

EFFECT OF PLANT GEL ON THE FLOWERS OF BALCONIES GARDEN (*Verbena canadiensis*) UNDER SULAYMANI CITY CONDITIONS

ALI O. M. SHARBAZHERY and LAVA ANWAR ABU-BAKR

Dept. of Horticulture, Faculty of Agriculture, University of Sulaymani, Kurdistan Region-Iraq.
Agricultural Research Center–Sulaymani, Kurdistan Region-Iraq.

(Received: November 26, 2015; Accepted for publication: October 9, 2017)

ABSTRACT

The experiment was carried out at the Agricultural Research Center - Bkrajo - Sulaymani City , in one Balconies with the direction to the south-west, at an altitude of 738 m, during the period between May 1st, 2012 to December 15th, 2012, to study the effects of plant Gel added to balcony's potting plants media under the environmental conditions of the Sulaymani city, with four level 0 , 30 , 75 and 100 gm Gel / pot. The experiment was laid out in a complete randomized design (CRD) with four replicates.

The study results showed that the 100gm Gel treatment on the reduced significant irrigation requirements by 20.3% , the rate of increase in soil moisture reaches to 74.9% compared with control , also increase significantly each of the Plant branches numbers and floral clusters numbers that 250 and 251.8 % respectively when compared with control , As well as increased each of the Plant fresh, foliage dry weight at high rates for each of them, also increasing the flowering period by 169.1 % .

KEYWORDS : Apartment balcony's plants , Plant Gel , *Verbena Canadensis* .

INTRODUCTION

Balcony gardens is a type of private garden that fits apartments in residential buildings, in those places we can grow climbing plants or flowering plants in containers, boxes and hanging baskets (Flink and Searns, 1993).

Although putting plants in balconies under the environmental conditions of the Sulaymani city , especially during the hot days in the summer and autumn which needs to make the irrigation process several times in one day, an important strategy for reducing these needs is to improve the amount of available water for plant growth in the medium , otherwise leads to death or loss of plants aesthetic .

This should be considered in finding materials or media keeps the water and soil moisture for a long time to reduce water requirements. This material may be polymers or plant gel, its small, clear, hard crystals, made of a water-absorbing polymer, all the polymers, Polyacrylamide is one of the most widely employed soil conditioners, this product has been determined to be non-hazardous, Contents; 94% co-polymer of polyacrylamide (cross-linked); 5-6% moisture. superior absorption rates 400 times its density in

de-ionized water, when added to soil media, provide reserve water for plants, stored in hydrated crystals the additional water is stored in bin crystals, 95% available to plants for use, improves soil conditions (Zhang *et al.*, 2006; Zohuriaan and Kabiri, 2008; Jatav *et al.*, 2013), this leads to a reduce in watering frequency - by 50-75% in potted plants, by 15-40% on lawns and 20-40% on irrigated field crops. Gel reduces leaching fertilizers, stores and releases soluble fertilizer and nutrients, good for hanging baskets, stops them from drying out (Jatav *et al.*, 2013). Also Bowman *et al* (1990) explained that adding Gel would improve the moisture-holding capacity of most container's media. Jamalpour *et al* (2013) also noted that the use of 15g superabsorbent polymer per 1kg soil can be offered with 10-12 days irrigation period for *Lysimachia nummularia* cv. 'Aurea'. Moreover reduce the rate of water loss by evaporation and drainage, enabling you to water less. Another excellent benefit of these products is that once applied, they can continue to work from 5 to 7 years with just one treatment (El-Hady *et al.* 1981; Pill and Jacono 1984; Baker 1991).

Applications for potted plants when possible can mix crystals with fresh potting soil and repot

plants, use dry granules or 2 cups of hydrated gel for 20cm pot dry granules or 6 cups of hydrated gel for 25cm pot (Wang and Gregg, 1990).

The goal of this study was to evaluate the effects of plant gel on balcony's potting plants under the environmental conditions of the Sulaymani city.

MATERIALS AND METHODS

The experiment was carried out at the Agricultural Research Center - Bkrajjo , in one Balconies with the direction to the south-west, at an altitude of 738 m above the sea level, during the period between May 1st to December 15th, 2012, plastic pots of 30 cm diameter and 40 cm height were used, the experiment consisted of four treatment 0 , 30 , 75 and 100 gm Gel (Gel was a German Origin), by four replications. To create a mixture of growing media which was consisted of agricultural soil, sandy loam and peat moss with proportions of 1: 1: 1, then put media inside the pots after mixing with the Gel. Pots were planted by one seedling of Verbena, *Verbena canadensis* 'Homestead Purple' is perennials, groundcovers with bright purple flowers produced on short spikes in along summer, it grows about 30cm height and 40 cm diameter (Burrell, 1999). Then pots were put in the balcony so that all the plants were displayed to the same site conditions. From the first day of experiment, some data measurements were begun to be taken, including the following experimental data:

1- Irrigation water requirements: The average of irrigation water was calculated daily for each treatment, according to the needs of each plant (pot), since interruption rain (May 29, 2012) until autumn rainfall (November 1).

2- Soil pH: was measured by using pH Meter .

3- Soil moisture: Was measured by using Digital Tension Meter.

4- Plant fresh weight and roots fresh weight (g): At the end of the experiment , plants were uprooted in pots and washed with water after drying for taking required measurements.

5- Flowering period: It was calculated that the average number of flowering days for each treatment from the beginning of the opening of the first flower in the cluster until the end of the plants flowering.

6- Branches numbers and floral clusters numbers: Most of the plant branches ending configure a cluster of flowers.

7- Plant length (cm): Plants were measured at the end of the growing season (December 15).

8- Foliage dry weight: It was calculated at the end of the experiment, dry weight was measured after drying the vegetative part in the oven at a temperature of 70 °C for 48 hours.

The experiment was laid out in a complete randomized design (CRD) with four replicates, the means were compared by use LSD test at the level of 5%.

RESULTS AND DISCUSSION

1- Irrigation water requirements and soil moisture: The results of statistical analysis presented in table (1) indicated a clear high impact to the sum of Plant Gel to the soil, that significantly reduced the amount of irrigation water, and the best result was in the treatment of 100 gm Gel, which obtained 51 liters compared with control which need 64 liters, with reducing percent reaches to 20.3%, as well as each of the two treatments 75 and 30g significantly reducing the rate of irrigation water which was decreased to 12.5 and 4.7% respectively. Also led to a significant increase in the percentage of moisture of soil for the three treatments by 20.60, 20.45 and 22.30%. compared with the Control (12.75), and soil moisture in the treatment of 100 gm Gel increased to74.9% compared to the Control.

The reason for these effects may be due to the effect of Gel in its high ability to store water 200 - 400 times its size and keeps them around the roots of plants, and slowly releases it into the root zone to be used by plant roots, significantly increases the water-holding capacity of soil and can prevent plant loss due to drought stress in non-irrigated areas and where water-holding capacity is low (Gehring and Lewis, 1980; Taylor and Halfacre, 1986; Bowman *et al.*, 1990; Zhang *et al.*, 2006; Bai *et al.*, 2010 and Jamalpour *et al.*, 2013).

2- Soil pH: Notes from the results of table (1) shows there are no significant difference among treatments and control, with pH values higher or lower, so the experiment results show that the Gel has less impact than the soil pH. This result is consistent with the conclusion reached by many researchers (Keever *et al.*, 1989; Kumar *et al.*, 2008; Hayat and Ali, 2004; Bai *et al.*, 2010; Yan and Yan, 2013; Sharbazhery and Gareeb, 2016).

3- Plant fresh weight, foliage dry weight and roots fresh weight: Although there is no effect of

adding Gel on the plant fresh weight, as shown in table(2), but it has significant effect on the verbena foliage dry weight, and dry weights ranged concentrations of 30, 50 and 100g/pot discipline 39.2, 41.7 and 42.7g respectively in comparison with the control that gave 31.4g. In another aspect it has added three Gel concentrations to reduce the weight of fresh roots significantly and reached for the three concentrations 30, 27.9 and 21.7g, respectively, compared to the Control (42.2g).

The reason for increase in foliage dry weight was the result of adding Gel, which can absorb water up to 400 times its weight, they are being promoted as media amendments to enhance plant growth and increase media nutrient retention and shelf-life of pot crops, they can help with soil aeration and soil porosity (Bearce and McCollum, 1977; James and Richards, 1986; Ingram and Yeager, 1987; Keever *et al.*, 1989; Hayat and Ali, 2004; Yan and Yan, 2013). This leads to an increase in foliage growth significantly compared to the roots groups, but the fresh weight of the plant (foliage + roots) has not increased significantly, but made a slight increase because when foliage weight is increased it reduces the weight of the roots at the same time. While the reason for reducing the roots fresh weight may return to the influence of absorbing high quantities of water, in addition to nutrients, and then slowly releasing the water through osmosis. When mixed into the soil, the Gel come in direct contact with the roots of plants, this is making the water easily available to plants. This translates to extremely efficient use of water in landscaping or with potted plants (Zohuriaan and Kabiri, 2008), and this leads to processing and provide for the needs of the roots and reduce the spread of the roots in the soil to long distances to search for these needs, as a result, it reduces the weight of roots mass of the plants.

4- Plant length, branches and floral clusters numbers: The results in the table (2) show that the increase in Gel levels from 30 to 100g / pots has increased each of the qualities of the number of inflorescences, plant height, number of branches significantly, with the highest values of the recipe number of clusters and number of

branches at the higher level of 100 g amounted to 77 raceme and 15 branch of the two treatments respectively, compared to the Control (26 and 30 branches). While it does not increase significantly the effect of Gel levels from 30 to 100g, despite the superiority of the three concentrations compared to the Control significantly and that gave 55 cm. The data in the table (2) indicated that plant length and maximum numbers of branches and floral clusters were observed in the treatment with 100 g Gel, the rate of increasing the plant length was reached to 140.9%, the rate of increase in the branches and floral clusters number have reached 250 - 251.8% respectively. **5- Flowering period:** The results in table 2 when increase the Gel to 100gm which reached 137 days compared to control (81 days), increasing percentage reached to 169.1%, as well as each of the two treatments 75 and 30g showed High a significant increased in flowering periods significantly increased flowering periods (122 and 97 days), But increasing percentage reached to 150.6 - 119.7% each respectively when compared with control.

The reason for this is because of the same reasons cited in the above paragraphs. Also was found by Kumar *et al* (2008) that hydrogel had a significant positive effects on growth and flowering of gerbera.

Depending on the results of the study conclude the following: We conclude that treatment of 100g of gel added to the soil of potted in balcony's gardens under the environmental conditions of the Sulaymani city led to reduced irrigation requirements significantly by 20.3%, and increase the soil moisture reached to 74.9%, also increase each of the Plant length, branches and floral clusters numbers to 140.9 - 250 - 251.8%, As well as also increase each of the Plant fresh, foliage fresh and foliage dry weight at high rates and are different for each of them, also increasing ratio of flowering period to 169.1%. At the same time did not have an effect on soil pH.

Based on the results and conclusions of the study, we recommend using Gel on allowable rates when planting flowers and plants in the gardens of balconies to their positive effect.

Table (1): The effect of plant gel on same characteristics of soil.

	Treatments requirements (L)	irrigation water (%)	Soil moisture	Soil pH
Control	64 a	12.75 b	7.36 a	
30 gm	61 b	20.60 a	7.30 a	
75 gm	56 c	20.45 a	7.34 a	
100 gm	51 d	22.30 a	7.38 a	

Treatments with same letters are non-significant and treatment bearing different letters are significantly different at 5% level probability .

Table (2): Effect of plant gel on some characteristics *Verbena canadiensis* in balacony.

Floral	Plant length period(D)	Plant fresh clusters No.	Roots fresh (cm)	Foliage dry weight (g)	Branches weight (g)	Treatments Flowering	
						weight (g)	Numbers
Control	81 d	20.0 c	55 b	170.2 a	42.2 a	31.4 b	26 c
30 gm	97 c	32.5 bc	70.a	174.8 a	30.0 b	39.2 a	30 ab
75 gm	122 b	43.0 b	72.5 a	178.2 a	27.9 b	41.7 a	41 b
100 gm	137 a	68.0 a	77.5 a	184.7 a	21.7 b	42.7 a	65 a

Treatments with same letters are non-significant and treatment bearing different letters are significantly different at 5% level probability .

REFERENCES

- Bai, W.; H. Zhang; B. Liu; Y. Wu and J. Song(2010) Effects of super-absorbent polymers on the physical and chemical properties of soil following different wetting and drying cycles. J. Soil Use and Management, Vol 26, Issue 3 : 253-260.
- BAKER SW.(1991) The effect of polyacrylamide copolymer on the performance of *Lolium perenne* L.turf grown a sand root zone. Journal of Sports Turf Research Institute 67 : 66 - 82.
- Bearce, B.C. and R.W. McCollum (1977) A comparison of peatlite and non composted hardwood-bark mixes for use in pot and bedding-plant production effects of a new hydrogel soil amendment on their performance. Flor. Rev. 161(4169):21-23, 66.
- Burrell, C. C.(1999) Perennial Combinations. St.Martins Press,London –UK.
- Bowman, D.C.; Richard Y.E. and J.L. Paul (1990) Fertilizer Salts Reduce Hydration of Polyacrylamide Gels and Affect Physical Properties of Gel-amended Container Media. Jor. of Amer. Soc. Hort. Sci. 115(3):382-386.
- EL HADY OA, TAYEL MY and LOFTY AA.(1981) Super gel as a soil conditioner. II. Its effects on plant growth, enzyme activity, water use efficiency and nutrient uptake. *Acta Horticulturae* 19 : 257 - 265.
- Flink, C.A. and R.M. Searns (1993) Aguide to Planning, Design and Development. Island press, Washington, D.C. USA.
- Sharbazhery, Ali O. and Berivan A. Gareeb(2016) Response of Turf Grass Mixture to Some Soil Amendment (Peat Moss , Perlite and Plant Gel) Under Sulaimani Governorate (Pishder Region) Conditions . Journal of Univ. of Duhok (JDU) Vol.19,No 1, 2016 .
- Gehring, J.M. and A.J. Lewis (1980) Effect of hydrogel on wilting and moisture stress of bedding plants. J. Amer. Soc. Hort. Sci. 105:511-513.
- Hayat,R. and S. Ali (2004) Water Absorption by Synthetic Polymer (Aquasorb) and its Effect on Soil Properties and Tomato Yield. International Journal of Agriculture & Biology. (6) 6 : 998–1002.
- Ingram, D. L. and T. H. Yeager (1987) Effects of irrigation frequency and a water-absorbing polymer amendment on ligustrum growth and moisture retention by a container medium. J. Environ. Hort. 5:19-21.
- Jamalpour, H.; A.M. Torkashvand; s. Seadaghathoor and N. Negahdar (2013) Evaluation the effect of different medias, superabsorbent polymers and irrigation period on increasing water holding and delaying Permanent wilting point in (*Lysimachianummularia* cv. Aurea). Annals of Biological Research, (4) :29-31.

- James, E.A. and D. Richards (1986) The influence of iron source on the water-holding properties of potting media amended with water absorbing polymers. *Scient. Hort.* 28:201-208.
- Jatav, G. K.; R. Mukhopadhyay and N. De.(2013) Characterization of Swelling Behaviour of Nanoclay Composite. *International Journal of Innovative Research in Science, Engineering and Technology* Vol. 2, Issue 5, ISSN: 2319-8753.
- Johnson, M.S. (1984a) Effect of soluble salts on water absorption by gel-forming soil conditioners. *J. Sci. Food Agr.* 35:1063-1066.
- Keever, G.J., G.S. Cobb, J.C. Stephenson and W.J. Foster (1989) Effect of hydrophilic polymer amendment on growth of container grown landscape plants. *J. Environ. Hort.* 7:52-56.
- Kumar, S.; S. Anupama; S. Bhupinder and Sharma R. (2008) Influence of vermi-products and pusa hydrogel on growth and flowering of landscape gerbera under greenhouse condition. *J. of Ecohydrology & Hydrobiology* . Vol. 8, 1 : 67-75.
- PILL WG and JACONO CC. (1984) Effects of hydrogel incorporation in peat-lite on tomato growth and water relations. *Communications in Soil Science and Plant Analysis* 15 : 799 - 810.
- Taylor, K.C. and R.G. Halfacre (1986) The effect of hydrophilic polymer on media water retention and nutrient availability to *ligustrum lucidum* *HortScience* 21:1159-1161.
- Wang, Y.T.; Gregg, L.L. (1990) Hydrophilic polymers—Their response to soil amendments and effect on properties of a soil less potting mix. *J. Am. Soc. Hort. Sci.* 115, 943-948.
- Yan, L. and Yan S. (2013) Effects of Super Absorbent Resin on Leaf Water Use Efficiency and Yield in Dry-land Wheat. *Advance Journal of Food Science and Technology* 5(6): 661-664, ISSN: 2042-4868; e-ISSN: 2042-4876.
- Zhang, J.; Chen, H.; Li, P.; Wang, A. (2006) Study on superabsorbent composite, 14. Preparation of poly(acrylic acid)/organo-attapulgit composite hydrogels and swelling behaviors in aqueous electrolyte solution. *Macromol. Mat. Eng.* 291, 1529-1538.
- Zohuriaan, M. and K. Kabiri (2008) Superabsorbent Polymer Materials: A Review. *Iranian Polymer Journal* 17 (6) : 451-477.

کاربرگی جیلی رووکی له سهر گولی باخچهی به له کونه کان (*Verbena canadiensis*) له ژیر کەشی شاری سلیماندا

پوخته

نهم توپژینه وهیه نه نجام دراوه له به له کونه یهک به ناراسته ی باشوری پوژناوا له به زایه 738 م دا له سه نته ری توپژینه وهی کشتوکالی به کره جو له شاری سلیمانی دا ، له ماوهی نیوان 1 مایه سی 2012 بو 15 م کانونی به که می 2012 ، بو لیکولینه وه له کاربگه ری تیکردنی جیلی رووکی بو میدیای نینجانه ی رووکه له کهش وهه وای شاری سلیمانی دا به چوار ناست که 0 ، 30 ، 75 و 100 گم بوو ، توپژینه وه که به دیزاینی هه ره مه کی ته واو CRD نه نجام درا به چوار دووباره کردنه وه . نه نجامی توپژینه وه که پیشانی دا که ناستی 100 گم جیل کاربگه ری زالی هه بوو له که مکردنه وهی پیداو یستی ناودان به ریژه ی 20.3% ، وه ریژه ی زیادبوونی شی خا ک گه یشته 74.9% ، هه ره ها زیادبوونی ژماره ی لقه کان و شاخه گه له کانی که ریژه کانیا ن گه یشته 250 و 251.8% یه ک دوا ی یه ک ، سه ره رای زیادبوونی کیشی رووکی ته و کیشی وشکی به شی سه وزایی به ریژه ی بهرز ، له گه ل زیادبوونی ماوهی گو لکردن به ریژه ی 169.1% دا .