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Effect of different ratios of municipal solid waste compost on growth parameters and yield of Marigold (*Calendula officinalis* Moench.) and Daisy (*Bellis Perennis* L.).

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Abstract

In a country like Iran, where soil organic matter is less than 1% and in most cases even less than 0.5 %, Municipal solid waste (MSW) is a permanent and inexpensive source of organic matter. Various experiments have indicated that applications of compost improve plant health, yield and nutritional quality. However, the quality of the compost determines the growth and the development of plants. The purpose of this study was evaluating the effect of different ratio of organic compost from urban waste on the growth of two Ornamental plants, Marigold (*Calendula officinalis* Monch.) and Daisy (*Bellis Perennis* L.). Five treatments (potting-mixes) were used, soil (Clay, Silt and sand with 1:1:1 ratios) (as a control),the soil with 25% compost, the soil with 50% compost, the soil with 75% compost and 100% compost. Fresh and dry-weight of shoots and roots, plant height, and chlorophyll content were measured. The results of this study confirm the beneficial treatment to improve the growth parameters is 25% and 50% compost in *alendula officinalis* and 25% compost in *Bellis perennis.*

Key words: Municipal solid waste (MSW), *Calendula officinalis* Monch, *Bellis Perennis* L.

Introduction

One of the main concerns in the management of a modern city is proper disposal of municipal waste. Every Iranian produces approximately 500 to 800 grams of waste per day. Approximately, 76% of it can be turned into compost. In a country like Iran, where soil organic matter is less than 1% and in most cases even less than 0.5 %, Municipal solid waste (MSW) is a permanent and inexpensive source of organic matter. A survey of MSW compost reported that on average, 20% of the total C in MSW compost was organic C, 8% carbonate C, and 71% residual C which may have included organic C components (He et al., 1995). It can be used as a suitable alternative to chemical fertilizers. Municipal solid waste is largely made-up of kitchen and yard waste, and its composting has been adopted by many municipalities (Otten,

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2001). Compost is produced through the activity of aerobic (oxygen requiring) microorganisms. These microbes require oxygen, moisture, and food in order to grow and multiply. The use of solid residues for the rational production of compost has started about a century ago (Espinoza, 1997). MSW compost increased the aggregate stability of soil through the formation of cationic bridges thereby, improving the soil structure (Hernando et al., 1989).

Various experiments have indicated that applications of compost improve plant health, yield and nutritional quality (Al-Dahmani et al., 2003). Researchers conducted by Lima et al. (2004), proved the beneficial action of compost on the physical–chemical properties of the soil and on the plant development. Ramadass and Palaniyandi (2007) concluded that the amount of nitrate nitrogen and ammonium nitrogen content were found significantly maximum in enriched compost applied soil. In addition, soil available phosphorous, potassium and micronutrients content were found to be higher under the enriched compost applied soil. Pant, et al., (2012) demonstrated that compost quality impacted: nutrient extraction efficiency, microbial activity, phytohormonesand, total nutrient content of the extracts. These differences in extract quality in turn influenced growth and tissue mineral nutrient content of pak choi.

The purpose of this study was evaluating the effect of different ratio of organic compost from urban waste on the growth of two Ornamental plants, Marigold (*Calendula officinalis*) and Daisy (*Bellis Perennis*).

Material and methods

The experiment was carried out at the Green House of Kerman Municipal, Iran. Five treatments (potting-mixes) were used, soil (Clay, Silt and sand with 1:1:1 ratios) (as a control),the soil with 25% compost, the soil with 50% compost, the soil with 75% compost and 100% compost. Each potting-medium was repeated 4 times (4 replications) and laid in a randomized complete block design. Chemical analysis of compost was shown in table 1. Plantlets were transplanted into pots having a diameter of 22×30×30 cm. On the first day of planting (Fifth December 2012) all the pots were watered equally. The data were recorded five weeks after the transplantation. Fresh and dry-weight of shoots and roots by putting them in an oven at 70°C for 48 hours, height of each plant, and chlorophyll content were measured.

Chlorophyll content was determined according to the method of Lichtenthaler (1987). Shoot samples (0.25 g) were homogenized in acetone (80 %). Extract was centrifuged at 3000×g and absorbance was recorded at wavelengths of 646.8 and 663.2 nm.

Chl. a= (12.25 A663.2- 2.79 A646.8), Chl. b= (21.21 A646.4- 5.1 A663.2)

Table 1: Chemical properties of the compost

pH	EC	N	P	K	Fe	Zn	Cu	Mn
7.3	4.8 dsm^{-1}	0.9%	0.6%	0.9%	1.32%	0.07%	0.03%	0.03%

Statistical analysis

Data for each parameter were subjected to ANOVA and significant differences between treatment means were determined by LSD using the SPSS software. Data are shown as means with three replicates and significance was determined at the 95% confidence ($p \leq 0.05$) limits.

Results

25% and 50% Compost significantly increased the plant height while 75% 100% compost significantly reduced the plant height of *Calendula officinalis.* In *Bellis perennis*, 25% compost significantly increased the plant height compost of 50% significantly reduced plant height and compost of 75% and 100% will cause plant death (Fig.1).

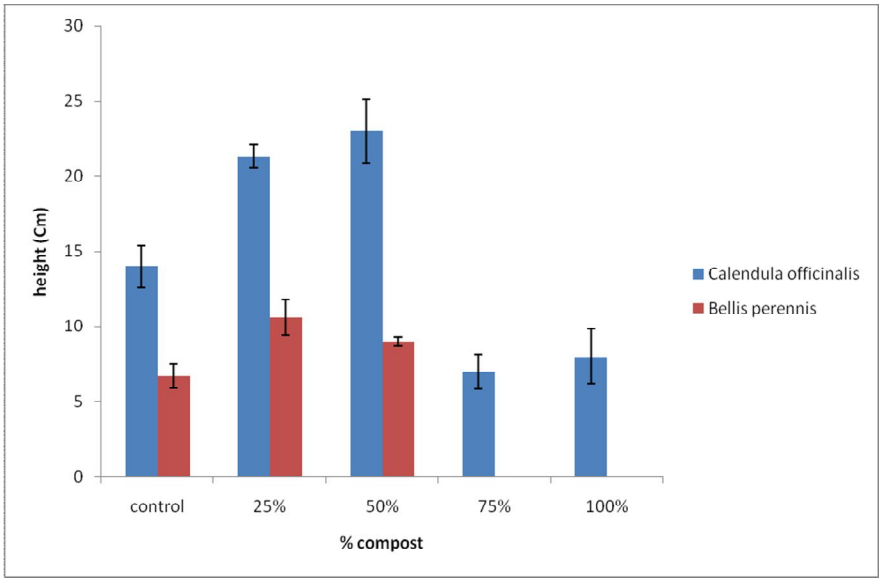

Fig 1- Effect of different levels of compost on on plant height (Mean±SE)

The results data variance analysis indicated that 25% of compost significantly increased roots and shoots fresh weight of *Calendula officinalis.* In *Bellis perennis* Compost 75% and 100%, causing wilting and death of *Bellis perennis* but the shoots and roots dry and fresh weight of the Calendula plant was significantly reduced (Fig 2-5).

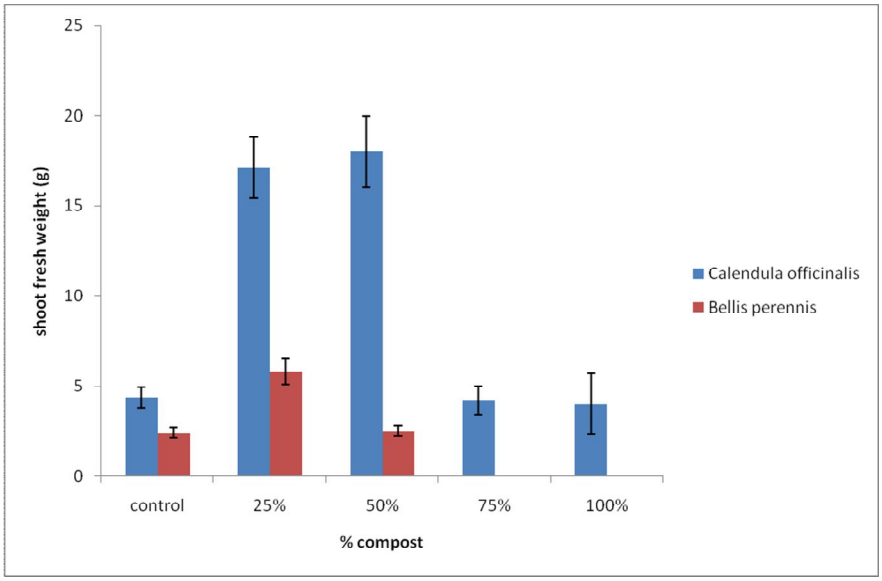

Fig 2- Effect of different levels of compost on shoot fresh weight

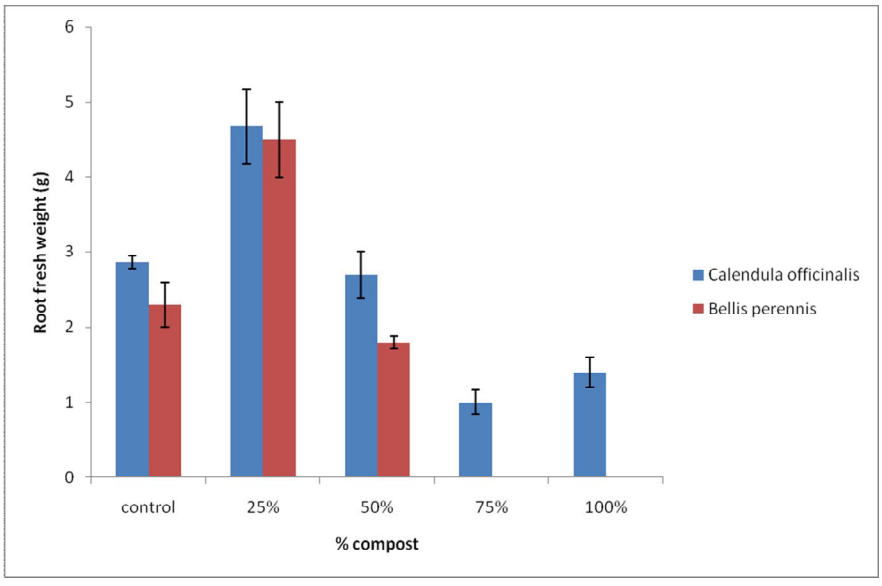

Fig 3- Effect of different levels of compost on root fresh weight

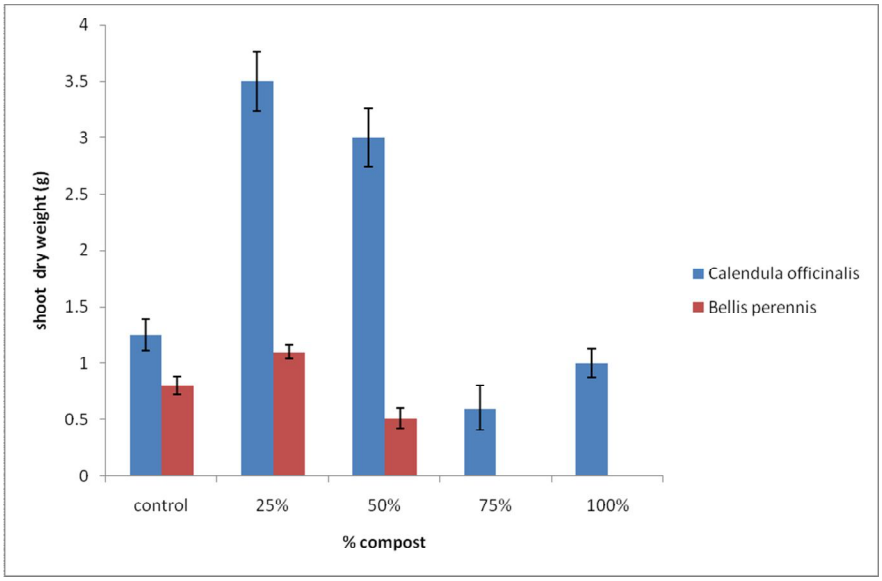

Fig 4- Effect of different levels of compost on shoot dry weight

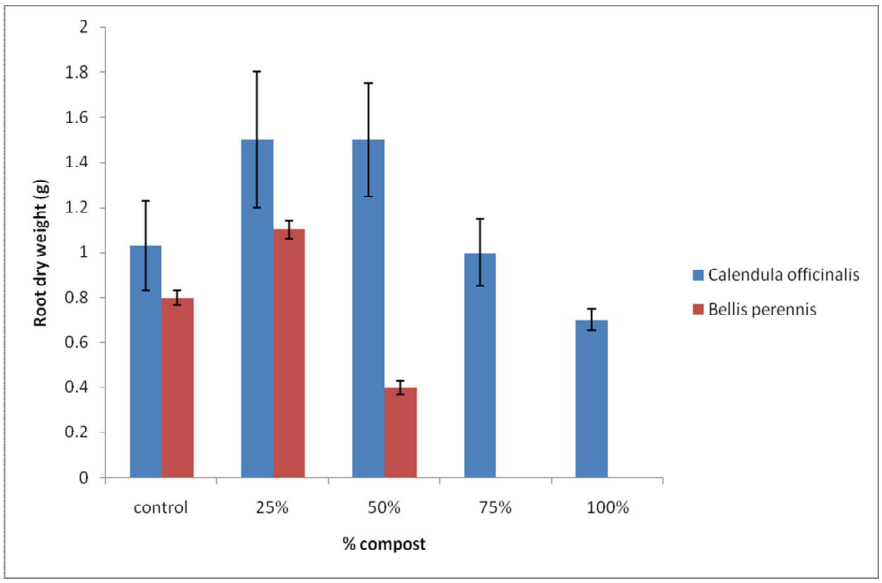

Fig 5- Effect of different levels of compost on root dry weight

25% compost significantly increased the total chlorophyll content of the Calendula plant. 50% and 75% compost had no significant effect on chlorophyll content. Level of 100% compost decreased the total chlorophyll content. In *Bellis perennis*, 25% compost increased the total chlorophyll content but Compost of 50% significantly reduced the total chlorophyll content (Fig.6).

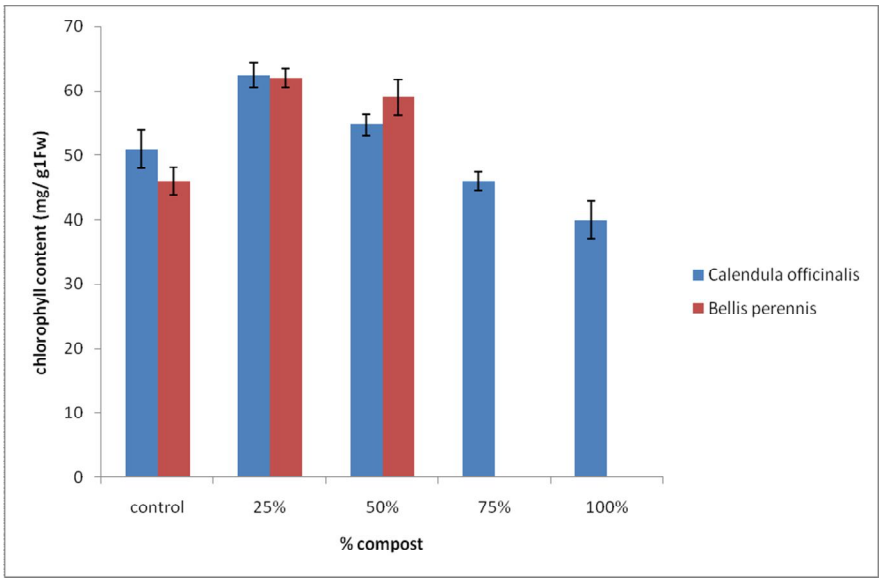

Fig 6- Effect of different levels of compost on total chlorophyll content (Mean±SE)

Discussion

According to the results of the present study, compost as a soil amendment can have considerable effects on plant growth and yield. However, results were not always positive and can vary depending on rates, compost maturity and available N (Cisar and Snyder, 1992). The results of this study confirm the beneficial treatment to improve the growth parameters is 25% and 50% compost in *Calendula officinalis* and 25% compost in *Bellis perennis.* These results are consistent with the result of Lima *et al* (2004) who concluded that the urban waste application contributes to increase the growth of corn plants. Wilson *et al* (2004) studied the use of compost in the production of four species of ornamental plants and found that the plants cultivated in MSW compost all growth parameters improved than the plants cultivated in pit. Francis (1985) proved that using 6% compost and some fertilizer produced marketable chrysanthemum. In this condition, the compost provides essential and non-essential elements required for plant. Results of Wilson et al., (2001) showed that increasing the amount of compost reduced plant height and shoot dry weight. Ribeiro *et al*., (2000) found that the addition of 10-20% MSW compost, increased growth and yield of *Geranium.*

Furthermore, application rates of 30 and 60 Mg ha^{-1} of MSW compost increased the aggregate stability of soil through the formation of cationic bridges thereby, improving the soil structure (Hernando *et al*., 1989). Improve plant growth after compost addition is related to increases of biomass N, C, and S (Perucci, 1990). Application of 2.5, 10, 20, and 40 Mg ha^{-1} MSW compost increased soil microbial biomass C and soil respiration when compared to a control (Bhattacharyya *et al*., 2003).

This study also showed with increasing the compost up to 50-75% decreases growth parameters and 75-100% compost leading to plant death. This is may be due to the excessive salt content of the municipal solid waste compost (Alvarenga *et al.*, 2007), the major factor limiting the use of certain composted wastes, because it generates phytotoxicity in some plants. Compost with a C/N ratio of less than 20 are

ideal for plant production (Davidson *et al.*, 1994) and ratios above 30 may be toxic, causing plant death (Zucconi *et al.*, 1981). Similar results are reported by Kasthuri *et al.*, (2001), Simone and Taylor (2003), Noguera *et al.*, (2003).

In this study significant increase in the chlorophyll concentration was observed in the 25% and 50% compost. In a study conducted by Kasthuri (2011) on green gram (*Vigna radiata* (L) wilczek) and fenugreek (*Trigonella foenum-graecum* L) no dosage effect was detected for total chlorophyll synthesized. Lima *et al*., 2004 reported the chlorophyll did not prove to be an efficient parameter to evaluate the effect of compost on the corn physiology. Increase in chlorophyll content in this experiment could be the result of stress by toxic elements in compost.

Electrical conductivity (EC) of the soil solution is related to the dissolved solutes content of soil and is often used as a measurement of soil salt content (Brady and Weil, 1996). A survey of selected United States MSW composts found that the EC of the composts were much higher than that of agricultural soils and their use in agriculture could potentially inhibit seed germination (He *et al*., 1995). Agricultural soils EC levels range from 0 to 4 dS m^{-1} while

MSW composts ranged from 3.69 to 7.49 dS m^{-1} (Brady and Weil, 1996). Noguera *et al.*, (2003) suggested low soluble salt levels (EC < 3.5 dS cm^{-1}) are suitable for potting compost. The EC of MSWC used in the present study was exceeding the limit recommended by Noguera *et al.*, (2003).

In conclusion the utilization of MSWC in low dose improved yield and growth of Marigold and Daisy. This experimental study shows that the best efficiency was obtain in 25% compost.

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