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The use of municipal wastes, azolla and tea wastes composts as the growth medium of English daisy

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ABSTRACT

The impact of municipal solid waste compost, Azolla, tea wastes on the growth and yield of English Daisy (Bellis perennis) was evaluated by an experiment based on randomized completely block design with 15 treatments in 3 replications. The experiment was conducted in a field located in Lakan village around Rasht, Guilan province, Iran. The height of plant, fresh and dry shoot weight were determined. The size and number of flowers in full bloom period of growth in each pot was recorded. Harvested branches transferred to the laboratory in an oven at 75 ° C, dried and then weighed. Kjeldal method was used to measure nitrogen. Spectrophotometer and flame photometer were used to measure phosphorus and potassium, respectively. Results showed the combined medium of control, municipal wastes compost and Azolla compost increased plant height; shoot dry weight, number of flowers and nitrogen and potassium uptake.

Keywords: *Bellis perennis*, Nutrients, Organic wastes, Rasht.

INTRODUCTION

English Daisy is a perennial plant to grow as wild in grasslands, wetlands and forest lands of Europe and West Asia [1]. Daisy is such a beautiful plant planted, mostly, because of the beautiful and seasonal flowers (white or reddish flowers) and resistant to cold. The nutrition management of ornamental plants has an important role in increasing the production and quality of these plants. Today, many substances have been used as media substrates of ornamental plants [2].

There is a principal problem in urban landscape of Rasht, Guilan province, is to plant of this flower in the experimental medium without fertilization. Consequently, it decreases plant growth and its longevity. It can be used from organic wastes available in region as the medium growth. Approximately 62-68 thousand cubic meter tea wastes are produced in tea factories of Guilan province. There is, also, high amount of Azolla in ponds of province especially Anzali pond that have been evolved as a basic problem [3]. In recent years due to increasing urbanization and the production of large volumes of waste, compost derived from sewage and agriculture [4], composting of municipal solid waste and irrigation with sewage [5] are common as sources of soil organic matter. The Skin of broadleaf and conifers trees, sewage sludge, sawdust, composted bed of edible mushrooms, municipal wastes compost are used as substrates in the medium of ornamental plants [6-8]. Use of domestic wastewater and compost in agricultural lands solves two problems: the first, wastewater consumption and second, increase in soil organic matter and nutrients for plants.

The effect of sewage sludge, municipal wastes compost and manure on the growth and yield of marigold and nutrients uptake were found that these wastes increased the growth of plant and the highest uptake of iron, zinc,

manganese and nickel was obtained by municipal wastes compost [9]. The municipal compost and sewage sludge their interaction impacts on the height, number of capsules per plant, number of seeds per capsule, seed number per plant, seed weight per plant, seed weight plant of sativa (medicinal plant) had a significant impact [10].

MATERIALS AND METHODS

The seed of English Daisy from seed company Mina Farid in Tehran and were planted in plots of garden soil (60% v/v soil + 20 % v/v manure + 10% sand, 10 % composted leaves). The produced seedlings were the same size and 5-6 leaves to transfer to pots containing various substrates. Municipal waste compost from municipal waste recycling plant in Lacan, Rasht was purchased. Tea wastes compost was purchased from tea research station. Composted Azolla Agriculture was prepared from Rice Research Institute of Iran located, rasht, Guilan province. After providing substrates, they first passed through a sieve with 5 mm and these substrates were combined in pots 4 L as the volume ratios in Table 1.

The pots were transferred to field base on design plan and they were disinfected with fungicide. The height of the plant from crown above the tallest plant leaves was determined by the ruler. The number of flowers was recorded in full bloom period of growth in each pot. From each pot, three leaves were selected and their chlorophyll content by chlorophyll meter was measured and the mean of three leaves were recorded. The Height of flowering stem was measured in each pot. In addition to shoot weight, root weight was also measured.

Table 1. The substrates used in different treatments of experiment

Treatment Number	Treatment
1	**control** (60% v/v soil + 20 % v/v manure + 10% sand, 10 % composted leaves)
2	100% Tea wastes compost
3	100% Municipal wastes compost
4	100% Azolla compost
5	50% control + 50% Tea wastes compost
6	50% control + 50% Municipal wastes compost
7	50% control + 50% Azolla compost
8	50% Tea wastes compost + 50% Municipal wastes compost
9	50% Tea wastes compost + 50% Azolla compost
10	50% Municipal wastes + 50% Azolla compost
11	33.3% control + 33.3% Tea wastes compost + 33.3% Municipal wastes compost
12	33.3% control + 33.3% Tea wastes compost + 33.3% Azolla compost
13	33.3% control + 33.3% Municipal wastes compost + 33.3% Azolla compost
14	33.3% Tea wastes compost + 33.3% Municipal wastes compost + 33.3% Azolla compost
15	25% control + 25% Tea wastes compost + 25% Municipal wastes compost + 25% Azolla compost

Harvested branches transferred to the laboratory dried in an oven set at 70°C for 48 h, and then weighed using a digital scale with an accuracy of a thousandth. Sub samples of dry matters were ground to provide dry-ashes in a furnace at 550°C and then extracted with 2M HCl. The concentrations of Ca, Mg, Fe, Mn and Zn were measured in the extracts by atomic absorption spectrophotometry, K by flame photometry, and P by spectrophotometry.

Some chemical properties of growth media were measured. Total kjeldahl nitrogen (TKN) and the total organic carbon (TOC) of the samples were estimated by using a microkjeldahl method [11] and Walkey and Blacks Rapid titration method [12], respectively. The pH and EC were determined on a water extract from compost using compost to water ratio of 1:5 by weight. Phosphorus by spectrophotometric method; potassium and sodium were determined by flame photometric methods.

The experiment was a completely randomized design with 15 treatments in three replications and MSTATC software was used for variance analysis of data by Least Significant Difference (LSD) test.

RESULTS AND DISCUSSION

Treatment effect on the growth indices

The Analysis of variance (Table 2) showed that the effect of substrates (growth media) on plant, shoot dry weight and flower numbers height was significant at 1% level. Results showed that the highest plant height obtained in the medium containing control, municipal waste compost and Azolla compost (Table 3). Similar results have been reported by Riberio et al. [13] and Vleeschauwer et al. [14]. The minimum height was observed in 100% Azolla compost. One of the most important indicators to evaluate the bed is the plant dry weight. The experimental data showed that the highest mean shoot dry weight and flower number in the context of municipal waste compost and control was observed (Table 3). The combining municipal compost nutrients-rich with control treatment containing 60% clay were caused to increase the medium productivity. Adding organic matter to soil improves physical and

chemical properties of soil to increase plant growth [15]. Organic fertilizers increase the soil cation exchange capacity [9]. Mcintosch et al. [16] also reported the use of municipal waste compost had significant effect on the growth of pine. Generally, the use of fertilizers increase the crop yield, but the response of plants to organic fertilizers differentiates in different soils.

Table 2. The Variance analysis of growth indices

Variation sources	Freedom degree	Plant height	Flower number	Shoot dry matter
Treatment	14	16.7**	412.06**	180.60**
Error	90	1.2	67.33	18.165

*** Significant at 1% level*

Table 3. The impact of treatments on the growth indices of plant

Treatment Number	Plant height	Flower number	Shoot dry matter
1	7.93 ef	30.67cd	11.80 de
2	9.46bcd	34.22bcd	16.63bc
3	8.92Cde	26.11de	15.05Cd
4	7.29f	20.78e	9.62e
5	8.4def	34.22bcd	17.32 bc
6	10.92a	46.33a	23.77a
7	7.64f	28de	13.70Cde
8	11.04a	37.67abc	20.45ab
9	8.97 cde	32.78bcd	14.17Cd
10	10.51ab	43.89a	20.71ab
11	10.08abc	34.56bcd	22.60a
12	8.23def	28de	14.65Cd
13	11.3a	40.11ab	22.18a
14	10.8a	32.11bcd	22a
15	10.54ab	37.89abc	22.03a

Treatment effect on the concentration and uptake of nitrogen

The Analysis of variance (Table 4) showed that the effect of substrates (growth media) on nitrogen, phosphorus and potassium concentrations was significant at 1% level. Comparison of data showed that the municipal wastes compost, tea wastes and Azolla compost increased nitrogen uptake in plant than other substrates (Table 5). The increase in nitrogen uptake is due to the high yield and the high concentration of nitrogen in plant. The highest C/N ratio was observed in Control and control plus Azolla, consequently N uptake was the lowest. When the C/N ratio is high in organic matter, microorganisms get out nitrogen of bed. As a result, the amount of nitrogen reduces in the bed that this is nitrogen immobilization. The lowest concentration and uptake of nitrogen were measured in control, tea waste and Azolla compost that can be due the small amount of nitrogen in medium (Table 5). Researchers believe that adding organic matter to the soil may be reduce nitrogen uptake by plants, so more nitrogen fertilizer should be used to prevent nitrogen deficiency [17].

Table 4. The Variance analysis of nutrients (NPK) status in plant

Variation sources	Freedom degree	Concentration			Uptake		
		N	P	K	N	P	K
Treatment	14	12.5**	0.9**	0.77**	839354.61**	30600.48**	198922.68**
Error	90	0.59	0.04	0.11	30950.42	3502.2	18074.4

*** Significant at 1% level*

Table 5. The effect of treatments on concentration of nutrients in plant and nutrients uptake

Treatment Number	Concentration (%)			Uptake (mg/pot)		
	N	P	K	**N**	**P**	**K**
1	3.06fg	1.27b	2.17f	358.86g	149.96de	259.18fg
2	3.76e	1.28b	3.02ab	624.03de	216.73abc	504.65bcde
3	3.74e	0.35f	2.75bcde	562.80ef	49.98f	427.32cde
4	4.87c	1.21bc	2.08f	446.68efg	119.43dc	197.85g
5	2.41i	0.62e	2.95abcd	420.11fg	108.16ef	512.42bcd
6	2.46i	0.74e	2.59de	575.10ef	185.46bcd	610.22ab
7	2.93g	1.05cd	2.64cde	402.26fg	145.03de	365.0ef
8	4.47d	1.12bcd	2.75bcde	928.55bc	227.06abc	554.88abc
9	3.19f	1.52a	2.89abcd	449.56efg	216.53abc	407.32de
10	5.19b	1.16bcd	2.74bcde	1072.64b	238.76ab	566.58abc
11	2.69h	1.131bcd	2.62de	607.63de	257.33a	605.68ab
12	1.85j	1.02cd	2.51e	271.18g	147.02de	368.12ef
13	4.42d	0.55e	3.12a	981.32b	125.84de	686.38a
14	6.12a	0.74e	2.99abc	1345.52a	168.13cde	662.72a
15	3.55e	0.99d	2.85Abcde	778.93cd	226.37abc	640.20ab

Treatment effect on the concentration and uptake of phosphorus

Mean values showed the highest shoot P concentration in the tea waste and Azolla compost was observed and the maximum uptake obtained in the medium containing control, tea waste and municipal wastes compost (Table 5). Some researchers reported that organic matter increases soil available phosphorus and as indirect to prevent the precipitation of phosphate at pH 6 to 9 [18-19]. The overall uptake from soil by plants depends on several factors including nutrient solubility, pH of soil, plant species, fertilization method, the element concentration of fertilizers and soil type [20-21].

Treatment effect on the concentration and uptake of potassium

The highest concentration of potassium obtained in treatment containing control, municipal wastes compost and Azolla compost to increase potassium uptake (Table 5). The use of municipal wastes compost increased nutrients such as phosphorus, potassium, iron, zinc, copper to media that can be reason for increase nutrients availability and plant uptake [22-26]. The studies have been showed that organic wastes increase the availability of some nutrients as organic chelates [26-27].

CONCLUSION

Based on results, the growth medium containing control (60% v/v soil + 20 % v/v manure + 10% sand, 10 % composted leaves), municipal wastes compost and Azolla compost had the further impact on the plant growth. This treatment increased plant height, shoot dry weight, flower number, nitrogen and potassium uptake by plant.

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