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The Possibility Using the Composted Peanut Shells in the Growth of Marigold and *Viola tricolor* Plants

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Abstract

This research was conducted to evaluate the possibility using peanut shells compost as a suitable medium in cultivating ornamental plants. Effect of peanut shells composts on the growth of *Viola tricolor* and marigold was investigated during seven months. Peat + perlite (with a ratio of 2:1) used as control treatment and peat replaced by 25, 50, 75 and 100 % v/v of peanut shells compost. Plant growth indices, including height, stem, leaf fresh weights, stem and leaf dry weights were measured in marigold and *Viola tricolor* plants. Results showed that peanut shells compost had more effects on growth properties like height, stem and leaf dry weigh in comparison to control. The lowest growth was related to 100% peanut shells and control treatments. The most growth of *Viola tricolor* and marigold plants resulted respectively in 25% and 75% peanut shells compost, respectively. Results showed that increasing compost peanut shells as well as reducing the use of peat, can be effective on the growth of *Viola tricolor* and marigold plant.

Keywords: Compost, Peanut shells, Peat, Perlite, Plant growth.

INTRODUCTION

Nearly one million ton of agricultural and industrial wastes is annually produced in Iran, that through recycling can become an organic source. Unfortunately, much of these wastes are burned or released that led to pollution of the environment (Atiyeh *et al.*, 2000 a; Azizi *et al*., 2008). Composted wastes can use in substitution of peat as the growth medium of ornamental plants. Today, most ornamental leaf plants are cultivated in soilless media, which peat is the basic medium (Atiyeh *et al*., 2000b). Many ornamental plants, including ornamental foliage plants grown in soilless growth media, in that peat make up the main part (Atiyeh *et al*., 2001). Because of the increasing awareness of environmental waste dangerous, and the need for recycling or landfill waste and reduce the use of non-renewable resources such as peat, greater use of composted biosolids in agriculture suggested by many researchers (Bugbee, 2002; Papafotiou *et al.*, 2005). The use of peat is dubious because of ecological damages to environmental and economical advantages for ornamental plant producers. Mentioned problems, led researchers to look for high quality and affordable beds for replacing peat (Krumfolz *et al*., 2000). Some studies showed that the peat can be replaced by organic wastes such as manure, paper, pruning residues mushroom beds after composting (Gayasinghe *et al*., 2010). Research showed *Ficus benjamina* in the growth medium containing 1:1 ratio of olive waste composts and peat (in volume) had the maximum height during a ten month period (Chen *et al.,* 1988). Nowadays, research on growth media because of continuous introduce of new parts are important and change in parts of growth media can cause changes in the chemical and physical properties of growth media (Fonteno, 1996). Peanut shells as remained wastes of peanut can be composted as available sources for use in ornamental plant growth medium. To find the possibility of peanut shells compost as an alternative of peat for growth medium of ornamental plant, this study conducted at ornamental plants and flower research station of Lahijan, Iran. In this study, the possibility using the peanut shell composts in replacement with peat was investigated as the growth medium of marigold and *Viola tricolor* plants.

MATERIALS AND METHODS

This study was conducted in a greenhouse of flowers and Ornamental Plants Research Station of Lahijan, Iran. After preparing media, the marigold and *Viola tricolor* plants transferred to four liter pots. Composition of the used growth media is listed in table 1. Two hundred milliliter of nutrient solutions consist of 130 mg/l N; 32 mg/l P and 117 mg/l K (as a KH_2PO_4, KNO_3, Ca $(NO_3)_2$) for each pot used every 10 days and irrigation applied as needed (Chen *et al*., 1988: Azizi *et al.*, 2008). The result of table 2 showed the nutrients in composted peanut shells being more than peat and can used as a nutritious supply for the plant. EC and pH of the media were ideal and does not cause limits for plants. For this experiment, composted peanut shells passed through a 20 mm sieve. The pH and EC were determined by pH meter and EC meter in an extract by 1:5 ratio of composted peanut shells and water (Verdonck and Gabriels, 1992). Total nitrogen measured by Bremner and Mulvaney (1982) method. For determination of other nutrients, each sample was ground and ashed in a furnace at 550 ˚C (Horwitz, 1980). The white ash was dissolved in 2N HCl and made up to 100 ml with distilled water. Total P was analyzed using by spectrophotometer according to Murphy and Riley (1962). Total K was measured according to Houba *et al*. (1989)

Table 1. Composition of the growth media.

Treatments	Growth media
Control	Peat + perlite + peanut shells compost (volume ratio of 0 + 2 + 1)
25% PSC	Peat + perlite + peanut shells compost (volume ratio of 0.5 + 1.5 + 1)
50% PSC	Peat + perlite + peanut shells compost (volume ratio of 1 + 1 + 1)
75% PSC	Peat + perlite + peanut shells compost (volume ratio of 1.5 +0.5 + 1)
100% PSC	Peat + perlite + peanut shells compost (volume ratio of 2 + 0 + 1)

Control: 2 peat +1 perlite in volume rate; PSC: peanut shells compost.

Table 2. Chemical properties of substrate.

Substrate	N (%)	P (%)	K (%)	Ca (%)	C: N	PH	EC (dS/m) 1:5
Peat	1.27	0.02	0.03	0.89	40.34	3.83	0.30
Peanut shells compost	2.43	0.67	1.19	33.6	9.80	6.08	1.57

Table 3. The equation to find out the physical properties of the growth media.

Equation numbers	Equation	Components of Equation
1	$Bd = (W_{dsp}-W_p/V_p)$	W_{dsp} = dry weight of substrates and container
2	$Pd = (W_{dsp}-W_{p/}V_p- V_{Wd}-(W_{Wsp}-W_{dsp}))$	W_p = dry weight of container
3	$AFP = (V_{Wd}\times_{100/}V_p)$	V_p = Volume of container
4	$WHC= ((W_{Wsp}-W_p)\times 100/V_p)$	V_{Wd} = Volume of water drained
5	$TP=AFP+CC$	W_{Wsp} = substrates and container fresh weight

method. Total organic carbon was measured by using the method of Nelson and Sommers (1982). The physical properties of growing media measured by Fonteno (1996) method and the bulk density, total porosity, water holding capacity and air volume of the growth media were computed by equations (Table 3). The data were analyzed by SAS and were compared by Tokay's multiple range tests (SAS, 2001).

RESULTS AND DISCUSSION

The statistical comparison showed that, 50% composted peanut shells in *Viola tricolor* plant created highest height, stem and leaf fresh weight, stem and leaf dry weight (Table 4). The highest height, stem and leaf fresh weight, stem and leaf dry weight in marigold gained with the use of 75% the peanut shells compost (Table 4). Treatment with 100% peanut shells compost in height, stem and leaf fresh weight and stem and leaf dry weight of tricolor and marigold plants did not differ significantly from control. The achieved results accorded to Pool and Conover (1991) in Dracaena, Abad *et al*. (2001), Mahboub Khomami and Padasht Dehkaei (2010) in *Ficus benjamin,* Basantia *et al.* (2011) in marigold. It seems that part of impacts of peanut shells compost is because of the presence of humic materials so Chen *et al.* (1988) claimed that part of the compost impact on the *Ficus benjamina* growth can be because of the same role of growth regulators in plants. Chen *et al*. (1988) reached to a highest plant height in a growth medium consisting of one part peat and one part olive waste (by volume) for *Ficus benjamina* varieties Starlight during ten months growth. Papafotiou *et al*. (2005) used olive waste compost instead of peat for cultivation of some ornamental plants and suggested 25%, 75% and 75% (v/v) of that respectively for cultivating *Ficus benjamina, Cordyline* and *Syngonium podophyllum.* Gayasinghe *et al*. (2010) in the cultivating marigold (*Tagetes patula*) used a combination of 40% synthetic compounds and 60% cow manure compost increases plant height, number of flowers on each plant, dry and fresh weight of stem, root length, dry and fresh weight. Assessing of plant growth characters showed that growth of

Table 4. Data mean comparison of *Viola tricolor* and marigold growth index.

Percent of compost	*Viola tricolor*			Marigold		
	Height (cm)	Leaf fresh weight (g)	Stem and leaf dry weight (g)	Height (cm)	Stem and leaf fresh weight (g)	Stem and leaf dry weight (g)
Control	17.30bc	26.30 ad	6.60 cd	31.00 ab	129.28 b	39.20 ab
25% PSC	17.40 bc	30.00 ab	7.40 bc	30.60 ab	123.24 b	36.60 c
50% PSC	21.20 a	35.10 a	8.90 a	29.40 ab	131.12 b	38.70 bc
75% PSC	19.40 ab	24.30 cd	5.60 cd	31.10 ab	148.38 a	41.30 a
100% PSC	14.80 c	17.10 d	5.30 d	27.60 b	105.62 c	34.30 c

Control: 2 peat +1 perlite in volume rate; PSC: peanut shells compost
Means followed by the same letters do not differ significantly (p = 0.05).

Table 5. Physical properties of growth medium.

Percent of compost	Air porosity (%)	Water holding capacity (%)	Total porosity (%)	Bulk density (g/cm^3)
Control	21.65	38.35	43.40	0.64
25% PSC	26.22	35.95	44.50	0.53
50% PSC	37.91	35.65	44.90	0.48
75% PSC	44.66	34.87	60.90	0.43
100% PSC	53.83	33.06	86.90	0.32

Control: 2 peat +1 perlite in volume rate; PSC: peanut shells compost

Viola tricolor in 50% and marigold in 75% peanut shells compost were more than control and 100% composted peanut shells (Table 4). Alidoust *et al*. (2012) on dracaena plant conducted a research to evaluate the possibility of using peanut shells compost as appropriate medium in the cultivation of ornamental plants using a 2:1 ratio of peat to perlite and peat was used as control treatment and peat was replaced by 15, 30, 45, 60, and 100 % v/v of peanut shells compost. Peanut shells compost affected on growth properties, like; height and dry weight of leaf as compared to control. It was found that peanut shells compost increases the growth of plants, but their effect on plant growth was promoted when accompanied by nutritional solution. Habib (2012) also found, grown fishtail palm seedlings in peanut shells compost with four grams of NPK fertilizer have a high content of N and P in leaves, whereas that grown in the clay medium contained the highest value of K. Since, nutrients the concentration in plants affected by characters such as growth, competition and deposition of ions, therefore, assessment of nutrients as a reliable border of plant growth is impossible.

Water and air content are the most important physical characters of substrates (Marfa *et al*., 1998). Water must be available in the substrate at the lowest possible energy status, but at the same time enough air in necessary in the root zone (De Boodt *et al*., 1974; Inbar *et al.*, 1993). With increasing peanut shells compost in the growth medium, container capacity and bulk density decreased, but air-filled porosity and total porosity increased (Table 5). Decreasing of container capacity concludes from the fact that peat able to absorb a greater amount of moisture in comparing to the peanut shells compost.

Verdonck and Gabriels (1992) proposed physical characters such as container capacity between 55% and 75% and between 20% and 30% air-filled porosity for ideal growth plant, in all substrates. The Air-fill porosity needed for enough gas exchange should make up at least 15%, but ideally it should be 20-35% of the medium volume depending on the plants (Kasica, 1997). Moisture content decreased with the add peanut shells compost to the media (Table 5). According to Fonteno (1996), peat has about a 25% volume of water that is unavailable water, or water the plant cannot use at a tension of 1.5 Mpa.

Overall, the results show that the use of peanut shells composts increases growth of the marigold and *Viola tricolor* plants in comparison to control. But the use of higher levels of peanut shells compost is not recommended. Peanut shells turn into compost, in addition to solving the environmental problems of accumulation of peanut shells, can offer affordable and high-quality alternative to peat.

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