International Journal of Chemical Studies

P-ISSN: 2349–8528
E-ISSN: 2321–4902
IJCS 2018; 6(5): 3225-3228
© 2018 IJCS
Received: 25-07-2018
Accepted: 30-08-2018

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Efficacy of graded doses of pusa hydrogel as a component of potting media on growth, fresh and dry weight of coleus (*Coleus blumei* L.) under polyhouse condition

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Abstract
An experiment was carried out to study the efficacy of graded doses of Pusa Hydrogel on growth, fresh and dry weight of Coleus (*Coleus blumei* L.) under polyhouse condition". Four different concentrations of Pusa Hydrogel @10 g, 20 g, 30 g and 40 g each mixed with 5 kg of potting media were set as treatments. Application of 40 g of pusa hydrogel per 5kg of potting media resulted in significantly higher plant height (38.5cm), plant spread (41.6 cm^2) fresh weight of shoot and roots (130 and 36 g respectively) and dry weight of shoots and roots (12.25g and 6.5g respectively), root length (25 cm), root volume (34.00 cm^3) and BC ratio (1.40) as compared to control (without Pusa Hydrogel) at 120 days after planting. Significantly least quantity of water requirement (22.7 litre) and frequency of watering (once in 2.9 days) with a water saving of 39% were also recorded in the same treatment when compared to control.

Keywords: fresh weight, dry weight, growth, *Coleus blumei* L., pusa hydrogel

Introduction
Ornamental filler crops occupy an important position in the local and international markets and constitute an important section of floral industry as cut foliage. It has big demand, as they represent a fundamental element of any floral arrangement and add an exotic touch to floral designs. *Coleus blumei* L. belongs to the family *Labiatae*. and it is an ornamental plant growing all over the world. It is a perennial herbaceous plant very commonly grown in the garden for its attractive colorful foliage and grows to a height of 30-50cm. The plants are more commonly grown as pot plants, but are a great favorite for the window box garden and a few dwarf types are also suitable for carpet bedding.

A number of studies had been conducted in past to evaluate the effect of soil conditioners on hydraulic properties and aggregation in soils but they were mostly confined to the laboratory and pot experiments. Moreover, most of these soil conditioners were organic linear chained polymers, had short life span and in some case their end products were poisonous. Since the newly developed Pusa hydrogel by the institute (I.A.R.I) has very high water retention capacity, forms water stable aggregates, has a life span of one year and on decomposition yields simple products, an attempt is being to evaluate its efficiency in under polyhouse condition as well in different quantity.

Materials and Methods
The experiment was conducted, under polyhouse conditions, in the University of Agricultural Sciences, GKVK, Bangalore, (India) during 2016-17, using CRD with five treatments and four replications. Four concentrations of Pusa Hydrogel @ (10, 20, 30 and 40 gm) were used along with control(without pusa hydrogel) different concentration of Pusa Hydrogel were added to 5kg of potting media [soil+ vermin-compost+ Sand(1:1:1v/v)] and mixed thoroughly before planting in 12 inch earthen pots. Ten plants of coleus (*Coleus blumei* L.) under each replication and five plants were randomly selected and tagged for recording various morphological observations at different stages of plant growth. Observation on plant height (cm), plant spread (cm^2), fresh weight (g) of entire plant along the roots and only roots was

weighed using electronic balance and dry weight of the plant and roots was determined after drying in the oven till the samples showed constant weight. Longest root length (cm) was measured in cm and root volume (cm^3) was determined by water displacement method. The selected tagged five plants roots were immersed individually in a container containing water and the amount of water displaced by each plant roots was measured. Initially all the experimental pots were thoroughly soaked with water every day. Soil moisture content was checked daily using digital soil moisture meter and known quantity of water was applied individually as and when the plants showed wilting symptoms. Frequency of watering was measured between two successive watering and total number of watering were recorded treatment wise during the crop growth period and cumulative quantity of water (litre) applied and BC ratio was calculated from the beginning of the experiment up to end of experiment (120) days after planting.

Results and Discussion

Growth characters as influenced by different concentration of Pusa Hydrogel

Pusa hydrogel had significant effect on all the plant growth characters at different stages of growth of Coleus. The data on growth parameters at 120 days after planting is shown in table 1. With an increase in Pusa Hydrogel concentration there was an increase in plant height, and plant spread. The highest plant height (38.5 cm) was recorded in 40 g of Pusa Hydrogel/5kg of potting media followed by 30 g of Pusa Hydrogel/5kg (36.5 cm) and lowest plant height (31.9 cm) was observed in control (without Pusa Hydrogel) (Table 1). Highest plant spread (41.6 cm^2) was observed in 40g of Pusa Hydrogel/5kg of potting media at all stages of growth as compared to control (without Pusa Hydrogel) (37.8 cm^2).

An increase in plant height might be attributed to water availability and indirectly nutrients provided by superabsorbent polymer, which have been reported to increase the activity of cell division, cell expansion and cell elongation, ultimately leading to an increased plant height. Similar results have been reported by Al-Harbi *et al*. (1999) [2] in cucumber, Sendur Kumaran *et al*. (2001) [15] in tomato and Sivalapan (2001) in soybean. The positive effect of super absorbent on stem elongation is reported by Brar *et al*. (2001) [4] in maize. This effect could be a result of high potential of superabsorbent to absorb water and conserve water in the soil in sunflower (Boman and Evans, 1991) [3]. Huttermann *et al.*, (1999) reported the stored water and nutrients are released slowly as required by the plant to improve growth under limited water supply in *Pinus halepensis*.

Shoot and root fresh and dry weight (g) and other root characters as influenced by different concentrations of Pusa Hydrogel in Coleus

With an increase in concentrations of Pusa Hydrogel, significant increase in shoot and roots fresh and dry weight and average root length and root volume was observed and the data is shown in table 1. The highest fresh weight and dry weight (130 g and 12.50 g respectively) of shoots was recorded in plants grown in treatment T_5 (40g of Pusa Hydrogel/5kg of potting media). Where as in treatment, T_1 (without Pusa Hydrogel) showed least fresh and dry weight of shoots. Maximum fresh weight (36.00 g) and dry weight (6.5g) of root was recorded in plants grown in T_5 (40g of pusa hydrogel/5kg of potting media) as compared to control (without Pusa Hydrogel) which recorded least fresh and dry weight of roots (16.75 and 2.25 respectively). The highest mean root length (25 cm) was observed in treatment. T_5 (40g of pusa hydrogel/5kg of potting media) and less root length (15.25 cm) was recorded in control (without pusa hydrogel). Similar trend was observed with respect to root volume. Highest root volume (34.00 cm^3) was observed in T_5 (40g of pusa hydrogel/5kg of potting media) and the lowest root volume (16.75 cm^3) was observed in control (without pusa hydrogel).

The fresh weight of the plants also increased with increases in the Pusa Hydrogel concentration which may be due to better growth and development of plant. Similar results were reported by Ingram and Yeager, (1987) [10] in *Ligustrum* who reported that shoot and root dry weights were higher with more frequent watering. Water stress had negative effect on current photosynthesis and remobilization. Reduction of weight may be due to a lower photosynthate production, because of excessive loss of leaves, as reported by Rauf, (2008) [14] in sunflower. Increase in weight, resulting from more irrigation, was probably due to the availability of adequate soil moisture. High contents of polymer with water supply, caused opening of stomata for a long time in corn, (Khadem *et al.*, 2010) [12]. Subsequently good fixation of CO_2 resulted an increase of dry matter in corn plants (Khadem *et al*., 2010) [12]. Similar results were reported by Howard *et al*., (1999) [8] in wheat.

Better aeration (exhausting of Carbon Dioxide and ingestion of Oxygen) in the root zone enhances germination, root development and microbial activities. Kaydan and Yagmur (2008) [11] opined that water deficient conditions decreased seedling growth with higher negative effects such as lower root and shoot length in wheat. Similarlly Duman (2006) [6] declared that water deficit stress decrease root length of lettuce seedling. Root length is an important trait against drought stress in plant varieties in general and varieties with longer root growth has resistant ability for drought (Leishman and Westoby, 1994) [13]. Similar results were recorded by Howard *et al*., (1999) [8], where incorporation of polymer into soil increased root dry weigh in wheat. Similarly, Silberbush *et al*. (1993) [16] and Sendur Kumaran *et al*. (2001) [15] reported the influence of hydrophilic polymer on root characteristics in tomato.

Effects of different concentrations of Pusa Hydrogel on frequency of watering and cumulative quantity of water

Least quantity of water (22.7 litre), frequency of watering (once in 2.85 days) and highest BC ratio (1.46) in 120 days were also observed in the treatment receiving 40gm of Pusa Hydrogel per 5kg of potting media (T_5). Minimum growth and production, higher cumulative water quantity (37.8 litre) (fig. 1), watering frequency (once in 1.09 days) and lowest BC ratio (1.03) were recorded in control. Significant reduction in watering frequency and cumulative quantity of water in coleus by application of Pusa Hydrogel may be due to increasing water holding capacity of media which is in accordance with the results observed by Sivalapan (2001) in soybean, Cookson *et al*., (2001) [5] in okra and Abedi-Koupai *et al*., (2004) [1] in *Cupressus.* The moisture content of the media increased with an increase in the concentration of Pusa Hydrogel at all the stages of growth.

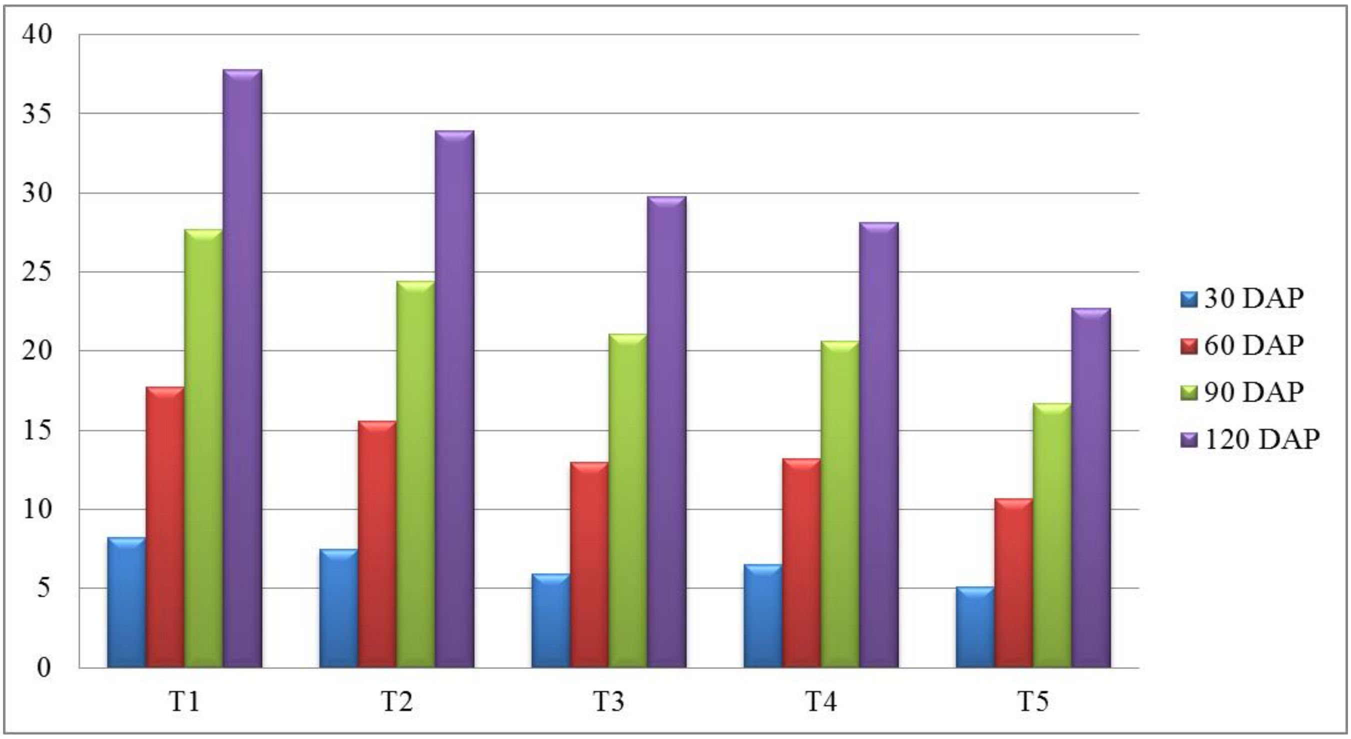
An increase in moisture content of plant may be due to sufficient availability of the soil moisture and its supply to plant as per need by Pusa Hydrogel. According to El-hady *et al*., (1980) [7] the increase water use efficiency may be due to decrease in evapo-transpiration ratio which in turn might have helped the crop growth. Wallace and Wallace (1990) [18] also reported increased level of water content of plant due to hydrophilic polymer (Grogel).

Table 1: Growth parameters, watering frequency and BC ratio as influenced by different concentration of Pusa Hydrogel

Treatment	Plant height(cm)	Plant spread(cm2)	Watering frequency(days)	BC ratio
Control	31.9	38	1.1	1.03
Pusa Hydrogel @ 10 g/5kg potting media	32.3	38	1.1	1.31
Pusa Hydrogel @ 20 g/5kg potting media	33.9	38.5	1.5	1.34
Pusa Hydrogel @ 30 g/5kg potting media	36.5	39.5	2.9	1.38
Pusa Hydrogel @ 40 g/5kg potting media	38.5	42	2.9	1.46
Mean	34.6	39.2	1.9	-
SEm±	0.4	0.37	0.37	-
CD at 5%	1.1	1.1	1.10	-

Table 2: Shoot and roots fresh (g) and dry weight (g) and root length (cm) and volume (cm^3) as influenced by different concentration of Pusa Hydrogel in Coleus

Treatments	Shoot		Root			
	Fresh weight (g)	Dry weight (g)	Fresh weight (g)	Dry weight (g)	Length (cm)	Volume (cm^3)
Control (without Pusa Hydrogel)	96.8	4.8	16.8	2.0	15.3	16.8
Pusa Hydrogel @ 10 g/5kg potting media	104.0	6.3	17.8	3.0	16.3	21.5
Pusa Hydrogel @ 20 g/5kg potting media	111.5	8.3	26.5	3.5	21.5	23.3
Pusa Hydrogel @ 30 g/5kg potting media	120.0	10.5	32.5	5.3	23.5	26.0
Pusa Hydrogel @ 40 g/5kg potting media	130.0	12.3	36.0	7.0	25.0	34.0
Mean	112.5	8.4	25.9	4.2	20.3	24.3
SEm±	4.3	0.4	0.9	0.2	0.8	1.1
CD @ 5%	12.8	1.2	2.6	0.5	2.3	3.2



T_1: Control
T_2: Pusa Hydrogel @ 10 g/5kg potting media
T_3: Pusa Hydrogel @ 20 g/5kg potting media
T_4: Pusa Hydrogel @ 30 g/5kg potting media
T_5: Pusa Hydrogel @ 40 g/5kg potting media

Fig 1: Cumulative quantity of water as influenced by different concentrations of pusa hydrogel in coleus

Conclusion

Application of Pusa Hydrogel as a component of potting media had significant positive effect on all morphological characters viz; Fresh weight, dry weight of shoots and roots, average root length, root volume and BC ratio of *Coleus blumei* L. plant. Among all the treatments, T_5 (40 g of Pusa Hydrogel per 5kg of potting media) showed significantly better plant growth and quality as compared to control (without pusa hydrogel) and required significantly less quantity of water and least frequency of watering as compared to control. Hence, application of Pusa Hydrogel @ 40 g of Pusa Hydrogel per five kg of potting media resulted in higher plant growth and production with lesser quantity of water

(22.7) and there by water saving to an extent of 39% could be achieved.

References

1. Abedi-Koupai J, Sohrab F. Evaluating the application of superabsorbent polymers on soil water capacity and potential on three soil textures, Iran. J Polym. Sci. Tech., 2004; 17:163-173.
2. Al-Harbi AR, Al-Omran AM, Shalaby AA, Choudhary MI. Efficacy of a Hydrophilic polymer declines with time in house experiments. Hort. Sci. 1999; 34:223-224.
3. Boman DC, Evans RY. Calcium inhibition of polyacrylamide gel hydration is partially reversible by potassium. Hort. Sci. 1991; 26:1063-1065.
4. Brar BS, Dhillon NS, Chhina HS. Integrated use of farm yard manure and inorganic fertilizers in maize (*Zea mays* L.). Ind. J Agri. Sci., 2001; 71:605-607.
5. Cookson P, Abdel Rehman H, Hirsbrunner P. Effect of hydrophilic polymer application and irrigation rates on yield of field grown okra. J Sci. Res. Agri., 2001; 6(1-2):67-75.
6. Duman I. Effects of seed priming with PEG or K3PO4 on germination and seedling growth in lettuce. Pak. J Biol. Sci., 2006; 9(5):923-928.
7. El-Hady OA, Tayel MY, Lotfy AA. Super gel as a soil conditioner, II-Its effects on plant growth, enzyme activity, water use efficiency and nutrient uptake. Acta. Hort. 1980; 119:257-265.
8. Howard S, Hanson JD, Benjamin JG. Nitrogen uptake and partitioning under alternate and every furrow irrigation. Plant Sci. 1999; 210:11-20.
9. Huttermann A, Zommorodi M, Reise K. Addition of hydrogels to soil for prolonging the survival of *Pinus halepensis* seedlings subjected to drought, Soil Tillage Res. 1990; 50:295-304.
10. Ingram DL, Yeager TH. Effects of irrigation frequency and a water-absorbing polymer amendment on *ligustrum* growth and moisture retention by a container medium. J Environ. Hort. 1987; 5:19-21.
11. Kaydan D, Yagmur M. Germination, seedling growth and relative water content of shoot in different seed sizes of triticale under osmotic stress of water and NaCl. Afric. J Biotech. 2008; 7(16):2862-2868.
12. Khadem, S.A., Galavi, M., Ramrodi, M., Mousavi, S.R., Rousta MJ, Rezvani-Moghadam P. Effect of animal manure and super absorbent polymer on corn leaf relative water content, cell membrane stability and leaf chlorophyll content under dry condition. Aust. J Crop. Sci. 2010; 4:642-647.
13. Leishman MR, Westoby M. The role of seed size in seedling establishment in dry soil conditions experimental evidence from semiarid species. J Ecol. 1994; 82(2):249-258.
14. Rauf S. Breeding sunflower (*Helianthus annuus* L.) for drought tolerance. Comm. Bio. Crop Sci. 2008; 3:29-44.
15. Sendur, Kumaran S, Natarajan S, Muthvel I, Sathiayamurthy VA. Efficacy of graded doses of polymers on processing quality of tomato cv. CO3. J. Madras Agri. 2001; 88(4-6):298-299.
16. Silberbush M, Adar E, De-Malach Y. Use of Hydrophilic polymer to improve water storage and availability to crops grown in sand dunes. i. corn irrigated by trickling. Agric. Water. Man. 1993; 23:303-313.
17. Sivalapan S. Some benefits of treating a sandy soil with a cross-linked type polyacrylamide. Aust. J Exp. Agri., 2006; 46:579-584.
18. Wallace A, Wallace GA. Interactions encountered when applying nitrogen and phosphorus fertilizer and a water-soluble polyacrylamide to soil. J plant nutrition. 1990; 13:343-347.