Biological Forum – An International Journal **8**(1): 555-558(2016)

ISSN No. (Print): 0975-1130
ISSN No. (Online): 2249-3239

The Effects of Agrizim® on Seedlings of Apple Cultivars

Mehdi Abbassi* and Bahman Panahi**
**Ex-Post graduate Student of Jiroft Islamic Azad University, Jiroft, Iran*
***Associate Professor in Horticultural Science, Horticulture Crops Research Department, Kerman Agricultural and Natural Resources Research and Education Center, AREEO, Kerman, Iran*

(Corresponding author: Bahman Panahi)
(Received 22 April, 2016, Accepted 19 June, 2016)
(Published by Research Trend, Website: www.researchtrend.net)

ABSTRACT: Apple is one of the important horticultural crops of the world. It is cultivated in most provinces of Iran as well. However, the calcareous feature of the most of soils in Iran, and lack of accurate nutrition management are among the problems of orchards cultivation. Today, using some amendments in soils has become accustomed. Accordingly, a factorial greenhouse experiment in form of complete random design was conducted with two factors including type of cultivar (Red Delicious & Golden Delicious) as the first factor, and different levels of Agrizim® application (0, 10, 20, 40 & 80 grams in a pot) as the second factor, in four replicates. After applying the treatments during the growth stages, factors of rate of leaf's elements (nitrogen, phosphorus, potassium, iron and zinc), stem length, stem diameter, stem dry weight, and number of buds were evaluated, and the following results were obtained. The effect of applying cultivar and Agrizim® application treatments was significant on the most of the vegetative properties of the grafted apple seedlings, and caused increase of these properties in compare to the control. The effect of cultivar treatment on leaf's nutrients including nitrogen, potassium and iron was insignificant, but the effect of Agrizim® application treatment on the aforementioned nutrients was significant and resulted in their increase. The best result was obtained from combined treatment of applying Agrizim® by 10g to 20g in pot on G.D. and R.D. cultivars, respectively. Applying Agrizim® in levels higher than 20g not only had no remarkable effect on the properties, but also reduced some properties in compare to the control.

Key words: Apple, Cultivar, Golden Delicious, Red Delicious, nutrients, Agrizim®.

INTRODUCTION

Most of the regions under apple cultivation in the State have medium-to-very high calcareous soils (about 60% limes) and a pH more than 7. By increased pH, solubility and absorption of some nutrients, especially phosphorus, iron, manganese, boron, copper and zinc, are reduced, and thus these soils have not desired fertility (Hadi, 1990). Using amendments, especially pH-reducing materials in the root development area, provides the conditions required for optimal use of nutrients and fertilizers consumed (Salardini, 1993). Agrizim® is the commercial name of a mineral amendment, based on gypsum compounds with a pH between 4 to 5, which is applied in amending calcareous soils in superficial and deep placement manners (Aghahasani, 2011). Nayak *et al.* (2011) studied the effect of phosphogypsum amendment on the physical and chemical properties of soil, number of bacteria and fungi, and activity of soil's enzymes. The results showed that use of phosphogypsum amendment has a statistically significant effect on increased activity of amylase and cellulase enzymes in compare to the control from statistical point of view. In a research, Robert *et al.* (2011) studied the amount of sulfur added to greenhouse soil mixture containing amendment manure for reduction or stabilization of pH in about 6.5. This research showed that some methods other than using sulfur, iron sulfate or aluminum sulfate required for controlling pH, since even high amount of these compounds failed to reduce pH of greenhouse soil to an optimal level.

Rezaei *et al.* (2006) stated that the effect of using sulfur, sulfuric acid and gypsum amendments on soil and yield of alfalfa is positive. Ansari Ezabadi *et al.* (2011) reported the effect of calcium carbonate and gypsum on the absorbability of some nutrients and also on growth of corn plant to be significant.

Ghanei Motlagh *et al.* (2010) reported the effect of three amendments of gypsum, sulfuric acid and sulfur to be significant on the chemical properties of sodium saline soil, as application of gypsum and sulfuric acid increased the amount of calcium and magnesium soluble ions, and reduced the amount of sodium soluble ion at 60 centimeters from soil surface. Shima *et al.* (2012) carried out some studies in regard with the effect of different amendments such as gypsum, citric acid, animal manure, composts and their combination on heavy clay soils affected by salinity and irrigated with unconventional waters, and reported that these materials result in increased yield of wheat through changing soil's chemical properties such as pH, EC, soluble ions, SAR and ESP.

MATERIALS AND METHODS

In a factorial experimental project carried out in a greenhouse located at Mahan area near Kerman city, and on a complete random basis, treatments of different levels of Agrizim® (0, 10, 20, 40 & 80 grams in a pot) on two G. D. and R. D. apple cultivars grafted on a same seedling rootstock were conducted with four replicates. First, a soil sample was collected from ground-surface soil at the depth of 30cm of a farm, and a mix of it was transferred to the lab to be analyzed. The rest of the sample was divided into 5 equal portions in a manner that any portion was enough to fill 8 pots with equal volumes then soil of any of the pots were determined using volumetric batcher, and Agrizim® treatments were added to soil of any of the pots in grams (totally 40 pots and 17kg of dry soil). Then, 40 grafted seedlings from two golden and red cultivars with similar morphologic characteristics were transferred to the pots (any cultivar at 20 pots). All cultivation practices were carried out equally and conventionally. For determining the rate of leaf's elements, nitrogen was measured using Kjeldahl method, phosphorus was measured using spectrophotometer, potassium was measured using flame photometer, and iron and zinc were measured using atomic absorption. In addition, for determining the vegetative characteristics, dry weight was measured by oven in grams, stem length was measured by accurate measurement in centimeters, stem diameter was measured by caliper in millimeters, number of buds was determined by counting (number) in early October, and the leaf area was measured by scanning and using Digimizer.4.1.1.0_persianGFX software. The statistical analysis was performed by MSTAT-C statistical software, and means comparison was conducted by Duncan's multiple range tests.

RESULTS AND DISCUSSION

A. Leaf Area

Applying the treatment of Agrizim® use on leaf surface resulted in significant increase of leaf area in compare to the control, as Agrizim® use up to the level of 10 to 20g in pot caused increased leaf area, and maximum increase of leaf area (13.2) was obtained in the treatment of 20g Agrizim®. Treatments of Agrizim® use by 40 and 80g in pot showed no significant differences with the control. The mutual effect of Agrizim® application and cultivar on leaf area showed a significant difference and resulted in increase of leaf area by 12 to 17 percent in compare to the control. Maximum leaf area (38.2cm2) was obtained from applying 20g Agrizim® in pot of the G. D. cultivar (table2). Rezaei et al. (2006) found similar results in regard with applying gypsum compounds on zinc element. The reason of this expression is probably the role Agrizim® compounds play in reducing pH and improving nutrients absorption.

B. Stem Diameter

Applying Agrizim® in 10, 20, and 40g resulted in significant increase of stem diameter. Using 80g Agrizim® in pot did not affect the stem diameter significantly.

C. Number of Buds

Between the two cultivars under study, the R. D. cultivar showed higher number of buds in compare to the G. D. cultivar. The highest number of buds was observed in applying 20g Agrizim® in pot on red cultivar. The critical role the gypsum compounds play in amending the structure of soils, especially on calcareous soils is very effective and improves the growth of plants cultivated in these soils (Robert et al, 2001).

D. Seedling Height

Agrizim® application had a significant and positive effect on the seedling's height. The highest seedling's height was observed in using 20g Agrizim® in pot, and the levels higher than 40g in pot, including 80g in pot, showed no significant effect. The maximum seedling's height was 139.7cm which was obtained from applying 20g Agrizim® in pot. A statistically significant effect was observed between the seedling's heights of the two cultivars under study in compare to each other in absence of Agrizim®. Effect of Agrizim® application on the seedling's height was observed to be higher in the golden cultivar in compare to the R. D. cultivar. The highest height was 140.2cm which was obtained under the condition of applying 20g Agrizim® in pot on G. D. cultivar (Table 1 & 2).

Table 1: Variance analysis of the treatment of applying Agrizim® on some vegetative characteristics and also on the nutrients' rate of the grafted seedling of red and golden apple cultivars.

Changes Source	df	N	P	K	Fe	Zn	Leaf Area	Number of Buds	Seedling Height	Stem Diameter	Stem Dry Weight
Agrizim® level of application (A)	4	0.219 *	0.007 *	0.427 *	3509.574 *	4672.969 *	495.592 *	981.081 *	8887.882 *	0.115 *	726.999 *
(B) Cultivar	1	0.119 ns	0.004 ns	0.063 ns	1.035 ns	2788.341 ns	2.628 ns	667.013 *	160.461 ns	0.032 ns	448.405 *
(A×B)	4	0.010 *	0.007 *	0.026 *	43.913 *	601.130 *	86.326 *	57.481 *	329.652 *	0.024 *	88.199 *
Error of Experiment	30	0.007	0.005	0.027	104.758	12.438	7.788	12.172	50.965	0.010	8.972
Total Error	39	-	-	-	-	-	-	-	-	-	-
cv٪	-	5.81	16.9	6.66	19.22	9.00	9.75	5.94	6.31	12.43	12.39

n.s., non-significant; *, significant at P≤0.05; **, significant at P≤0.01.

Table 2: The means of vegetative characteristics and also the nutrients' rate of the grafted seedling of red and golden apple cultivars that Agrizim● treatments were applied on them.

Cultivar	Agrizim® (g/pot)	Leaf area (cm^2)	Number of Buds	Stem Dry Weight (g)	Diameter (cm)	Seedling Height (cm)	Zn (ppm)	Fe (ppm)	N (%)	P (%)	K (%)
Red	0	31.8e	55.2d	16.5de	0.726cd	88.4de	18.575g	35.737b	1.39bcd	0.09e	2.437bcd
Golden		24.9e	48.8e	20.5cd	0.755bcd	93.0d	27.05ef	39.787b	1.27de	0.094bc	2.375cd
Red	10	32.2bc	66.0ab	27.5b	0.873abc	131.0ab	30.875e	58.625a	1.57a	0.103ab	2.762a
Golden		31.95bc	57.5c	28.7b	0.854abc	123.3bc	49.387c	60.012a	1.47abc	0.113a	2.525abcd
Red	20	34.8ab	77.1a	29.5ab	0.95a	139.2a	43.85d	67.125a	1.53ab	0.096b	2.7ab
Golden		38.2a	66.7ab	35.6a	0.901ab	140.2a	67.975a	64.5a	1.37abc	0.098b	2.637abc
Red	40	29.4cd	63.8b	22.3c	0.713cd	119.5c	53.925bc	65.625a	1.35bc	0.077d	2.444bcd
Golden		24.0e	58.3c	28.4b	0.874abc	125.9bc	58.325b	67.375a	1.31cde	0.068e	2.425bcd
Red	80	25.6de	51.7de	13.6e	0.685d	80.5e	19.188g	39.75b	1.23e	0.063f	2.238d
Golden		23.0e	47.6e	19.8cd	0.762bcd	91.3d	22.712fg	34.05b	1.25de	0.056g	2.338d

Values in each column (Mean) with the same alphabet are not significantly different at 5% level whereas values with different alphabets are significant at 5% level.

E. Dry Weight

The red cultivar had higher dry weight in compare with the golden cultivar. Agrizim® application by 10 to 20g resulted in increased dry weight of seedling. However, higher levels of Agrizim®, especially 80g in pot, not only had no effect on the seedling's dry weight, but also reduced the dry weight. The maximum dry weight was 35.6g in the golden cultivar which was obtained from treatment of using 20g Agrizim® in pot (Table 1 & 2).

F. Nutrients

Agrizim® affected the absorption of some nutrients including nitrogen, zinc, phosphorus, iron, and resulted in their improved absorption. The highest degree of elements absorption was observed in applying 20g Agrizim® in pot. However, higher levels of Agrizim® (80g) not only had no remarkable effect on the nutrients' absorption, but also reduced their absorption in some cases. No statistically significant difference was observed between the two cultivars under study, especially in regard with absorption of macro elements (nitrogen, phosphorus, and potassium). Considering the main compound of Agrizim®'s structure which is from gypsum matters and high level of pH in soils under seedling's cultivation, and the calcareous feature of the said soils, absorption of the aforementioned nutrients in such soils encounters some difficulties. Thus, reducing pH can play a remarkable role in nutrients' absorption.

CONCLUSION

According to the results obtained from this research it can be said that applying Agrizim® in levels of 10 to 20g in pot results in improved morphological properties and seedlings' growth of golden and red apple cultivars.

In addition, applying Agrizim® in higher levels, especially 80g in pot, not only has no remarkable effect on seedlings' growth and absorption, but also in some cases reduced the properties under study in compare to the control. Accordingly, considering the calcareous feature of the soils under seedling cultivation in most regions of this Country, especially in arid areas, this compound (Agrizim®) can be used as a soil amendment by the appropriate level of 20g in a pot.

REFERENCES

Aghahasani M, Naghshband M. (2012). Agrizim®: application rates and methods, Extension Journal, Charfasl Iranian Mobtaker Publications, PP. 30.

Ansari Ezabadi M, Shirani H, Dashti H, Tajabadipour A. (2011). Effect of calcium carbonate and gypsum on yield, yield components, and iron, copper and zinc absorption of corn (*Zea mays* L.) in two soil texture, Agricultural and Natural Science & Technology *Magazine, Soil and Water Science*, No. 52, PP. 171-181.

Ghanei Motlagh GH R, Pashaeiu A, Khormali F, Mosaedi A. (2010). Studying the effect of some amendments on the chemical properties of saline- sodic soil, Watershed Researches Magazine (Research & Construction), No. **86**, PP. 24-34.

Rezaei M, Gandomzar A, Fathi M, Mohammadi R. (2006). Using sulfur and sulfuric acid produced by the oil industries in amending soil and increasing yield of crop plants, the first specialized engineering gathering of environment, Faculty of Agriculture, University of Tehran, PP. 80.

Salardini A, Mojtahedi, M. (2003). Principles of plant nutrition and its fundamental aspects, first volume, publications of University of Tehran, PP. 372-433.

Statistics of the State's areas under crop and horticultural cultivation. (2010). Ministry of Jihad-*e-Agriculture*, PP. 72.