

# Marigold: The Possibility Using Vermicompost as the Growth Medium

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In order to investigation of vermicompost effect on growth and yield of marigold in pot medium, an experiment was done by a randomized completely block design in three replications. Treatments were included control (30% v/v of soil plus 70% v/v of sand) and three levels of vermicompost (20, 40, 60 % v/v of vermicompost + 30% v/v of sand and soil) that applied in three lit. pots. Marigold seeds (*Tagetes erecta* cv. Tiashan) were planted in media. The shoots were cut and it was measured the bush height, the lateral branches, size and flower weight, dry weight of shoot, and the concentration of nutrient elements. The results showed that added vermicompost to the growth media tend to improve the growth and yield of marigold than in the control. The Vermicompost (60%) had the highest weight, size and dry weight of shoot, but the maximum bush height was obtained by 20% vermicompost. The most lateral branches was belong to 40% vermicompost treatment. The results showed that the plants which cultivated on 60% vermicompost medium had the most amount of nitrogen, phosphorus and calcium. The most amount of potassium was related to 40% vermicompost treatment.

Abstract

**Keywords:** Growth medium, Marigold, Peat, Vermicompost.

## INTRODUCTION

For providing growth media of ornamental plants, some organic material are used in amending some physical and chemical characteristics of growth media that can refer to peat, compost, grinded shells of trees, the hull of coconut and rough rice. Using manure, wood chips and paper wastes with volcanic mixture to produce croton, *Cordyline*, chrysanthemum media showed that these materials are very useful and appropriable as a growth medium (Cull, 1989). Broad leaf shell, conifer, the compost of mushrooms and municipal wastes compost can be used as a growth bed (Pool *et al.*, 1998).

Today it has been proposed to use useful fauna of soil as the best natural way to keep biotic system in agriculture lands. Presentation of organic matter as the food of these useful fauna is one of the advantageous of some fertilizer such as vermicompost (Saleh Rastin, 2001). Vermicompost is a bio-organic fertilizer which contains a biological active mixture of bacteria, enzymes, manure, earthworm capsule which led to decomposition of organic material and improvement of microbial activity in growth media (Benitez, 1999).

Vermicompost had a positive effect on the germination rate in seeds by increasing the capacity of water holding, nutrients and producing hormones (Tomati *et al.*, 1998). The results showed that the application of 10% vermicompost increased significantly dry weight in *Magnolia virginiana* (Bachman, 2000). The produced vermicompost by animal wastes is quite monotonous and stable quality. In this material, primary contaminations have decreased, it is stable in long term without compaction of growth medium, and it provides some nutrient for plants. In the producing stage of vermicompost, even the drainage water discharge from the bed contain some nutrient and growth factors, which it has nutritional value. A study of *Aglaonema* and *Dieffenbachia* showed that spraying by drainage water solution of bed; significantly increased the height, dry matter, diameter, fresh weight and nitrogen (Mahboub Khomami, 2005).

Atiyeh *et al.*, (2000) showed that adding hog manure vermicompost to marigold and tomato increased the growth rate that vermicompost had more positive effect on germination rate in tomato than marigold. Bachman (2008) had conduct some research to study the growth rate in some nursery flora such as tomato, marigold and pepper in economical growth medium which contain vermicompost. He observed that a mixture of 20% v/v hog manure vermicompost with growth medium increased root and shoot dry matter, leave area, the rate of shoot to root in Tomato and marigold, but it had a little effect on growth rate of pepper and santeria, so it had no effect on germination rate in all plants.

Mal Yin (2010) reported that the mixture of sewage sludge vermicompost amounted 20% v/v with soil was the best rate. Atiyeh *et al.*, (2002) studied the effect of hog vermicompost on growth rate and yield of *Magnolia* and concluded that the highest rate of growth was observed on 30% and 40% rates of vermicompost and the lowest growth rate was observed on 90% and 100% proportions. They reported that the highest and the lowest rate of flower bud were in the proportion of 40% and 100%, respectively. In this study, the aim is to evaluate the possibility using vermicompost as the growth medium of marigold.

## MATERIALS AND METHODS

An experiment was conducted by a completely randomized block design to study the effect of different rates of vermicompost in pot growth medium. Treatments include:

1. Growth medium contains 30% v/v of soil + 70% v/v of sand (control)
2. Growth medium contains 20% v/v of vermicompost + 30% v/v of sand + 50% v/v of soil
3. Growth medium contains 40% v/v of vermicompost + 30% v/v of sand + 30% v/v of soil
4. Growth medium contains 60% v/v of vermicompost + 30% v/v of sand + 10% v/v of soil

Some chemical characteristics of soil including pH and EC (in saturated extraction), texture (by hydrometric method), calcium carbonates (by titration method), available phosphorus (by spec-

trophotometry method), and available potassium (by flame photometry) were measured. Some chemical properties of vermicompost including pH and EC in extract 1:5 (vermicompost to distilled water), CEC (by Chapman method), organic material, total nitrogen (Kjeldal method) were measured (Jackson, 1967). In order to determination of nutrients in shoot dry matter, 1 g vermicompost powder was turned to ashes in 550 °C and it was extracted by HCl 2N and in derived extraction, phosphorus by spectrophotometry, potassium and calcium by flame photometry were measured.

Growth media was poured on three lit. pots and then marigold seed was cultivated in these pots. All necessary attention including the use of fertilizers, irrigation and poisoning were done. After four months, the plant shoots was cut to measure final height of plant, lateral branches, shoot dry matter, size and weight of flower. The concentration of potassium, phosphorus, nitrogen, calcium and magnesium was measured in shoot dry matter. The results were analyzed by using LSD test and SAS software.

## RESULTS

Fig. 1 shows the results which related to the effect of different amount of vermicompost in cultivation bed on the marigold height. Vermicompost increased the height of plant at 20 and 40% vermicompost, significantly, but the height decreased by 60% vermicompost that of course it was not significant than in the control. Adding vermicompost to medium increased the number of lateral branches significantly. The number of lateral branches increased about 3 times in 60% vermicompost treatment as compared with the control.

Vermicompost tend to increase in flower size than in the control, so that this increase was 8.53 mm in 60% vermicompost treatment more than control. The flower weight has also increased in vermicompost treatments which this increase was about 1.5 times more than control in all vermicompost treatments. Shoot dry matter increased in the vermicompost treatments. Increasing dry matter was 4.73, 4.93 and 7.40 g more than control in 20, 40 and 60% vermicompost, respectively.

The impact of different vermicompost rates on nitrogen are observed in fig. 6. The significant impact of vermicompost was not observed on the nitrogen of marigold shoot. Application of vermicompost 20% decreased phosphorus concentration of plant shoot, significantly, but there was not a significant difference at the 40 and 60% of vermicompost as compared with control. The use of vermicompost increased potassium of plant significantly in 40 and 60% vermicomposte rates, but it had not significant difference at the 20% rate in compared to control. The increase in potassium of shoot was 1.69 times more than control in 60% vermicompost. Thus, the calcium concentration of shoot has increased in the vermicompost treatments which Ca of 60% vermicompost treatment about 2 times more than control.

## DISCUSSION

Vermicompost include some aerobic microorganisms such as *Azotobacter* and it lack of non aerobic bacteria, fungi and pathogenic microorganisms. Vermicompost like peat has been formed of materials with pores, aerator capacity, drainage and high capacity for water holding, it has a high surface area in exchanging nutrients. Vermicompost has little amount of solvable mineral than primitive material, also it has more acid humic and more capacity for cations exchange (Atiyeh *et al.*, 2001). Vermicompost has many nutrients such as phosphorus, potassium, calcium, magnesium as available for plants (Orozco *et al.*, 2001).

Vermicompost contains plant growth hormones, several enzymes, more microbial populations and it is free of harmful pathogens and small animals such as form colonies bacteria and *Salmonella*. The results of this experiment showed that the effect of vermicompost on plant height was similar to peat, while in the perlite bed, plant height was lowest. Atiyeh *et al.*, (2002) studied the effect of pigs manure vermicompost on the growth and yield of french marigold. The most vegetative growth had obtained at 30 and 40% v/v vermicompost and the least growth obtained of

90 and 100% values. The highest and the lowest number of flower buds were related to 40% and 100%, respectively. The studies of Snagwan *et al.*, (2010) showed that the adding 40% w/w of sugar factor waste to vermicompost caused to increase in flower size than in 10-30% w/w rates.

Rani and Srivastava (1997) found that replacement of  $\frac{1}{3}$  or  $\frac{1}{4}$  of the nitrogen chemical fertilizers with vermicompost tend to increase in the rice height.

Peyvast *et al.*, (2008) investigated effect of soil and vermicompost composition in the growth bed of parsley (*Petroselinum crispum*) at different ratios. Their results showed that the addition of vermicompost to soil increased plant height. Walker and Bernal (2008) reported that application of compost and organic fertilizer dramatically increased growth of best branch. The effect of vermicompost on plant growth is through effect on photosynthesis and various products of plants such as leaves, stem and root to stimulate the material stored in the leaves and nutrients uptake and water by roots. Bwamiki *et al.*, (1998) showed that the use of organic amendments such as compost can increase the production of yield.

Vermicompost contains some nutrients which are important in plant production. The nitrogen, phosphorus and potassium levels of the earthworm wastes mostly 5 to 11 times is more than soil and during the processing, the calcium, magnesium and micronutrients can also increase (Smith, 1998). There is much evidence that the activity of earthworms accelerates organic matter mineralization, decomposition of polysaccharides, increase the humus material, reducing the carbon to nitrogen ratio and reducing availability of heavy elements (Domingues *et al.*, 1997). Vermicompost indirectly through the impact on soil micro flora will affect on plant growth. For example, adding vermicompost to the growth medium containing peat increases the colony formation of mycorrhiza (Cavender *et al.*, 2003).

## CONCLUSION

Vermicompost increased the plant growth and nutrient concentration in shoot. The best impact of vermicompost obtained at the 60% rate. Therefore, results showed that the vermicompost in an appropriate medium for growth of ornamental plant. It is proposed to study other researches about impact of vermicompost on ornamental plants growth in compared with other planting beds such as peat and perlite.

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## Tables

Table 1. Some chemical characteristics of soil

EC(dS/m)	4.8
pH	8.0
Texture	Sandy Loam
Calcium Carbonates	3.3
Available phosphorus (mg/kg)	14.3
Available potassium (mg/kg)	656.8

Table 2. Some chemical characteristics of vermicompost

EC(dS/m)	23.4
pH	7.7
CEC (me/100g)	43.4
Organic carbon (%)	65.4
Total nitrogen (%)	0.038
Available phosphorous (mg/kg)	3.9
Available potassium (mg/kg)	750.0
Available Calcium (mg/kg)	85.0

Table 3. The effect of different treatments on nitrogen, phosphorus, potassium, calcium and magnesium concentration of shoot organs of Marigold

Treatment	Compound	N	P	K	Ca
		(% )			
Control	30% soil + 70% sand	7.8 a	0.20 b	2.50 bc	0.83 c
20% Vermicompost	50% soil + 30% sand + 20% vermicompost	5.7 abc	0.14 bc	2.06 cd	1.56 a
40% Vermicompost	50% soil + 30% sand + 40% vermicompost	6.5 ab	0.18 b	4.16 a	1.50 ab
60% Vermicompost	50% soil + 30% sand + 60% vermicompost	7.2 a	0.21 b	2.80 b	1.60 a

## Figures

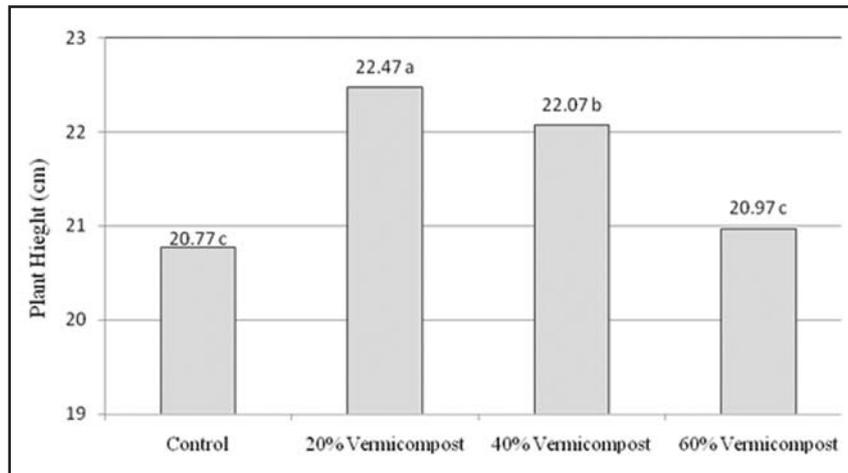


Fig. 1. The effect of treatments on the plant height

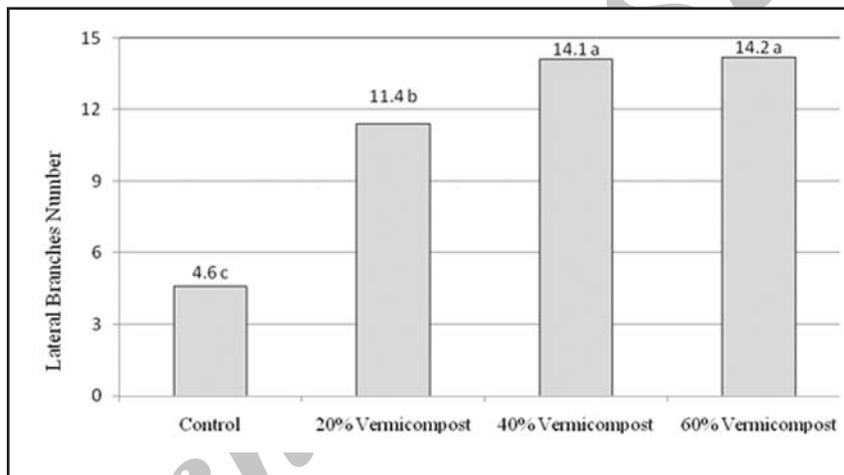


Fig. 2. The effect of treatments on the lateral branche number of plant

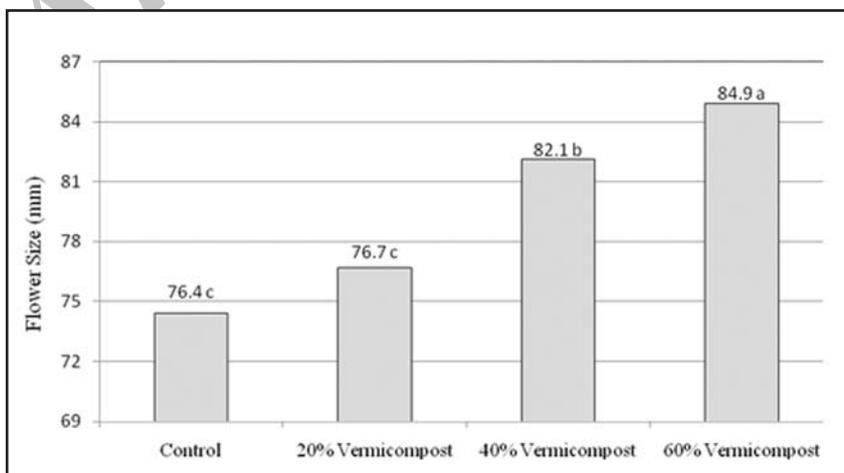


Fig. 3. The effect of treatments on the flower size of plant

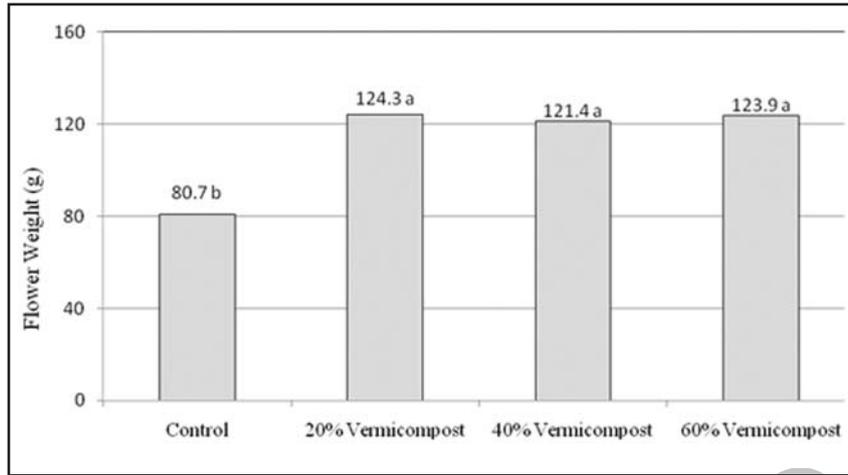


Fig. 4. The effect of treatments on the flower weight of plant

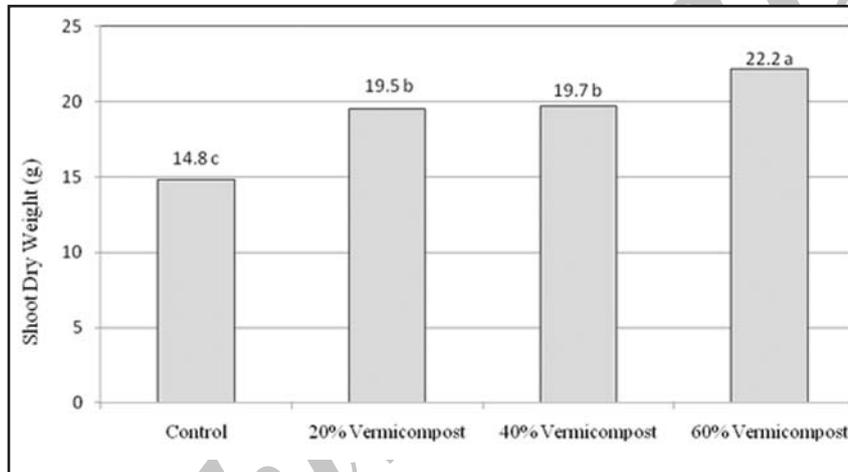


Fig. 5. The effect of treatments on the shoot dry matter of plant