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A Note on the Effect of Some Biofertilizers and Compost on Growth and Flowering of Gerbera (*Gerbera jamesonii* Bolus)

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Abstract: The objective of the research was to study the effect of some biofertilizers and compost on growth and flowering of Gerbera. The fertilizers applied were nitrogen fixing bacteria (*Rhizobium sp*.) (Bio.1), phosphorus solubilizing bacteria (*Bacillus megatherium var. phosphaticum*) (Bio.2), potassium solubilizing bacteria (*Bacillus circulans*) (Bio.3), combination between Bio.1 , Bio.2 and Bio.3 (Bio.4) and compost at the rate of rate of 8.1g of fertilizer/9kg of soil. Results showed that gerbera responded positively to biofertilizer and compost application. All treatments, except Bio2, gave significantly higher values of plant height compared to the control. Compost gave significantly ($P \leq 0.05$) the highest number of leaves/plant compared to the control. With regard to leaf length, all treatments except Bio3 were significantly superior to the control. Although the differences between the treatments were not significant, the control showed the earliest flowering while compost and Bio2 resulted in the latest flowering. Bio.4 gave significantly the highest number of inflorescences/plant and inflorescence diameter compared to the control.

Key words: *Gerbera jamesonii* Bolus, Biofertilizer, Compost, Growth, Flowering.

Cultivated gerbera (*Gerbera jamesonii Bolus*) is one of the most important cut and pot flowers worldwide, ranking fifth after rose, carnation, chrysanthemum, and tulip, in the global cut flower trade

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(Bhatia *et al.*, 2009 and Teeri *et al.*, 2006). Biofertilizers are those substances that contain living microorganisms which colonize the rhizosphere of the plant and increase the supply and availability of primary nutrient and/or growth stimulus to the target crop. They have the ability to mobilize plant nutrients in soil from unusable to usable form through biological processess. They help building up the microflora and in turn improve the soil health in general (Ismail *et al.*, 2014). Biofertilizers have shown great potential as supplementary, renewable and environmental friendly sources of plant nutrient and are an important component of integrated nutrient management and integrated plant nutrition system (Raghuwanshi, 2012). Compost was reported to promote the physical and chemical properties of growing media. Maheswarappa *et al* (1999) and Pandey and Shukla (2006) reported that the application of compost favorably 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, 1998; Mitchell and Edwards, 1997; Liang *et al.* 2005). In the Sudan there is an increase in using gerbera as cut flower and potted flowering plant. It is produced locally in greenhouses and some nurseries. There is no scientific research concerning fertilization of gerbera. The main objective of this research was to study the effect of some biofertilizers and compost on growth and flowering of gerbera in Sudan.

This study was conducted at the nursery of the Department of Horticulture – Faculty of Agriculture, University of Khartoum, Shambat, Sudan, during September 2015 –April 2016. Two months old gerbera seedlings were planted in polyethylene bags s30 cm diameter and 40 cm height containing a mixture of silt + sand at a ratio of 2:1. A compost known as "Alkhirat fertilizer" and some biofertilizers brought from "The National Center for Research" - Sudan were tested in this study at the rate of 8.1g of fertilizer/9kg of soil. The fertilizers were applied at planting. The treatments were:

- (1) Control
- (2) Bio.1: Nitrogen fixing bacteria (*Rhizobium sp*.).
- (3) Bio.2: Phosphorus solubilizing bacteria (*Bacillus megatherium var. phosphaticum*).
- (4) Bio.3: Potassium solubilizing bacteria *(Bacillus circulans*).
- (5) Bio.4: A combination between Bio.1, Bio.2 and Bio.3.
- (6) Compost.

The treatments were arranged in a completely randomized design and replicated thrice. The data were subjected to analysis of variance using IBM SPSS statistical software (version 22). Differences between means were compared by Duncan's Multiple Range Test. The parameters measured were plant height, number of leaves/plant, leaf length, number of days from planting to first flower bud formation, number of inflorescences/plant and inflorescence diameter.

All treatments, except Bio2, gave significantly ($P \geq 0.05$) higher values of plant height than the control. The highest value was recorded by Bio1 followed by Bio4, compost, Bio3 and Bio2. However the differences between these treatments were not significant (Table 1). This may have beeen due to enough content of K in the soil and to the slow release and low availability of P. Only compost gave significantly the highest number of leaves per plant compared to the control. The differences between the rest of the treatments were not significant (Table 1). With regard to leaf length all treatments except Bio3 were significantly superior to the control. However, the differences between them were not significant (Table 1). As shown in Table 2, there were no significant differences between the treatments in number of days from planting to first flower bud formation. The control recorded the lowest number of days (earliest flowering) followed by Bio4, Bio1 and Bio3 while the compost and Bio2 gave the highest number of days (Latest flowering).

Bio.4 gave significantly higher number of inflorescences per plant than Bio.3 and the control. The differences between the rest of the treatments were not significant. Only Bio.4 gave significantly higher inflorescence diameter than the control. The differences between the rest of the treatments were not significant. These result are in agreement with those of Ali *et al.* (2014) who investigated the effect of biofertilizers on vegetative growth, flower quality, bulb yield and nutrient uptake in gladiolus (*Gladiolus grandiflorus L.*) and found improvement of vegetative and reproductive growth by application of biofertilizers. The results are also in accordance with that of El-Quesni *et al*. (2013) who studied the impact of some biofertilizers and compost on growth and chemical composition of *Jatropha curcas* L. and found that all treatments significantly promoted all growth parameters than control plants. The

added biofertilizers my have increased phosphorus content of the soil as a result of phosphate dissolution. Growth promoting substances such as indole acetic acid and gibberellins that may have been produced by organisms used may have stimulated establishment and elongation of root hairs and increased their number and hence enhanced uptake of nutrients leading to improved growth. Application of compost might favorably affect soil pH, microbial population and soil enzyme activities leading to improved growth. As a conclusion, addition of Bio4 to the gerbera growing medium seems to be a reasonable choice. However, addition of compost together with Bio4 may lead to better results and this requires further investigation.

Table 1. Effect of some biofertilizers and compost on growth of gerbera (*Gerbera jamesonii*) twenty four weeks after planting.

Treatments	Plant height (cm)	Number of leaves per plant	Leaf length (cm)
Control	10.900[b]	5.667[b]	8.167[b]
Compost*	18.167[a]	12.167[a]	11.600[a]
Bio1	20.067[a]	8.500[ab]	12.000[a]
Bio2	15.067[ab]	6.333[ab]	12.667[a]
Bio3	18.000[a]	11.167[ab]	11.300[ab]
Bio4	18.733[a]	9.000[ab]	11.933[a]

Means followed by the same letter (letters) in a column are not significantly different (P=0.05) according to Duncan's Multiple Range Test.
*Compost: Al-khirat.
Bio1: Nitrogen fixing bacteria (*Rhizobium sp.*).
Bio2: Phosphorus solubilizing bacteria (*Bacillus megatherium var. phosphaticum*)
Bio3: Potassium solubilizing bacteria (*Bacillus circulans*).
Bio4: Combination between Bio.1, Bio.2 and Bio.3.

Table 2. Effect of some biofertilizers and compost on flowering of gerbera (*Gerbera jamesonii*).

Treatments	Days to first flower bud formation	Number of Inflorescences per plant twenty four weeks after planting	Inflorescence diameter (cm)
Control	140.3[a]	1[b]	3.17[b]
Compost*	158.3[a]	1.33[ab]	3.83[ab]
Bio1	154.6[a]	1[b]	6.83[ab]
Bio2	158.6[a]	1.33[ab]	6.00[ab]
Bio3	154.6[a]	0.67[b]	4.67[ab]
Bio4	145.6[a]	3[a]	8.43[a]

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

*Compost: Al-khirat.

Bio1: Nitrogen fixing bacteria (*Rhizobium sp.*).

Bio2: Phosphorus solubilizing bacteria (*Bacillus megatherium var. phosphaticum*)

Bio3: Potassium solubilizing bacteria (*Bacillus circulans*).

Bio4: Combination between Bio.1, Bio.2 and Bio.3.

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تأثير بعض الأسمدة الحيوية و الكومبوست على نمو وازهار نبات الجيربرا (*Gerbera jamesonii* Bolus)

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المستخلص: هدف البحث لدراسة تاثير بعض الاسمدة الحيوية والكومبوست على نمو و ازهار نبات الجيربرا. الاسمدة المضافة هى البكتيريا المثبتة للنيتروجين (*Rhizobium sp.*) (**Bio.1**)، البكتيريا المذيبة للفسفور (*Bacillus megatherium var. phosphaticum*) (**Bio.2**)، البكتيريا المذيبة للبوتاسيوم (*Bacillus circulans*) (**Bio.3**) ومزيج من اللقاحات السابقة (Bio.1+ Bio.2 +Bio.3) (**Bio.4**) والكومبوست بمعدل 8.1 كلجم من السماد لكل 9 كلجم من التربة والشاهد. اظهرت النتائج استجابة نبات الجيربرا لإضافة السماد الحيوي و الكومبوست. كل المعاملات عدا Bio2 أعطت معنويا أعلى قيم لارتفاع النبات مقارنة بالشاهد. الكومبوست اعطى اعلى قيمة لعدد الاوراق بالنبات بدرجة معنوية مقارنة بالشاهد. في ما يتعلق بطول الورقة كانت كل المعاملات عدا Bio3 اعلى من الشاهد بدرجة معنوية. بالرغم من أن الفرق بين المعاملات لم يكن معنويا فقد أظهر الشاهد ازهارا أكثر تبكيرا بينما نتج عن الكومبوست و Bio2 ازهارا أكثر تأخيرا. اعطى **Bio.4** بدرجة معنوية اعلى عددا للنورات بالنبات وقطرا للنورة.

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