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Response of Snapdragon (*Antirrhinum majus* Coronette F1) To Compost Amendment and Foliar Fertilization

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Abstract: Two experiments were conducted at the ornamental plants nursery of the Department of Horticulture - Faculty of Agriculture, University of Khartoum at Shambat to study the response of snapdragon plants to compost amendments and foliar fertilization. In the first experiment, a compost was mixed with field soil to form four treatments namely 0:1(control), 1:3, 1:1, 3:1 (compost:field soil).Treatments were arranged in a completely randomized design. Results showed that the three ratios of compost had a positive effect on vegetative growth and flowering parameters which were plant height, stem diameter, number of branches per plant, number of leaves per plant, days to first flower bud, number of inflorescences per plant, inflorescence length and inflorescence weight. There were significant differences among treatments. All treatments resulted in significantly higher values and earlier flowering than the control. In the second experiment, four doses of the foliar fertilizer Wuxal representing four treatments namely 0 ml/L (control), 2 ml/L, 4 ml/L and 6 mls fertilizer/liter of water. Results demonstrated that growth parameters (plant height, number of branches/plant, number of leaves/plant and stem diameter) were highest at the dose of 4 ml/L. Increasing the dose of the foliar fertilizer from 4 mls /L to 6 mls/L did not result in significant increase in growth parameters. With regard to flowering, earlier flower bud emergence was at 4 mls/L and 6 mls/L. With respect to number of inflorescences/plant, inflorescence length and inflorescence weight, all treatments were significantly superior to control. The study recommends the use of the mixture (compost: field soil) at the

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ratio 1 **:** 3 and the foliar fertilizer Wuxal at 4 ml/L for Snapdragon (*Antirrhinum majus* Coronette F1) production.

Key words: *Antirrhinum majus*, Compost, Foliar Fertilization.

INTRODUCTION

Snapdragons (*Antirrhinum majus*) are colorful, prolific bloomers that have been flower-garden staples for centuries. They nearly rank as the seventh most valuable cut flower crop produced eclipsed by roses, carnations, pompon chrysanthemums, and standard chrysanthemum, gladiolus, and Cattleya orchids. Maheswarappa *et al* (1999) and Pandey and Shukla (2006) reported that the application of compost favourably affects soil pH, microbial population and soil enzyme activities. It improves soil structure, increase organic matter content, water holding capacity and reduces the frequency and rate of irrigation (Azores-Hampton, *et al*, 1998; Liang *et al* 2005). Compost is a good source to provide both macro-and micronutrients for plant growth. Courtney and Mullen (2008) found that nutritional elements such as potassium, calcium, magnesium, phosphorus, iron, copper and manganese increased, when compost was applied.

Furthermore, Liang *et al* (2005) reported that application of compost to soil improves physical and chemical characteristics of the soil, enhances tolerance of crops to salt stress by increasing drainage and soil water retention. The use of compost can reduce environmental pollution. Stofella and Graetz, (2000) stated that compost application reduces the proportion of water-soluble chemical species, which cause possible environmental contamination. Atif *et al* (2008) evaluated the effect of five different growth media including coconut compost, silt, soil, leaf manure and the mixture (silt + leaf manure + coconut compost; 1:1:1) on growth and flowering of *Zinnia elegans* cv. Blue Point. Ravishankar *et al* (2004) investigated the effect of organic manures on growth characteristics of papaya plant grown under field conditions. They found that papaya plants treated with organic manures recorded the maximum plant height, stem girth, number of leaves per plant compared to the control.. Foliar fertilizers are absorbed right at the site where they are used as quite fast acting, whereas, much of the soil fertilizers may never get used by plants

(Schonherr, 2006). Ahmad *et al* (2010) studied the effect of foliar application of different micronutrients (B, Zn and Fe; 0.5%, 1.5% and 1%, respectively) on plant growth and flowering of three rose (*Rosa hybrida* L.) cultivars viz. Kardinal, Amalia and Rosy Cheeks. Nutrients were applied alone and with different combinations after 6, 8 and 10 weeks of pruning. Plant height, number of leaves/ branch, leaf area, number of flowers/plant, flower stalk length and leaf Zn contents were maximum with B + Zn application followed by only B application which also resulted in early flower production as compared to rest of the treatments while bud diameter, flower diameter, as well as fresh and dry weight of flowers were maximum with B application alone followed by combination of B + Zn application. Leaf chlorophyll contents, flower quality, flower stalk diameter and leaf B and Fe contents were highest when plants were sprayed with combinations of all micronutrients. Plants without micronutrients application produced poor quality vegetative growth and less number of flowers. It was concluded that application of micronutrients could improve flower yield and quality of roses. Khosa *et al* (2011) examined the effect of foliar application of macro (NPK) and micro nutrients (Zn, B, Fe and Mn) on gerbera growth and flowering.

Plant height, number of branches per plant, length of branches, number of leaves per plant, leaf area, stalk length, flower diameter and flower quality increased with increasing fertilization level and began to turn down when fertilization level exceed beyond the above given levels of macro and micro nutrients. Foliar fertilization influenced the days to first flower emergence as compared to control. Research on cut flower production is very rare in the Sudan and research on snapdragons had not been carried out. Therefore there is immense need for reliable research data on snaps culture. This study was carried out to study the response of snapdragon to compost and foliar Fertilization.

MATERIALS AND METHODS

Two pot experiments were carried out in an open space at the ornamental plants nursery of the Department of Horticulture - Faculty of Agriculture, University of Khartoum at Shambat area, (Latitude 15° 40` N, longitude 30° 32` E) in the winter season during the year 2012 – 2013. The climate

of the area is semi-arid with low relative humidity and daily mean maximum temperature of 40°C in summer and 21°C in winter.

Experiment 1: The purpose of this experiment was to investigate the effect of compost on growth and flowering of *Antirrhinum majus* (Coronette F1). A compost prepared by the Department of Soil and Environmental Sciences, Faculty of Agriculture, University of Khartoum, was mixed with field soil from the demonstration farm of the faculty of Agriculture, University of Khartoum to form four treatments namely 0:1 (control), 1:3, 1:1, 3:1 (compost: field soil). The mixture was potted in polyethylene bags of 25 cm diameter and 30 cm high. Compost composition is shown in Table1, while field soil composition is shown in Table 2. For the analysis of compost and field soil, the pH, ECe, Ca, Mg, Na, K were determined by by Richards (1969) method. Total N and total P were determined by Hesse (1971) method.

Experiment 2: The purpose of this experiment was to investigate the effect of the foliar fertilizer Wuxal on growth and flowering of *Antirrhinum majus* (Coronette F1). Only field soil was potted in polyethylene bags of the same dimension as in experiment 1. Plants were sprayed with four doses of the foliar fertilizer Wuxal representing four treatments namely 0 ml/L (control), 2 ml/L, 4 ml/L and 6 ml fertilizer/liter of water. Foliar fertilizer Wuxal composition is shown in Table 3.

Seedlings of about one month of age of Coronette F1 variety of *Antirrhinum majus* were brought from DAL Company, Sudan and transplanted into the above mentioned bags for the two experiments.

Table 1: Compost chemical properties:-

N %	P %	K %	Mg %	Ca %	Na %	O.C %	Ash %	M.C %	pH	E.C dS/m
0.5	4.5	4.7	2.9	13.5	1.7	40	66.3	15	6.7	1.8

Growth parameters measured were Plant height, number of branches/plant, number of leaves/plant and stem diameter. Flowering parameters were number of days from planting to first flower bud,

Table 2: Field soil chemical and physical properties:-

Total N %	Total P ppm	K mm1/ L	Mg mm1/L	Ca mm1/L	Na mm1/L	S.P	pH	E.Ce dS/m	SAR	Sand %	Silt %	Clay %
0.05	2.55	0.14	1.1	1.9	3.9	65.4	7.9	1.7	9	17	20	63

Table 3: Foliar fertilizer Wuxal chemical properties:-

	Macro nutrients%				Micronutrients (ppm)						
	N	P	K	S	Zn	Fe	Mn	Cu	B	Mo	Amino acids
Nutrient contents	10	10	7.5	1.64	80	159	151	84	190	20	3%

number of inflorescences/plant, inflorescence length and inflorescence weight. Parameters were measured forty days after transplanting. A completely randomized design was used, six plants represented an experimental unit, and each experimental unit was replicated four times. Statistical analysis was carried out using the SPSS program (version 22/ 2013). Mean separation was carried out using Duncan's multiple range testat 5% level of significance.

RESULTS AND DISCUSSION

Experiment 1:
Effect of different ratios of (compost: field soil) on growth of snapdragon (*Antirrhinum majus* Coronette F1):

Plant height: As shown in Table (4) there were significant differences among treatments. All treatments gave higher values than the control with no significant difference between them.

Number of branches/plant: There were significant differences among treatments. All treatments gave higher values than the control with no significant difference between them (Table 4).

Number of leaves / plant: There were significant differences among treatments. The ratios (1:3) and (3:1) were significantly different from control (0:1) and the ratio (1:1) with no significant difference between them. There was no significant difference between the ratio (1:1) and the control (Table 4).

Stem diameter: As shown in Table (4) there were significant differences between treatments. All treatments were significantly superior to the control.

Table (4): Effect of different ratios of (compost: field soil) on growth of Snapdragon (*Antirrhinum majus* Coronette F1) forty days after transplanting.

Treatments (Compost: Field soil)	Plant height (cm)	Number of branches/plant	Number of leaves per plant	Stem diameter (mm)
(0:1)	18.63b	15.58b	79.88b	3.60b
(1:1)	21.50a	19.04a	85.58a	4.08a
(1:3)	22.75a	19.29a	99.33b	4.36a
(3:1)	22.25a	19.63a	96.17a	4.15a

Means followed by the same letter (letters) in a column are not significantly different at P≥0.05 according to Duncan's Multiple Range Test.

Effect of different ratios of (compost: field soil) on flowering of snapdragon (*Antirrhinum majus*Coronette F1):

Days to first flower bud emergence: There were significant differences between treatments in days taken to first flower bud emergence . Control showed the latest flowering recording the highest number of days (31.29). There was no significant difference among compost treatments (Table 5).

Number of inflorescences/plant: There were significant differences between treatments. All treatments were significantly superior to the control. The ratio (1:3) recorded the highest value followed by (3:1) with no significant difference between them (Table5).

Inflorescence length: As shown in Table (5) there were significant differences among treatments. All treatments gave higher values than the control with no significant difference between them.

Inflorescence weight: There were significant differences among treatments. All treatments gave significantly higher values than the control with no significant differences between them (Table 5).

Table (5): Effect of different ratios of (compost**:**field soil) on flowering of Snapdragon (*Antirrhinum majus*Coronette F1).

Treatments (compost: field soil)	Days to first flower bud emergence	Number of Inflorescences per plant	inflorescence length (cm)	Inflorescence weight (gm)
(0:1)	31.29a	5.75 c	11.00b	1.95b
(1:1)	28.96b	10.50 a	25.92a	5.82a
(1:3)	28.62b	20.50 b	26.00a	6.09a
(3:1)	29.00b	12.75 ab	26.15a	5.93a

Means followed by the same letter (letters) in a column are not significantly different at P≥0.05 according to Duncan's Multiple Range Test.

Fuchs and Larbi (2005) reported that compost amendments were found to influence various soil fertility parameters, such as nutrient content and availability, soil structure and microbiological activity. They also impact plant growth and health directly and in directly. Results of the present study demonstrated that the three ratios of compost added to the field soil had a positive impact on vegetative growth and flowering parameters measured. This was reflected in the tallest plants, highest values of number of branches, counted leaves, greater stem diameter, earlier flowering, higher number of inflorescences per plant, longer and heavier inflorescence. Similar results were reported by several workers working with different plant species (Hemphill *et al*,1984 in pansy, snapdragon and cabbage; Ravishankar *et al*, 2004 in papaya; Mumtaz *et al*, 2006 in sour orange). Gamal and Ragab (2005) reported that positive effects of high rate of organic compost could be attributed to their effects in supplying the treated plants with their requirements of nutrients for relatively long time as well as their effects in lowering soil pH which could aid in facilitating availability of soil nutrients and improve physical characters in favour of roots development. In this research compost treatments showed earlier emergence of first flower bud compared to control These results support the findings of Atif *et al* (2008).

Experiment 2:

Effect of different doses of the foliar fertilizer (Wuxal) on growth parameters of snapdragon (*Antirrhinum majus* Coronette F1) is shown in

Table 6. Plant height was highest at 4 mls /L which was significantly different from 2 mls/L and control but was not significantly different from 6 mls/L. Number of branches/plant was also highest at 4 mls /L which was significantly different from 2 mls/L but was not significantly different from 6 mls/L and control. Number of leaves per plant was also highest at 4 mls /L which was significantly different from 2 mls/L but was not significantly different from 6 mls/L and control. There was no significant difference in stem diameter among treatments. Plants exhibiting thick stem have more mechanical strength to resist breaking and bending against stress environmental conditions. Increasing the dose of the foliar fertilizer from 4 mls /L to 6 mls/L did not result in significant increase in growth parameters.. The positive effects of the foliar fertilizer (Wuxal) on growth parameters of snapdragon could be attributed to the fact that it supplied the plant directly with N, P and K together with the essential micronutrients which promoted growth of this plant.

Effect of different doses of the foliar fertilizer (Wuxal) on flowering parameters of snapdragon (*Antirrhinum majus* Coronette F1) is shown in Table 7. Earlier flower bud emergence (at about 27 dayes) was at 4 mls /L and 6 mls /L which was significantly different from 2 mls/L and control (30.33 and 29.38 days respectively).With respect to number of inflorescences/plant, inflorescence length and inflorescence weight, all treatments were significantly superior to control. Similar results in growth and flowering were reported by many workers working on foliar fertilization in different plant species (Sharaf and El-Naggar, 2003 in carnation; El-Naggar, 2009 in *Dianthus caryophyllus* cv. "Red Sim"; Ahmad *et al*, 2010 in rose and Khosa *et al*, 2011 in gerbera). With regard to inflorescence length and weight, the control surpassed all treatments which might be due to less number of inflorescences it formed where there was less competition for food reserve.

It can be concluded that the use of the mixture (compost **:** field soil) at the ratio 1 **:** 3 and the foliar fertilizer Wuxal at 4 ml/L is suitable for Snapdragon (*Antirrhinum majus* Coronette F1) production.

Table (6): Effect of different doses of the foliar fertilizer (Wuxal) on growth of Snapdragon (*Antirrhinum majus* Coronette F1) forty days after transplanting.

Foliar fertilizer doses	Plant height (cm)	Number of branches/plant	Number of leaves per plant	Stem diameter (mm)
Control	19.79b	16.50ab	85.96a	3.24a
2 mls/ liter of water	18.70b	13.58b	69.21b	2.91a
4 mls/ liter of water	23.04a	17.38a	96.50a	3.19a
6 mls/ liter of water	21.25ab	15.67ab	94.46a	3.15a

Means followed by the same letter (letters) in a column are not significantly different at P≥0.05 according to Duncan's Multiple Range Test.

Table (7): Effect of different doses of the foliar fertilizer (Wuxal) on flowering of Snapdragon (*Antirrhinum majus* Coronette F1) forty days after transplanting.

Foliar fertilizer doses	Days to first flower bud emergence	Number of inflorescences per plant fifty days after transplanting	Inflorescence length (cm)	Inflorescence weight (gm)
Control	29.38a	16.50b	28.32 a	7.63 a
2 mls/ liter of water	30.33a	19.75a	25.11 b	6.35 b
4 mls/ liter of water	27.75b	28.00a	24.88 b	6.51 b
6 mls/ liter of water	27.08b	22.25a	b	b

Means followed by the same letter (letters) in a column are not significantly different at P≥0.05 according to Duncan's Multiple Range Test.

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إستجابة نبات الأنترهينم لإضافة الكمبوست والتسميد الورقي

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اجريت تجربتان لدراسة استجابة نبات الأنترهينم لإضافة الكمبوست والتسميد الورقي. في التجربة الاولي خلط الكمبوست مع تربة الحقل في هيئة اربع معاملات هي 0 : 1 (الشاهد)، 1 : 3، 1 : 1، 3 : 1 (الكمبوست: تربة حقل) . اظهرت النتائج ان نسب الكمبوست الثلاث كانت ذات تاثير ايجابي على معايير النمو الخضري والزهري وهي طول النبات، عدد الافرع بالنبات، عدد الاوراق بالنبات، سمك الساق، عدد الايام لظهور اول برعم زهري ، عدد النورات بالنبات ، طول النورة ، وزن النورة. كانت هنالك فروقات معنوية بين المعاملات. كل المعاملات نتج عنها قيما أعلى و ازهارا مبكرا مقارنة بالشاهد. في التجربة الثانية استخدمت اربع جرعات من السماد الورقي وكسال ممثلة أربع معاملات هي 0 مل / لتر (الشاهد) ، 2 مل / لتر ، 4 مل / لتر ، 6 مل سماد ورقي / لتر ماء . أوضحت النتائج ان معايير النمو الخضري (طول النبات، عدد الافرع بالنبات، عدد الاوراق بالنبات، سمك الساق) كانت أعلاها عند الجرعة 4 مل / لتر. زيادة جرعة السماد الورقي من 4 مل / لتر إلى 6 مل / لتر لم ينتج عنه زيادة معنوية في معايير النمو الخضري. فيما يخص النمو الزهري كان ظهور البراعم الزهرية مبكرا عند الجرعتين 4 مل/لتر و 6 مل/لتر. بالنسبة الى عدد النورات بالنبات ، طول النورة ، وزن النورة فقد كانت قيمها أعلى بصورة معنوية مقارنة بالشاهد.

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