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Journal of Applied Science and Agriculture

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Organic Transplant Production of Pot Marigold in Vermicompost-Amended Medium

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ARTICLE INFO

Article history:

Received 13 October 2013

Received in revised form 17

November

2013

Accepted 22 November 2013

Available online 15 December 2013

Keywords:

Medicinal plants, *Calendula**officinalis*, growing mixture,

vermicompost, biofertilizer

ABSTRACT

Pot marigold, member of family Asteraceae, is an annual plant. Healthy vigorous transplants will be less susceptible to insects, diseases and transplant shock leading to better crop performance. Formulating growing mixtures is especially challenging. Vermicompost has a high mineral nutrient content. An experiment was carried out in a completely randomized design with three replications to evaluate the effects of cow manure vermicompost rates (10%, 20%, 30% and 40%) in growing medium on growth of pot marigold transplants. The maximum of shoot fresh weight, shoot dry weight, root fresh weight and root dry weight were achieved on 40% vermicompost rate.

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To Cite This Article: Mitra Rahbari, Marziye Omid and Shahram Sharafzadeh. Organic Transplant Production of Pot Marigold in Vermicompost-Amended Medium. *J. Appl. Sci. & Agric.*, 8(5): 548-550, 2013

INTRODUCTION

Pot marigold (*Calendula officinalis* L.), belonging to family Asteraceae (Compositae), is an annual plant. The origin of this plant is the west of Asia and Mediterranean. This plant is an ornamental flower and can cultivate as a medicinal plant (Ganjali *et al.*, 2010). The composite flowers are yellow and orange blossom in the spring-summer seasons (Okoh *et al.*, 2008). While the biennial form grows wild in the Southern, Eastern and Central Europe, the annual form is more widely cultivated. The beautiful calendula flowers are frequently seen and easily grown in home gardens all over the world (Ramos *et al.*, 1988).

This medicinal plant use for treating skin disorders and pain, gastric and intestinal disease, inflammation, and as a bactericide and antiseptic and coloring agent in the foods. Researchers indicated the positive effects of its oil on HIV (Kalvatchev *et al.*, 1997). Industrial and pharmaceutical properties of seed oil have been proved by scientists (Dinda and Craker, 1998; Bernath, 2000; Fuchs *et al.*, 2005; Bolderston *et al.*, 2006).

Organic gardeners are usually faced with reduced supply and poor quality transplants. Transplants produced organically are often of low quality because of poor fertilization management. There is limited information available on organic production of pot marigold transplants. Great problem in organic production is the uncertainties in bio-availability of nutrients contained in organic fertilizers or amendments. In most instances the essential nutrients are in unavailable forms or need to be chemically modified to be available to plants. Thus, it is usually difficult to determine optimum application rates of organic fertilizers based only on the chemical composition of organic amendments (Diaz-Perez *et al.*, 2008). Transplant production using organic media reported in some studies (Biernbaum, 2006; Diaz-Perez *et al.*, 2008; Rangarajan *et al.*, 2008).

Vermicomposting is biotechnological process of composting. In this process, earthworms are used to enhance the process of residue conversion. Vermicompost has good conditions for plant growth. This study focused on the effect of vermicompost rates on growth of pot marigold transplants.

MATERIALS AND METHODS

The study was carried out using the marigold seeds in the experimental greenhouse of Islamic Azad University, Firoozabad Branch, Iran (28°35' N, 52°40' E; 1327 m above sea level). The transplants were grown in a mixture of sand with different rates of cow manure vermicompost (10%, 20%, 30% and 40%, by weight). Analysis of cow manure vermicompost indicated PH=7.54, N=1.57%, P=0.32%, K=0.78%, Cu=40 ppm, Zn=128 ppm, Fe=1850 ppm, Mn=358 ppm and EC=13.18 dS/m. The experiment was conducted in a completely randomized design with three replications. Each replication included one 72-cell tray. Seedlings received no

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additional fertilizer. During the experimental period, seedlings were watered daily. After 30 days, twenty plants were randomly selected from each replication and shoot height, shoot fresh and dry weights and root fresh and dry weights were measured. Shoots and roots were dried at 60°C for 72 hours. Data from the experiment were subjected to analysis of variance (ANOVA) using Statistical Analysis System (SAS) computer software and means compared with Duncan's new multiple range test (DNMRT) at $P < 0.05$.

RESULTS AND DISCUSSION

The rate of vermicompost applied in growing media altered growth of the transplants (Table 1). The highest values of shoot height (6.91 cm), shoot fresh weight (2.00 g/plant), shoot dry weight (0.19 g/plant), root fresh weight (1.73 g/plant) and root dry weight (0.18 g/plant) were achieved on 40% vermicompost.

Table 1: Effects of cow manure vermicompost rates on growth of pot marigold transplants.

rate (%)	Shoot height (cm)	Shoot FW (g/plant)	Shoot DW (g/plant)	Root FW (g/plant)	Root DW (g/plant)
10	3.95d	0.80d	0.09c	0.68c	0.07b
20	4.67c	1.15c	0.12bc	1.03b	0.09b
30	5.58b	1.52b	0.17ab	1.22b	0.12b
40	6.91a	2.00a	0.19a	1.73a	0.18a

In each column, means with the same letters are not significantly different at 5% level of Duncan's new multiple range test.

Recently, a great attention was paid towards the application of bio-organic farming to avoid the heavy use of agrochemical that resulted in environmental troubles (Lampkin, 1999). Plant grown with biological sources of nutrients such as composted organic waste is less susceptible to insects than conventionally grown plants (Lotter, 2003). Moreover, organic matter plays an important role in the chemical behavior of several metals in soils throughout its active group (flavonic and humic acids) which have the ability to retain the metal in complex and chelate forms (Abou El-Magd *et al.*, 2006).

vermicompost can improve seed germination, growth and yield of crops (Gandhi *et al.*, 1997; Crescent, 2003; Nagavallema *et al.*, 2004). Vermicompost provides all nutrients in readily available form and also enhances uptake of nutrients by plants (Nagavallema *et al.*, 2004). Vermicompost affects on soil physical properties (Wang *et al.*, 2010). It improves soil structure, texture, aeration, and water holding capacity. The application of vermicompost can alter soil pH, microbial population and soil enzyme activities (Maheswarappa *et al.* 1999). vermicompost includes plant-growth regulators which increase growth and yield (Canellas *et al.*, 2002). Excreta of earthworm were rich of Micro-organism especially bacteria and contain large amounts of plant hormones (auxin, gibberellin and cytokinin) which affect plant growth and development (Atiyeh *et al.*, 2001).

In conclusion, in our experimental conditions, application of cow manure vermicompost at rate of 40% resulted in the highest growth values of marigold transplant.

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