genera seeds.

GA_3 conc. ($mg.l^{-1}$)	Turf grass Genera				GA_3 conc. Mean
	Bermuda	Fescue	Kentucky blue	Rye	
0	54.00 f	54.44 F	54.22 f	73.11 b	58.94 C
50	62.44 cd	46.89 g	54.22 f	76.00 b	59.89 Bc
100	55.78 ef	54.22 f	60.44 cd	82.44 a	63.22 A
200	58.22 d-f	62.44 cd	54.00 f	72.67 b	61.83 Ab
400	55.11 f	63.11 c	60.00 c-e	76.67 b	63.72 A
Turf grass genera mean	57.11 b	56.22 b	56.58 b	76.18 a	

Means with same letter for each factor and interaction are not significantly different at 5% level based on Duncan's Multiple Range test

Table (2). Effect of different concentrations of GA_3 on the Germination Rate (Day) of turf grasses genera seeds.

GA_3 conc. ($mg.l^{-1}$)	Turf grass Genera				GA_3 conc. Mean
	Bermuda	Fescue	Kentucky blue	Rye	
0	19.24 b-e	20.30 Bc	18.29 d-g	14.90 j	18.18 A
50	20.49 b	18.79 b-f	17.41 f-h	15.73 ij	18.11 A
100	18.86 b-f	17.20 Gh	16.76 g-i	14.06 j	16.72 B
200	20.01 b-d	17.62 e-g	14.86 J	15.29 ij	16.94 B
400	18.70 c-f	22.33 A	15.24 Ij	11.15 k	16.86 B
Turf grass genera mean	19.46 a	19.25 A	16.51 B	14.23 c	

Means with same letter for each factor and interaction are not significantly different at 5% level based on Duncan's Multiple Range test

(14.23 days) and followed with Kentucky blue genera (16.51 days) and then Fescue and Bermuda genera seeds (19.25 and 19.46 days) respectively. The dual interaction between GA_3 and turf grass genera seeds showed that soaking Rye seeds in 400 $mg.l^{-1}$ of GA_3 lead to decrease time required for germination (11.15days) which was significantly superior than all other interactions

Plant height (cm):

The results in Table 3 show that the highest concentration of $GA_3$400 $mg.l^{-1}$ obtained the highest plants (5.99 cm) which differed significantly as compared with other concentration except the control. A significant variation in plant height was also noticed among different turf grass genera. The highest plant (7.07 cm) was recorded in Rye grass genera, whereas the lowest height (2.36 cm) was obtained in Bermuda grass genera. The interaction between GA_3 concentrations and turf genera showed significant effect on this character and growing of untreated Rye genera plants with GA_3 gave the best height (9.23 cm) in comparison with the least values for Bermuda grass plants at different concentrations of GA_3.

Number of tillers per plant:

It can be seen from Table 4 that the tillers number increased significantly with increasing GA_3 concentrations, the highest number of tillers (6.25) was recorded for 400 $mg.l^{-1}$, while the least numbers (5.58) for untreated seeds. A significant variation in tillers number was also noticed among different turf grass genera. The high number (7.29) was recorded in Bermuda grass whereas, while the least numbers (5.31) was for Fescue grass. The interaction of

Table (3). Effect of different concentrations of GA3 on the Plant height (cm) of turf grasses genera.

GA_3 conc. ($mg.l^{-1}$)	Turf grass Genera				GA_3 conc. Mean
	Bermuda	Fescue	Kentucky blue	Rye	
0	2.18 g	5.19 e	6.67 c-d	9.23 A	5.81 Ab
50	2.37 g	5.89 de	6.67 Cd	7.26 Bc	5.54 C
100	3.34 f	5.67 e	5.57 E	6.68 Cd	5.31 C
200	1.97 g	6.99 c	6.49 Cd	5.26 E	5.18 C
400	1.97 g	7.12 c	7.98 B	6.91 C	5.99 A
Turf grass genera mean	2.36 d	6.17 c	6.67 B	7.07 A	

Means with same letter for each factor and interaction are not significantly different at 5% level based on Duncan's Multiple Range test

Table (4). Effect of different concentrations of GA_3 on the tillers number per plant of turf grasses genera.

GA_3 conc. ($mg.l^{-1}$)	Turf grass Genera				GA_3 conc. Mean
	Bermuda	Fescue	Kentucky blue	Rye	
0	6.67 Bc	6.00 c-e	3.67 G	6.00 c-e	5.58 C
50	7.56 Ab	4.67 fg	4.56 Fg	6.44 Cd	5.81 a-c
100	8.33 A	5.44 d-f	4.67 Fg	6.22 Cd	6.17 ab
200	7.78 A	5.44 d-f	3.78 G	5.78 c-e	5.69 bc
400	6.11 Cd	5.00 ef	5.78 c-e	8.11 A	6.25 a
Turf grass genera mean	7.29 A	5.31 c	4.49 D	6.51 B	

Means with same letter for each factor and interaction are not significantly different at 5% level based on Duncan's Multiple Range test

Table (5). Effect of different concentrations of GA_3 on Fresh weight of vegetative growth (g) of turf grasses genera.

GA_3 conc. ($mg.l^{-1}$)	Turf grass Genera				GA_3 conc. Mean
	Bermuda	Fescue	Kentucky blue	Rye	
0	6.49 de	4.39 ij	4.40 Ij	7. 02 Bc	5.57 c
50	5.06 h	4.08 j	4.55 I	7.02 Bc	5.18 d
100	5.92 fg	5.52 g	4.27 Ij	7.33 B	5.76 bc
200	6.31 ef	5.92 fg	4.96 H	6.23 Ef	5.86 b
400	6.73 cd	5.77 g	4.20 ij	9.14 A	6.46 a
Turf grass genera mean	6.10 b	5.14 c	4.47 d	7.35 A	

Means with same letter for each factor and interaction are not significantly different at 5% level based on Duncan's Multiple Range test

GA_3 concentrations and turf grass genera, results showed that soaking of Bermuda grass seeds in 100 $mg.l^{-1}$ of GA_3 gave the highest number of tillers (8.33) in comparison with the lowest number (3.67) for untreated Kentucky blue grass seeds.

Fresh weight of vegetative growth($g.pot^{-1}$):

The data in Table 5 clarified that the different concentrations of GA_3 had a significant effect on fresh weight of turf grass growth, the fresh weight was increased with increasing of GA_3 concentrations the highest weight (6.46 g) was obtained from seeds that were soaked in 400 $mg.l^{-1}$ GA_3 but the control and 50 $mg.l^{-1}$ treatments gave the lowest values (5.18 and 5.57 g) respectively. In addition, the Rye grass genera showed significant increase in vegetative fresh weight (7.35 g) which differed significantly with other turf grass genera. The values of interaction of turf grass genera and GA_3 pointed that the soaking seeds of Rye grass in 400 $mg.l^{-1}$ of GA_3 gave significantly the highest value (9.14 g) as compared with the other interactions.

Dry weight of vegetative growth ($g. pot^{-1}$):

The results in Table 6 indicated that high concentration of GA_3 400 $mg.l^{-1}$ lead to obtain the highest dry weight (2.61 g) which differed significantly compared to other concentration and control. A significant variation in dry weight of vegetative growth was noticed among the different turf grass genera. The highest weight 2.82 g was for Rye grass genera whereas the lowest weight (1.56 g) was for Kentucky blue grass. In addition, the dual interaction between GA_3 concentrations and turf genera showed significant effect on this character and the soaking of Rye genera seeds in 400 $mg.l^{-1}$ GA_3 gave the greatest weight (4.60 g) compared to the least values (1.39 g) for Kentucky blue grass seeds that soaked in the same concentration of GA_3.

Table (6). Effect of different concentrations of GA_3 on the dry weight of vegetative growth (g) of turf grasses genera.

A_3 conc. ($mg.l^{-1}$)	Turf grass Genera				GA_3 conc. Means
	Bermuda	Fescue	Kentucky blue	Rye	
0	2.30 b-d	1.36 e	1.53 de	2.98 B	2.04 B
50	1.86 c-e	1.63 de	1.55 de	2.35 b-d	1.85 B
100	2.06 c-e	1.74 de	1.53 de	2.00 c-e	1.83 B
200	2.13 c-e	2.01 c-e	1.78 de	2. 16 c-e	2.02 B
400	2.68 bc	1.76 de	1.39 e	4.60 A	2.61 A
Turf grass genera means	2.21 b	1.70 c	1.56 c	2.82 A	

Means with same letter for each factor and interaction are not significantly different at 5% level based on Duncan's Multiple Range test

Fresh weight of roots (g. pot^{-1}):

The data in Table 7 demonstrated that the GA_3 concentrations had a significant effect on root fresh weight and the soaking seeds in 400 and 100 $mg.l^{-1}$ of GA_3 showed significantly the highest root fresh weight (3.24 and 3.22 g) respectively while the lowest fresh weight (2.52 g) was for untreated seeds. In addition, the Rye grass genera showed significantly highest roots fresh weight (5.50g) which differed significantly with other turf grass genera which decreased to (1.57g) in Kentucky blue grass roots. The values of interaction of turf grass genera and GA_3 pointed that soaking seeds of Rye grass in 400 $mg.l^{-1}$ of GA_3 gave significantly the highest value (6.01g) as compared with the other interactions.

Dry weight of roots (g. pot^{-1}):

Results in Table 8 indicated that the high concentration of GA_3 400 $mg.L^{-1}$ lead to the highest dry weight of roots (1.66g) which differed significantly when compared with other concentrations except100 $mg.l^{-1}$ of GA_3. A significant variation in dry weight of roots was noticed among the different turf grass genera. The highest weight (2.94 g) was for Rye grass genera whereas the lowest weight (0.80g) was for Kentucky blue grass. The dual interaction between GA_3 concentrations and turf genera showed significant effect on this character and soaking of Rye genera seeds in 100 $mg.l^{-1}$ GA_3 gave the highest weight (3.39 g) compared to the least values (0.48 g) for Fescue grass seeds that soaked in the 50 $mg.l^{-1}$ of GA_3.

As for GA_3 concentrations effects in this experiment the results show that the soaking of turf grass genera seeds in high concentrations of GA_3 specially 400 $mg.l^{-1}$ was

Table (7). Effect of different concentrations of GA3 on the fresh weight of turf grasses genera roots (g).

GA_3 conc. ($mg.l^{-1}$)	Turf grass Genera				GA_3 conc. Mean
	Bermuda	Fescue	Kentucky blue	Rye	
0	1.96 g	1.88 gh	1.36 Ij	4.87 c	2.52 c
50	1.54 i	1.10 j	1.99 G	5.66 b	2.57 c
100	2.16 g	3.16 e	1.33 ij	6.24 a	3.22 a
200	3.54 d	1.94 gh	1.64 hi	4.73 c	2.96 b
400	2.50 f	2.89 e	1.56 i	6.01 a	3.24 a
Turf grass genera mean	2.34 b	2.19 c	1.57 d	5.50 a	

Means with same letter for each factor and interaction are not significantly different at 5% level based on Duncan's Multiple Range test

Table (8). Effect of different concentrations of GA3 Dry weight of roots (g) of turf grasses genera roots (g).

A_3 conc. ($mg.l^{-1}$)	Turf grass Genera				GA_3 conc. Mean
	Bermuda	Fescue	Kentucky blue	Rye	
0	1.01 h	0.97 hi	0.74 j	3.27 Ab	1.50 B
50	0.80 ij	0.48 k	1.12 gh	2.64 C	1.26 D
100	1.12 gh	1.41 f	0.60 jk	3.39 A	1.63 A
200	1.70 e	0.78 ij	0.78 ij	2.28 D	1.39 C
400	1.29 fg	1.44 f	0.78 ij	3.13 B	1.66 A
Turf grass genera mean	1.19 b	1.02 c	0.80 d	2.94 A	

Means with same letter for each factor and interaction are not significantly different at 5% level based on Duncan's Multiple Range test

significantly superior to the other concentrations and leads to increase all studied characters. These results are discussed in relation to the effects of GA3 on the plants and tissues, and it is suggested that the responses are explicable in terms of mobilization of food reserves. Pre-sowing seed treatments with growth substances such as GA3 have been found to improve the seedling growth of many species (17 and 18). Seed germination and seedling growth are known to be regulated by exogenous hormones (10 and 22). GA_3 plays an important role in the germination process (14) through a multiple regulatory mechanism (8). The obtained results indicated that high concentrations of GA_3 increase the germination percentage, reduced the germination duration and then increase the agricultural value of seeds where Mohammad (12) showed that the GA3 breaks seed dormancy, promotes germination, and cause the formation of proteins, decomposing specialized enzymes and their role in the activation of genes and so induce germination process and accelerated the germination, seedling emergence and the increase of vegetative growth. Also Rood *et al.* (15) referred that the GA_3 is the most important growth regulator, which breaks seed dormancy, promotes germination, intermodal length, hypocotyls growth and cell division in cambial zone and increases the size of leaves. GA stimulates hydrolytic enzymes that are needed for the degradation of the cells surrounding the radical and thus speeds germination by promoting seedling elongation growth of cereal seeds. GA_3 treatment also resulted a significant increase in plant height and this was in line with Patel *et al.* (13) who indicated that the role of GA_3 in increasing plant height is through stimulating cell division and elongation in growth region (zone) where are concentrated in the lower part of leaves, and these regions contains intercalary meristem which leads

to cell elongation, which works to help the synthesis and formation of α-amylase enzyme and works mainly to convert starch into reduced sugars, which lead to the rise of osmotic pressure in plant cells and then increase in the entry of food and water, causing swollen and large size of the cells so reflected on the elongation of the cells (1). GA_3 had a significant effect on increasing the number of tillers, fresh and dry weight of vegetative growth and roots, this was in agreement with Yassin (25) who referred that GA_3 stimulates growth and increased formation of synthetic foods by photosynthesis and also encourages the cellular division, expansion and increase the level of RNA, protein and stimulates biological processes within plant cells, including the transmission of nutrients to the shoot.

The data for turf grass genera in this experiment showed that the turf grass genera had significant effect on all characteristics studied in the where the seeds of Rye grass genera showed significant increase in germination percentage, plant height, fresh and dry weight of vegetative growth, fresh and dry weight of roots. Which was significantly superior to other turf grass seeds genera except in number of tillers character as in where Bermuda grass genera was significantly superior to other genera. The variation in these characters among the genera might be due to the difference among the genetic potentials of these genera (19).The reason for the superiority of Ray grass genera that this experiment has been completed in the pots and not in ground for briefly time in spring where there were no rise in temperature or decrease in relative humidity, or perhaps may be superiority due to the seeds vitality as the seedling vigor is the factors that contribute in the growth and fixing of seedling, and thus get a high germination, speed up the germination process and a strong and good of seedling growth (23).

Conclusions and Recommendations:

Based on the results founded in the present experiment. We can conclude that the high concentration 400 $mg.L^{-1}$ of GA3 caused significantly increased in most of studied characteristics like (seed germination percentage, plant height, number of tillers, fresh and dry weight of vegetative growth, fresh and dry weight of roots) in comparison to other concentrations 0, 50, 100 and 200 $mg.l^{-1}$ 0f GA_3. Rye grass genera was significantly superior to other turf grass genera Bermuda grass, Tall fescue and Kentucky blue grass except in number of tillers character, whereas Bermuda grass was significantly superior to other turf grass genera. Generally, the Rye grass seeds genera that were treated with different concentration of GA_3 lead to obtain the best results in all studied characteristics as compared to control. So to obtain a higher response of the studied characteristics for the seeds germination and growth of turf grass genera in optimally form we recommend using Ray and Bermuda grass genera after treated with higher concentrations of GA_3.

References

1- Abu Zeid, A. N. 2000. Plant Hormones and Agricultural Applications. Dar Al -Arabia for publication and distribution, National Research Center in Cairo. (In Arabic).

2- Al-Ba'aly, S. A. 1967. The Gardens. The printing press of local administration. Baghdad, Iraq. (In Arabic).

3- Al-Sahaf, F. H. 1989. Applied Plant Nutrition. Ministry of Higher Education and Scientific Research, University of Baghdad.

4- Bell, D. T.; D. P. Rokich; C. J. Mcchesney and Plummer, J. A. 1995. Effects of temperature, light and gibberellic acid on the germination of seeds of 43 species native to Western Australia. J. Vegetat. Sci., 6: 797–806.

5- Borman, H. F.; D. Balmori and Geballe, G. T. 1993. Redesigning the American lawn: A search for environmental harmony. Yale university press.

6- Casler, M. D. and R. R. Duncan 2003. Turf Grass Biology, Genetics and Breeding. John Wiley and Sons, Inc. Hoboken, NJ.

7- Christian, N. 2004. Fundamentals of Turf Grass Management, John Wiley and Sons, Inc. Hoboken, NJ.

8- Fincher, G. B. 1989. Molecular and cellular biology association with endosperm mobilization in germination cereal grains. Ann. Rev. Plant Physiol. Plant Mol. Biol., 40: 305-346.

9- Gould, F. W. and R. B. Shaw. 1983. Grass Systematics. Texas A and M university press, college station, TX.

10- Khan, A. A. 1977. The Physiology and Biochemistry of Seed Dormancy and Germination. Elsevier Scientific Publications Co. Amsterdam. 477 pp.

11- Mohammed, E. S. 1983. Vegetable Seed Production. Directorate of Dar Al-Kotub for printing and publishing. Mosul University. Iraq. (In Arabic).

12- Mohammed, A. K. 1985. Plant Physiology Science. (2 Ed.) Directorate of Dar Al – Kotub for printing and publishing, University of Mosul. (In Arabic).

13- Patel, J. M.; H. C. Patel; J. C. Chavda and Saiyad, M. Y. 2011. Effect of plant growth regulators on growth and yield of Gladiolus Cv. *International Journal of Agriculture Sciences*, Vol. 7 (1): 141-143.

14- Ritchie S. and S. Gilroy 1998. Gibberellins, regulating genes and germination. New Phytol., 140: 363-383.

15- Rood, S. B.; R. I. Buzzell; D. J. Major and Pharis, R. P. 1990. Gibberellins and heterosis in maize: quantitative

relationship. Crop Sci. 30: 281–6.

16- Salih, T. J. 2001. The turf grasses, their define, importance, characteristics, types and problems in Kurdistan- Iraq. Kushtokal magazine, seasonal magazine of agriculture science, Ministry of Agriculture, Kurdistan region, Iraq. 8: 75-79.

17- Shanmungavelu, K. G. 1970. Effect of gibberellic acid on seed germination and development of seedling of some tree species. Madras Agri-J. 57:311-314.

18- Singh, M.; G. N. Singh; L. N. Singh and Singh. B. N. 1989. Effect of GA3 on seed germination in mosambi (*Citrus sinensis* osbeck). Haryana J. Horti. Sci., 18:29-33.

19- Tahir, A.; K. H. Abdul-Mateen; U. A. Noor and Muhammed, A. KH. 2011. Response of Freesia cultivars to different growing media under Peshawar conditions, Sarhad J. Agric. 27: 43-49.

20- Tallarico, R. and G. Argenti. 2001. Indagini sull'evoluzione della composizione floristica di piste da sci inerbite in Val Badia (Studies on the evolution of floristic composition in revegetated ski runs in Val Badia) Italia Forestale e Montana, 56, 143-155

21- Tawajin, A. M. M. 1987. Ornamental Plants. Printing press of Basrah Univ. (in Arabic).

22- Verma, A. N. and P. Tandon. 1988. Effect of growth regulators on germination and seedling growth of *Pinus kesiya* and *Schima khosiana.* Indian Journal of Forestry 11: 32 - 36.

23- Wali, S. B. 1990. The Germination and Seeds Dormancy. Ministry of Higher Education and Scientific Research, University of Salahaddin.

24- Yang, Q. H.; W. H. Ye and Yin, X. J. 2007. Dormancy and

Germination of Areca triandra Seeds. Scientia Horticulturae, 113. 107–111.

25- Yassin, B. T. 1992. Physiology of Water Tension in Plant. Ministry of high education and scientific research, Mosul University, Directorate of Dar Al – Kotub for printing and publishing, Al-Mosul. IRAQ.

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تأثير تراكيز مختلفة من حامض الجبرليك في إنبات ونمو بذور أنواع مختلفة من المسطحات الخضراء

بيريفان صديق عبدالله يوسف علي عبد الرحمن

قسم البستنة - كلية الزراعة - جامعة دهوك – إقليم كردستان – جمهورية العراق

المستخلص

أجريت الدراسة في المدة من 15 آذار ولغاية 15 تشرين الأول 2013. بهدف دراسة تأثير خمسة تراكيز من حامض الجبرليك وهي (صفر ، 50 ، 100، 200 و 400 ملغم.لتر$^{-1}$) في أنبات وأداء النمو لأربعة أنواع مختلفة من بذور المسطحات الخضراء تتضمن (حشيشه برمودا *Cynodon dactylon* L. var. cd4 ، حشيشه الفستوكا الطويلة *Festuca arrundaceae* L. var. Barleroy ، حشية الكنتاكي الزرقاء *Poa pratensis* L. var. Baron وحشيشة الراي المعمرة (*Lolium perenne* L. var. Barlennium) ، نفذت التجربة العاملية وباستخدام تصميم القطاعات العشوائية الكاملة. تلخصت النتائج انه بازدياد تراكيز حامض الجبرليك لـ 400 ملغم. لتر$^{-1}$ تسبب في زيادة معنوية ولجميع الصفات قيد الدراسة في هذه التجربة (نسبة الانبات المئوية للبذور 63,72% ، ارتفاع النبات 5,99 سم ، عدد الاشطاء 6,25 ، الوزن الطري والجاف للمجموع الخضري 6,46 و 2,61 غم والوزن الطري والجاف للجذور 3,24 و1,66 غم على التوالي) مقارنة مع بقية التراكيز الأخرى. حشيشه الراي المعمرة تفوقت معنويا وفي الصفات المدروسة عدا صفة عدد الاشطاء حيث تفوقت حشيشة البرمودا معنويا في صفة عدد الاشطاء 7,29 بالمقارنة مع بقية انواع المسطحات الخضراء.

الكلمات المفتاحية: تراكيز حامض الجبرليك GA_3 ، بذور انواع المسطات الخضراء

*البحث جزء من رسالة ماجستير للباحث الأول