International Journal of PharmTech Research
CODEN (USA): IJPRIF, ISSN: 0974-4304
Vol.9, No.4, pp 174-178, 2016

Response of vegetative growth of *Codiaeum variegatum* L. for potassium forms

EL-Quesni, F. E. M.*, Magda M. Kandil and Azza A. M. Mazhar

Ornamental Plants and Woody Trees Dep., National Research Centre, 33 El- Bohouth St., (former El- Tahrir St.,) Dokki, Giza, Egypt. Postal Code: 12622.

Abstract: Two pot experiments were carried out at greenhouse of National Research Centre, during 2013 and 2014 seasons . The aim of this work to study the effect of two forms of potassium on vegetative growth parameters of *Codiaeum variegatum* L. plants. The results indicated that potassium chloride fertilizer at the two levels significantly increased plant height, stem diameter, leaves number/plant, fresh and dry weight of branches and roots .Plants treated by 4gm/pot K_2SO_4 significantly increased number of leaves /plant ,root fresh weight . Whereas 2gm/pot K_2SO_4 significantly increased dry weight of leaves, branches and roots . Applying KCl at for mentioned concentrations gave the highest parameters for croton plants.

Introduction

Codiaeum variegatum ("garden croton" or "variegated croton"; syn. *Croton variegatum* L.) is a species of plant in the genus *Cadiaeum*, which is a member of the family Euphorbiaceae. This plant comes originally from Indonesia, Malaysia, Australia and the Western Pacific Ocean Islands, it grows in forests and scrub. This plant is an evergreen plant and it grows up to 3 meters tall and it has large thick leather-like and shiny evergreen leaves. When cultivated, *Codiaeum variegatum* is smaller in size and come in a wide variety of leaf shapes and colors. It is very hard to keep Croton's beautiful foliage plants health outside of the tropics or greenhouses; it needs to be kept in a warm, humid and bright light environment with some shade. *Codiaeum variegate* makes beautiful hedges and potted polio specimen for its great foliage value. It brings wonderful contrast of colors with its unusual leaves. It also grows well in containers which make it very popular but difficult to grow at home. It can be used in hedges, foundation or to border landscape. Its overwintering is quite challenging which is why it is better done in green houses where the warmth and high levels of can be attained. On the other hand, it can be grown as well in living rooms in bright places with some air moisture.

Potassium is vital to many plant processes. Potassium is multifunctional versatile nutrient indispensable for plants. K has a number of roles such as activating enzymes, stimulating the assimilation and transport of assimilate anion/ cation balance and regulating water by controlling stomata[1]. [2,3]indicated that adding potassium fertilizer significantly increased each of number of branches. Potassium plays significant roles in enhancing crop quality. High levels of available K improve the physical quality, disease resistance. Potassium increases root growth and improves drought resistance, enhances translocation of sugars and starch[4]. [5]reported that K was superior in the features of area, number and weight of leaves / plant. [6]found that potassium make a major contribution to the osmotic pressure of glycophytic plant species and to play an important role in the carbohydrate migration. [7]indicated potassium sulphate fertilizer made a significant increase in the content of Zinc in herbicide strips in both soil layers compared with potassium chloride. [8]reported that all growth characters except root parameters increased when the concentration was raised to 50 ppm compared with the untreated one.

The aim of the present research has been to determine the influence of different forms of potassium fertilization on vegetative growth of *Codiaeum variegatum.*

Materials and Methods

Two pot experiments were carried out at greenhouse of National Research Center, during two successive seasons 2013 and 2014 to study the effect of two potassium forms of potassium fertilization on vegetative growth of *Codiaeum variegatum*.

Six months old seedlings of *Codiaeum variegatum* were obtained from the nursery of Forestry Department Horticulture Research Institute, Agricultural Research Center, the seedling / pot (30 cm in diameter) the average height of the seedling was (20 - 25 cm). The investigated soil characterized by sand 45.93 %, silt 14.35 %, clay 39.72 %, pH 7.71, EC 0.81 dSm^{-1}, $CaCO_3$ 2.3 %, OM 2.11 %, Ca 2.7 %, Mg 0.1, Na 2.2, K1.3, Cl^- 2.5, SO_4 2.8 meq / L^{-1}. The physical and chemical properties of the soil were determined by[9].

Starting from April until one month before ending the experiment, the seedlings received potassium was applied at two forms as follows: potassium cholorid at two levels 2 and 4 gm / pot and potassium sulphate at two levels 2 and 4 gm / pot., and the untreated plant as control. Basal doses of Nitrogen and phosphorus were added as ammonium sulphate (49 gm / pot) and superphosphate (4 gm / pot) in four doses. At last week of November of 2013 and 2014, the following data were recorded: plant height (cm), stem diameter (mm), branches number / plant, leaves number / plant, fresh and dry weight (g) of stem, leaves and roots. The experiment was sit in a completely randomized design with five treatments and six replicates of each treatment. The data were statistically analyzed according to [10]using the least significant differences (LSD) at 5 % level and the combined analysis of the two seasons was calculated according to[11].

Results and Discussion

Vegetative growth:

1- Plant height:

On plant height of *Codiaeum variegatum* plants, as affected by the different potassium forms, are presented in Table (1). The plants treated with adding 4gm KCl were the tallest (68.00cm), followed by plants treated with adding 2gm KCl (63.33cm). Also, the data revealed that adding 2 or 4 gm K_2SO_4 increased plant height compared with the control. The shortest plants (60.33cm) were recorded for untreated plants. Similar trend was obtained by [8] on *Bauhina varigata*.

2- Stem diameter:

Data presented in Table (1) show the effect of different forms of Potassium on stem diameter of *Codiaeum variegatum* plants. The thickest diameter (1.4 cm) was recorded on plants treated with 4gm KCl, whereas, the lowest value of stem diameter (0.73 cm) was found with the untreated plants. In this context, adding 2 gm KCl, 2 gm, K_2SO_4 or 4 gm K_2SO_4 increased the value of stem diameter (0.83, 0.81 and 0.79 cm) respectively. These findings are in agreement with those obtained by [12]on *Jatropha curcas*.

3- Leaves number/plant:

The results in Table (1) show that the number of leaves/ plant was affected in response of the different forms of potassium. The average number of leaves/plant ranged between 69.33 and 48.30. The results indicate that treated plants with 4gm KCl, 2gm KCl, 4gm K_2SO_4 and 2gm K_2SO_4 increased the number of leaves/ plant giving 69.33, 64.60, 62.33 and 57.33) leaves /plant , respectively, as compared with untreated plants. The lowest value number of leaves/ plant (48.30) leaves/plant was recorded on untreated plants. Those findings are in accordance with those reported by [12]on *Jatropha curcas.*

4- Branches number/plant:

Data on branches number/ plant of *Codiaeum variegatum* plants as affected by different forms of potassium. The plants treated by adding 4 gm KCl gave the highest number of branches (12.00), followed by plants treated with 2gm KCl (10.33).The lowest value branches number /plant (5.67) were recorded for untreated plants. Generally, Adding and form of potassium (KCl or K_2SO_4) had an effect on increasing branches number/ plant. These results were confirmed with those obtained by [13]on proper .

5- Root length (cm):

Root length in *Codiaeum variegatum* was affected by treating different forms of potassium as shown in Table (1). Codiaeum plants formed the highest value of root length (31.66 cm) when plants were treated with adding 4gm KCl followed by 4gm K_2SO_4 (28.66 cm) and 2 gm K_2SO_4 (27.33cm). Also, the shortest roots were obtained with untreated plants (25.33 cm) followed by plants treated with adding 2 gm KCl (26.66 cm). This effect was previously found by [12]on *Jatropha curcas.*

Table (1): Effect of different form of potassium on some growth constituents of *Codiaeum variegatum* (Average values of 2013 and 2014 seasons).

Characters Treatments	Plant height (cm)	Stem diameter (cm)	Leaves number/plant	Branches number/plant	Root length (cm)
Control	60.33	0.73	48.3	5.67	25.33
2gmKCl	63.33	0.83	64.60	10.33	26.66
4gmKCl	68.00	1.40	69.33	12.00	31.66
2gmK2O4	62.33	0.81	57.33	6.67	27.33
4gmK2O4	61.33	0.79	62.33	8.67	28.66
L.S.D at5%	10.81	0.37	21.01	2.54	4.61

6- Fresh and dry weight of leaves:

Regarding the effect of potassium forms on the fresh and dry weight of leaves, the data in Table (2), indicated that fresh weight of leaves was increased in plant treated with any potassium forms . The plants treated with 2gm K_2SO_4 followed by 4 gm KCl and 4gm K_2SO_4 which produced the highest leaves fresh weight (62.41, 54.90 and 54.71 cm respectively), compared with other treatments, and control. The untreated plants gave the less lightest fresh weight compared with the other treatments.

Concerning the effect of the potassium forms on the dry weight of leaves in Table (2), the response of dry weight of leaves of *Codiaeum varigatum* plants to potassium forms had a positive effect of dry weight, where using 2 gm K_2SO_4, 4 gm K_2SO_4 and 2gm KCl) as potassium forms were favorable for producing the heaviest dry weight of leaves (13.52, 12.00 and 11.52 gm) respectively.

These results were in the same line of the findings of [8,12,13].

7- Fresh and dry weight of branches:

As shown in Table (2), there were significantly differences in fresh weight of branches of *Codiaeum variegatum* plants. It was evident that using 4gm KCl and 2gm K_2SO_4 had a favorable effect in increasing fresh weight of branches (38.28 and 35.66 gm) respectively. While, the untreated plant and the plants treated with 2gm KCl gave the minimum values of branches fresh weight (17.27 and 24.15 gm) respectively.

In connection with the effect of potassium forms on the fresh weight of branches as shown in Table(2), the response of dry weight branches to potassium forms had almost the same trend to fresh weight. The dry weight of branches was heaviest when the plants were treated with 4 gm KCl (12.60 gm), followed by 2 gm K_2SO_4 (10.40 gm) and 4 gm K_2SO_4 (9.16 gm). Whereas, untreated plants (6.59 gm)or plants treated with 2gm KCl (7.88 gm) reduced the dry weight of branches to the minimum values, compared with the other treatments. These results are in agreement with[14].

Table (2): effect of different forms of potassium on fresh and dry weight of all plant organs *leaves, stems and roots) (gm) of *Codiaeum variegatum* (Average values of 2013 and 2014 seasons).

Characters	Fresh weight(gm)			Dry weight (gm)		
Treatments	**Leaves**	**Branches**	**Roots**	**Leaves**	**Branches**	**Roots**
Control	30.10	17.27	39.91	5.25	6.59	11.29
2gmKCl	37.16	24.15	50.92	9.41	7.88	19.36
4gmKCl	54.90	38.28	60.99	11.52	12.60	27. 15
2gmK2O4	62.41	35.66	45.44	13.52	10.40	15.17
4gmK2O4	54.71	30.34	50.08	12.00	9.16	17.50
L.S.D at5%	2.54	3.05	6.44	1.20	1..16	3.09

8- Fresh and dry weight of roots:

The effect of potassium forms on the fresh and dry weight of roots as shown in Table(2). It is clear from the data of fresh weight of roots of the *Codiaeum variegatum* plants was markedly increased when plants were treated with 4gm Kcl gave (60.99 gm),2 gm Kcl gave (50.92gm),4gm KS_2O_4 gave (50.08 gm) and 2gm K_2SO_4 gave (50.08 gm) and 2 gm K_2SO_4 gave (45.44 gm) compared with untreated plants gave (39.91gm).

Regarding the effect potassium forms on dry weight of roots of Croton, the response of roots dry weight to adding different potassium forms had almost the same trend as fresh weight. It is obvious from the data that the dry weight of roots was markedly increased when the plants were treated with the following forms, 4gm KCL giving (27.15gm), 2gm KCL giving (19.36gm), 4gm K_2SO_4 giving(17.50 gm), 2 gm K_2SO_4 (15.17gm). The untreated plants gave the lightest dry weight of roots (11.29 gm). These findings are in accordance with those reported by [8,12].

It can be concluded that adding potassium fertilizers at any forms (KCL or K_2SO_4) increased all growth characters**,** this may be owed to the fact that Potassium's main role is to give the appropriate ionic environment for the processes of metabolism in the regulation [15]. Plants need Potassium ions (K^+) to be able to synthesize protein and for stomata's opening and closing which the proton pumps regulate to make the surrounding guard cells turgid or flaccid. Lack of potassium ions can impair the ability of a plant to maintain these processes. Potassium also has a role in other physiological processes like photosynthesis, protein synthesis and activation of some enzymes and is vital for the production of adenosine triphosphate ATP [15].

References

1. Krauss, A. and Jin Jiynn, (2000). Strategies for improving balanced fertilization. International Potash Instiute, Basel, Switzerland
2. Dutta, R.; Gogoi, P. K.; Lalramhluni, R.; Thakur, A. C. and Deka, N. C., (2001) Effect of levels of lime and potash o production of ground nut. Crop Res. Itisar., 26;420-423
3. Ali, A. A. G. and Mowafy, S.A.E., (2003). Effect of different levels of potassium and phosphorus fertilizer with the foliar application of zinc and boron on peanut in sandy soil. Zagazig J. Agric. Res., 30: 335-358
4. Better Crops. (1998). Vol. 83: No. 3
5. Thalooth, A.T., Tawfik, A.A. and Magda H. M. (2006). Comparative study on the effect of foliar application of Zinc, potassium and magnesium on growth yield and some chemical constituents of mungbean plants grown under water stress conditions. World J. Agric. Sci. 2:37-46
6. Marschner, H, (1995). Mineral nutrition of higher plant. Academic press, Orland F.L.
7. Adam Szewczuk; Andrzej Komosa and Ewlina Gudarowska (2009); Effect of different potassium soil level and forms of potassium fertilizers on micro-elemental nutrion status of Apple trees in early fruition period. J. Elementol 14(3):553-562
8. Azza, A. M. Mazhar; Yassen A. A. and Sahar, Zaghloul M., (2007). Influence of foliar application of potassium on growth and on growth and chemical composition of *Bauhinia variegala* seedlings under different irrigation intervals. World journal of Agricultural Sciences 2(1):23-31

9. Chapman H.D and Pratt P.F. (1961). Methods of Analysis for soil plant and water. Div. of Agric. Sci, Univ. of Chlif, pp309
10. Snedccor, G.W. and W. Cochran, 1980. Statistical Methods. 7th Edn, Jowa State Univ., Press, Jowa, USA
11. Steel, R. G. D. and Torrie, J. H. (1980). Principles and Procedures of statistics Mcgrow-Hill boak Co., Inc. New York, Toronto London
12. Hashish, Kh. I, Abdalla E.F.; Mazhar A. A. M.; T. A. El-Mesiry, (2014) Influence of potassium foliar application on growth and chemical constituents of *Jatropha curcas* seedlings grown under water regime. International Journal of Academic Research 6(2)142- 147
13. El-Tohamy, W. A.; Ghoname A. A. and S. D. Abou-Hussein, (2006). Improvement of pepper growth and productivity in sandy soil by different fertilization treatments under protect cultivation. Journal of Applied Sciences Research 2 (1): 8 – 12
14. Ahmed, M. K. A. and Mohamed, H. Magda, (2005). Effect of foliar fertilization compound and soil application with Potassium fertilizer on Mungbean plants in Newly Reclaimed sandy Soil. Egypt. J. Agric. Res., 2(1) 185- 195
15. Leigh, R.A; Wyn Jones, R.G. 91984). A Hypothesis relating critical potassium concentrations of growth to the distribution and functions of this Ion in the Plant cell. New Phytologist. 97:1-3

*****