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Research Article

Evaluation of media, organic and chemical fertilizer applications on growth of pot gerbera (Gerbera jamesonii)

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Abstract

Pot gerbera is a beautiful compact ornamental variety that can be a high value commercial pot plant. Growing gerbera seedlings in a small container with a limited amount of growing media, requires a high level of fertilizing to vitalize plant growth up to the flowering stage. This experiment aimed to evaluate the growing media and fertilizer applications for pot gerbera cultivation. The trial was laid out in a randomized complete block design with 13 treatments and 4 replications per treatment. A variety of pot gerbera seedlings derived from in vitro culture was grown in 7 different media; six seedlings were fertilized with aged cow manure and/or pig manure, while one medium contained no organic fertilizer. Beginning one week after transplanting, the plants grown in media with farm manure were treated with either organic fertilizer, in the form of a pig manure extract, or with chemical fertilizer. The plants in the medium without farm manure were treated only with chemical fertilizer. Plant growth was recorded in 2-week intervals from 4 - 20 weeks after transplanting. The average number of leaves, plant height, canopy width and flower number per pot varied significantly by treatment. All treatments with chemical fertilizer showed the best performance with maximum values in leaf and flower number. Meanwhile some media which were treated with pig manure extract also performed well. The results from this research revealed a potential for growing pot gerbera using organic fertilizers alone.

Keywords: pot gerbera; organic fertilizer; chemical fertilizer; pig manure extract

Introduction

Producing pot gerbera from seedlings to the flowering stage requires a high level of fertilizer, which can be mixed in the growing medium or treated during the growing period. The essential nutrients can be provided in the form of either organic or chemical fertilizers. Research by Anuje *et al.* [1] evaluated different media used for gerbera cultivation under polyhouse conditions and reported that the medium consisting of red soil + farmyard manure in a 1:1 ratio recorded the maximum values for plant height and flower stalk length. In their research the medium consisted of cocopeat and farmyard manure in a 1:1 ratio recorded the maximum values for leaf number, flowers per plant, flower diameter and vase life as well as the time to earliest flowering. The thickest flower stalk was observed in the medium containing cocopeat + garden soil + farmyard manure in 1:1:1 ratio [1]. Similar work in a in glasshouse, found that the best media was a mix of saw dust: ash bran: organic manure (v/v) = 7:7:6 [2]. The present research aimed to evaluate media, organic and/or chemical fertilizer applications on the growth of pot gerbera in order to determine the potential for growing pot gerbera using organic fertilizers alone.

Materials and Methods

The trial was laid out in randomized complete block design with 13 treatments and 4 replications per treatment, at the Faculty of Science and Agricultural Technology, Rajamangala University of Technology Lanna, Phitsanuloke Campus during November 2008-April 2009. A variety of dark pink petal pot gerbera seedlings derived from *in vitro* culture were grown in 6 inches plastic pots that contained 7 different media; six of them were fertilized with cow manure and/or pig manure, while one medium contained no organic fertilizer.

Plants were watered once in the mornings. Beginning one week after transplanting, the plants grown in media with farm manure were treated with either organic fertilizer (T1-T6), in the form of pig manure extract, or with chemical fertilizer (T7-T12). The plants in the medium without farm manure (T13) were treated only with chemical fertilizer.

The pig manure extract was obtained by soaking dried pig manure in water at a ratio of 1:10 (w/w) for 24 hours and the clear solution was filtered to use as organic fertilizer. Treatments 1-6 received a daily 1:20(v/v) water dilution of pig manure extract, instead of plain water, for up to 8 weeks old seedlings. After 8 weeks the concentration was changed to a 1:10(v/v) up the completion of the research. All of plants in T1-T6 were also treated with 2 tablespoons of dried cow manure at 4 and 8 weeks after transplanting.

Each plant in the T7-T13 treatments was fertilized with ½ teaspoonful of 16-16-16 chemical fertilizer and watered with 2 tablespoons dissolved in 20 litres of water once a week. Two foliar sprays were applied at 2-week intervals by dissolving a 21-21-21 chemical fertilizer in 20 liters of water. At 10 weeks after transplanting, the 14-14-14 osmocote and the 12-24-12 chemical fertilizers were applied at ½ teaspoonful per pot and the plants were sprayed with 10-52-17+TE at a rate of 25 gm/ 20 litres of water once a week.

As the pot gerbera plants grew up and the media dried out faster, then plants were supplied with plain water one more time in the afternoons.

The physical and chemical properties of the growing media were analyzed prior to planting. Plant growth was recorded in 2-week intervals from 4 - 20 weeks after transplanting.

Results and Discussion

The physical and chemical properties of the growing media prior to planting are shown in Table 1. The average leaf number per plant varied significantly for 6-12 and 16-20 weeks old plants. Although at the flowering stage the pot gerbera plants that were treated with chemical fertilizer showed a trend toward greater leaf numbers, no significant differences were found when compared to T1, T3 and T5, which were treated with pig manure extract (Table 2).

Table 1. Physical and chemical properties of growing media used for growing gerbera in pots.

Growing media	Physical properties		Chemical properties						
	Density g/c.c.	Porosity (%)	pH	Organic matter g/100g	Organic carbon g/100g	Total N g/100g	C/N ratio	P mg/kg	K mg/kg
T1 and T7	1.06	33.33	6.52	5.26	3.05	0.276	11.1	1320	779
T2 and T8	0.66	36.19	6.96	13.61	7.90	0.552	14.3	2314	1476
T3 and T9	0.88	20.95	7.08	6.55	3.80	0.421	9.0	1072	1939
T4 and T10	0.75	39.04	6.91	9.74	5.65	0.291	19.4	1092	1502
T5 and T11	0.56	62.85	6.35	11.51	6.68	0.282	23.6	1545	797
T6 and T12	0.71	52.38	7.32	5.25	3.05	0.297	10.2	802	1378
T13	0.46	66.66	6.75	10.22	5.93	0.174	34.0	423	1616

T1 and T7 soil : sand : pig manure = 1:1:1
T2 and T8 soil : paddy husk charcoal : pig manure = 1:1:1
T3 and T9 soil : paddy husk charcoal : cow manure = 1:1:1
T4 and T10 soil : sand : paddy husk charcoal : coconut coir dust : pig manure : cow manure = 2:2:2:2:1:1
T5 and T11 soil : sand : paddy husk charcoal : pig manure = 1:1:3:3
T6 and T12 soil : sand : paddy husk charcoal : cow manure = 1:1:3:3
T13 soil : sand : paddy husk charcoal : coconut coir dust = 1:1:3:3

Table 2. Average leaf number per plant of pot gerbera at 4-20 weeks after transplanting.

Treatment	Average leaf number per plant								
	4	6	8	10	12	14	16	18	20 weeks
T1	7.27	13.03 A[z]	18.23 A	25.80 A	28.97 A	24.70	26.44 AB	27.65 ABC	24.68 BCD
T2	6.75	9.38 BC	14.00 ABC	18.31 BC	19.70 BCDE	18.43	19.32 BC	20.76 CD	19.38 D
T3	7.00	11.08 ABC	15.20 ABC	18.15 BC	23.15 BCD	23.58	22.50 ABC	24.59 BCD	28.48 ABC
T4	6.30	9.23 BC	12.05 BC	14.13 CD	18.64 CDE	20.20	17.19 C	17.83 D	16.61 D
T5	5.98	11.19 ABC	15.85 AB	19.81 B	23.69 BC	21.79	22.01 ABC	22.68 CD	23.05 BCD
T6	6.76	8.53 C	12.95 BC	14.57 CD	19.93 BCDE	21.18	18.58 BC	19.76 CD	22.11 CD
T7	8.19	11.06 ABC	12.67 BC	16.19 BC	24.50 AB	24.44	29.69 A	33.94 A	30.06 ABC
T8	7.56	12.31 AB	16.73 AB	17.67 BC	20.84 BCDE	27.15	29.04 A	32.88 AB	35.44 A
T9	6.33	10.42 ABC	12.69 BC	13.89 CD	16.90 EFG	19.54	19.69 BC	25.59 ABCD	29.75 ABC
T10	6.32	10.10 ABC	14.04 ABC	13.60 CD	17.89 DEF	19.92	24.00 ABC	24.44 BCD	30.83 ABC
T11	7.23	11.26 ABC	13.62 BC	15.57 BCD	18.93 CDE	23.22	30.21 A	33.75 A	32.05 AB
T12	5.60	8.23 C	12.04 BC	14.27 CD	12.00 G	18.73	23.27 ABC	28.25 ABC	30.71 ABC
T13	6.03	9.00 BC	11.04 C	10.50 D	13.29 FG	17.42	24.00 ABC	23.95 CD	32.00 AB
C.V.(%)	23.85	19.12	20.12	19.57	16.96	21.06	22.41	20.44	20.00

[z]Mean separation in columns by Duncan's new multiple range test, 5% level.

Plant canopy width showed significance at 10-20 weeks after transplanting. Most of the treatments with chemical fertilizer gave a wider canopy than those treated with pig manure extract, except for T1 (Table 3).

Plant height was also significant at 10-20 weeks after transplanting. At the blooming stage, gerbera in T4 and T6 were shortest but not significantly different compared to T9, T10, T12 and T13 (Table 4).

Table 3. Average canopy width of pot gerbera at 4-20 weeks after transplanting.

Treatment	Average canopy width (cm.)									
	4	6	8	10	12	14	16	18	20	weeks
T1	11.60	12.79	13.59	16.01 AB[z]	17.41 A	18.35 AB	20.48 AB	22.28 AB	18.89 ABCD	
T2	10.62	12.06	13.42	16.48 A	14.97 ABC	19.13 A	18.81 ABCD	17.20 C	16.16 CD	
T3	11.26	11.80	11.98	12.84 C	13.98 ABCD	17.18 ABC	17.83 ABCD	16.23 C	17.11 BCD	
T4	11.14	11.18	12.33	12.54 C	13.16 BCD	15.51 ABCD	15.40 D	15.44 C	13.58 D	
T5	10.80	11.34	12.45	12.48 C	14.56 ABC	16.87 ABCD	17.12 BCD	17.90 BC	18.07 BCD	
T6	9.96	10.46	11.11	12.00 C	10.39 D	17.29 ABC	18.13 ABCD	17.64 BC	15.80 CD	
T7	10.06	12.06	13.24	14.81 ABC	16.67 AB	18.88 A	21.13 A	20.31 ABC	23.69 A	
T8	10.40	12.57	12.42	13.92 ABC	12.93 BCD	18.46 AB	20.43 AB	23.15 A	22.50 AB	
T9	9.81	10.66	10.85	11.79 C	11.81 CD	15.35 ABCD	16.75 BCD	18.33 ABC	19.91 ABC	
T10	10.37	11.39	11.81	12.35 C	11.58 CD	13.19 D	15.87 CD	16.08 C	16.71 CD	
T11	9.96	11.67	12.30	13.97 ABC	14.18 ABCD	17.25 ABC	19.73 ABC	19.94 ABC	20.12 ABC	
T12	9.99	11.87	11.62	12.79 C	11.95 CD	14.92 BCD	16.50 CD	16.36 C	22.56 AB	
T13	10.65	12.53	12.90	13.46 BC	13.69 ABCD	13.92 CD	16.56 BCD	18.95 ABC	21.00 ABC	
C.V.(%)	14.39	12.90	11.25	13.42	18.03	14.03	13.06	16.67	17.66	

[z]Mean separation in columns by Duncan's new multiple range test, 5% level.

Table 4. Average plant height of pot gerbera at 4-20 weeks after transplanting.

Treatment	Average plant height(cm.)									
	4	6	8	10	12	14	16	18	20	weeks
T1	6.14	6.33	7.08	9.23 AB[z]	10.87 A	10.59 AB	11.28 AB	11.53 ABC	10.38 ABC	
T2	6.20	6.50	7.50	9.78 A	10.07 AB	9.91 ABCD	10.04 ABC	8.68 CD	9.91 ABC	
T3	6.60	6.57	6.39	8.09	7.98 CDE	9.08 ABCD	9.71 BC	9.98 BCD	9.81 ABC	
T4	5.79	6.09	5.79	7.40 BCD	8.25 BCDE	8.35 BCD	8.91 C	8.41 D	8.57 C	
T5	6.61	6.71	7.17	7.76 BCD	9.14 ABCD	9.01 ABCD	9.79 BC	9.60 BCD	11.40 ABC	
T6	5.39	5.66	5.96	6.90 CD	8.70 BCD	10.08 ABC	9.81 BC	9.29 BCD	8.65 C	
T7	5.94	6.84	8.00	8.87 ABC	9.62 ABC	11.08 A	11.78 AB	12.09 AB	13.03 A	
T8	5.80	7.25	7.09	8.20	7.80 CDE	10.56 AB	11.76 AB	13.18 A	12.66 AB	
T9	5.71	5.85	6.12	7.39 BCD	7.39 DE	9.18 ABCD	9.68 BC	8.94 CD	10.69 ABC	
T10	5.40	6.36	6.46	6.91 CD	8.09 BCDE	7.57 D	8.83 C	9.34 BCD	9.38 BC	
T11	6.45	7.37	6.95	8.37	8.30 BCDE	9.67 ABCD	12.05 A	11.21 ABCD	12.37 AB	
T12	6.33	6.76	6.72	7.12 CD	6.61 E	8.14 CD	10.37 ABC	10.34 BCD	10.56 ABC	
T13	6.55	7.16	6.67	6.79 D	7.22 DE	8.10 CD	10.06 ABC	10.16 BCD	10.88 ABC	
C.V. (%)	14.17	13.04	13.30	15.03	14.58	15.29	12.69	16.88	18.50	

[z]Mean separation in columns by Duncan's new multiple range test, 5% level.

The days from transplanting to bloom, length of flower stalk and diameter of blooming were not significantly different between treatments. Only the average flower number per pot showed significant differences. All of gerbera treated with chemical fertilizers (T7-T13) and some of those treated with organic fertilizers (T2, T3 and T6) produced a larger flower number per pot (Table 5).

Table 5. Average days from transplanting to bloom, flower number per pot, length of flower stalk and diameter of blooming for pot gerbera.

Treatment	Days from transplant to bloom	Number of flower per pot	Length of flower stalk (cm.)	Diameter of blooming (cm.)
T1	114.08	1.13 C[z]	17.56	6.52
T2	106.63	1.88 ABC	14.09	7.47
T3	119.00	1.88 ABC	12.15	6.01
T4	120.06	1.44 BC	11.29	6.26
T5	112.50	1.13 C	15.63	6.88
T6	118.00	1.75 ABC	10.22	7.34
T7	107.29	1.96 ABC	12.51	5.36
T8	112.46	2.96 A	13.69	6.22
T9	124.42	3.17 A	13.87	5.46
T10	113.75	2.00 ABC	13.33	5.42
T11	112.29	2.73 AB	16.31	6.63
T12	127.71	3.00 A	12.31	6.98
T13	130.75	3.00 A	15.51	6.17
C.V. (%)	15.25	39.88	22.15	23.98

[z]Mean separation in columns by Duncan's new multiple range test, 5% level.

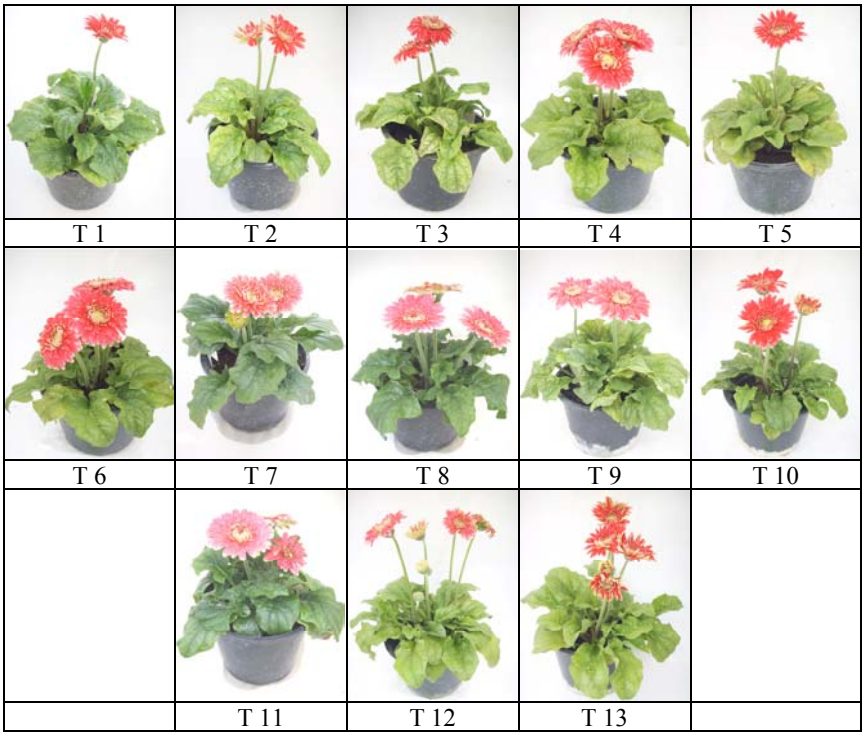

Figure 1. Blooming stage of each treatment in pot gerbera treated with chemical and organic fertilizers.

The blooming for each treatment is shown in Figure 1. The disadvantage of using chemical fertilizer, found in this experiment, was that every pot had salty remains at the lower outer section of the pots (Figures 1 and 2). The results of this research show some advantages from utilizing farm manures for growing gerbera, which corresponds to the results obtained by earlier reports [1, 2]. Hence the cost of pot gerbera production in the future could be reduced by using less or no chemical fertilizers.

Figure 2. Pot of gerbera treated with organic fertilizer (A) was clean while the one treated with chemical fertilizer (B) had salty residues at the lower outer section of the pot.

Conclusion

The average leaf number, plant height, canopy width and flower number per pot varied significantly by treatment. Pot gerbera planted in any kind of media when treated with chemical fertilizer showed the best performance by maximum values in terms of leaf and flower number. Meanwhile some media that contained farm manure and that were treated with pig manure extract also performed well, in terms of the measured growth parameters.

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References

1. Anuje, A.A., Dalal, S.R., Gonge, V.S. and Deshpande, R.M. (2004). Effect of growing media on growth, flowering and yield of gerbera under polyhouse conditions. **Orissa Journal of Horticulture**, Vol. 32(2), pp. 106-108.

2. Wang MinYan, Wu LiangHuan, Zhu WeiGen and Zhang YongYong. (2005). Study on good quality and high effective eco-organic culture medium of *Gerbera jamesonii*. **Acta Agriculturae Zhejiangensis**, Vol. 17(5), pp. 326-329.