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Research Article

INFLUENCE OF COW MANURE VERMICOMPOST ON GROWTH CHARACTERISTICS OF GERMAN CHAMOMILE

Niloofar Dastgheibifard, *Shahram Sharafzadeh and Forood Bazrafshan
Department of Agriculture, Firoozabad Branch, Islamic Azad University, Firoozabad, Iran
**Author for Correspondence*

ABSTRACT
Vermicomposting is biotechnological process of composting. In this process, earthworms are used to enhance the process of residue conversion. A pot experiment was conducted to evaluate the influence of cow manure vermicompost rates on vegetative and flowering characteristics of German chamomile. The study was carried out using a completely randomized design with three replications. The pots were treated with cow manure vermicompost at different rates (0%, 2%, 4%, 6% and 8% w/w). The results indicated that vermicompost altered vegetative growth and flowering of the plants significantly. The highest values of shoot height, shoot fresh and dry weights, flower number, flower fresh and dry weights were achieved on the rate of 8%.

Keywords: *Matricaria recutita, Organic Fertilizer, Earthworm, Cow Manure, Vermicompost*

INTRODUCTION
Animal wastes have environmental risks similar to those of human wastes. Stabilization involves the decomposition of a waste substance to a margin where the hazards are eliminated. Vermicomposting is one of the best-known processes for the biological stabilization of solid organic wastes (Lazcano *et al*., 2008).

In vermicomposting, earthworms are used to enhance the process of residue conversion. The resulting earthworm castings are rich in microbial activity and plant growth regulators and fortified with pest repellence properties as well. Vermicomposting reduces the C:N ratio and retains more N than the traditional methods of preparing composts so, vermicompost can improve seed germination, growth and yield of crops (Gandhi *et al*., 1997; Crescent, 2003; Nagavallemma *et al*., 2004).

Researchers have revealed that some earthworm species can consume various organic residues such as animal wastes (Chan and Griffiths, 1988; Hartenstein and Bisesi, 1989). They have shown the application of earthworm processed wastes, known as vermicomposts, in the agriculture (Buckerfield and Webster, 1998; Atiyeh *et al*., 1999). *Eisenia fetida* and *Eisenia andrei* are the earthworm species commonly used for this purpose (Reinecke and Venter, 1987; Venter and Reinecke, 1988; Reinecke and Viljoen, 1990; Domínguez and Edwards, 1997).

Matricaria recutita L. (syn. *M. chamomilla* L., *Chamomilla recutita* L. Rauschert) from family Compositae (Asteraceae) is known as true chamomile or German chamomile. This plant has white ligulate flowers, smells pleasantly of chamomile (typical chamomile smell) and is annual, grows 10 to 80 cm in height (Franke, 2005). Chamomile is widely used throughout the world. Its primary uses are as a sedative, anxiolytic and antispasmodic, and as a treatment for mild skin irritation and inflammation. It has widespread use as a home remedy (Gardiner, 1999).

Environmental factors can affect on plant growth. One of the most important environmental factors is growing medium. Conventional farm systems have been characterized by high utilization of chemical fertilizer which decrease quality of soil and products due to reductions in soil organic matter content so, the use of organic matter as nutrient inputs is increasing for crop production (Singh *et al*., 2007; Liu *et al*., 2009; Padel *et al*., 2009). By increasing levels of compost fertilizer to *Sideritis montana* L., vegetative growth increased (El-Sherbeny *et al*., 2005).

The aim of this study was evaluation of the effects of vermicompost rates on vegetative and flowering characteristics of German chamomile.

MATERIALS AND METHODS

Plant Materials and Experimental Conditions

The study was conducted at a garden in Shiraz (29°38' N, 52°28' E; 1486 m above sea level), state of Fars, Iran, on September (beginning of autumn). The pots were filled up by a mixture contained 2/3 soil and 1/3 sand (v/v). The mixture of pots were tested before applying treatments and the texture was sandy clay loam with PH=8.48, organic C=0.29%, total N=0.03%, available P=0.9 mg/kg, available K=274 mg/kg, TNV=53.8% and EC=1.02 ds/m. The mixture of pots was treated with cow manure vermicompost at different rates (0%, 2%, 4%, 6% and 8% w/w). Analysis of 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. Chamomile seeds were germinated in pots and thinned at 2-4 leaves stage to one plant per each pot. The experiment was conducted using a completely randomized design (CRD) with three replications. Each replicate contained 15 pots. The flower heads were collected each 15 days during one month (three times) and were dried at room temperature. Finally, the number of main shoots, shoot height and shoot fresh weights were measured. The shoots were dried at 65°C for 72 hours in order to determine the shoot dry weights.

Statistical Analysis

Data from the experiment were subjected to analysis of variance (ANOVA) using SAS computer software and the means compared with Duncan's new multiple range test (DNMRT) at $P < 0.05$.

RESULTS AND DISCUSSION

Different rates of vermicompost resulted in the significant differences at vegetative characteristics of German chamomile (Table 1). The maximum numbers of main shoots (6.73) and shoot height (85.00 cm) were achieved on 8% which were not significantly different when compared to 6% rate. The highest values of shoot fresh weight (332.33 g/plant) and shoot dry weight (58.26 g/plant) were obtained at 8% which were significantly different when compared to other vermicompost rates. The lowest values of vegetative growth characteristics were achieved on control.

Table 1: Effect of vermicompost rate on vegetative characteristics of German chamomile

Vermicompost rate	Number of main shoots	Shoot height (cm)	Shoot fresh weight (g)	Shoot dry weight (g)
Control (0)	1.00d	37.60d	113.60c	18.96c
2%	2.60c	52.80c	124.93c	27.00c
4%	3.93b	67.46b	142.73bc	20.50c
6%	6.33a	76.46ab	195.73b	41.80b
8%	6.73a	85.00a	332.33a	58.26a

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

Vermicompost rates altered flowering characteristics of German chamomile significantly (Table 2). The highest value of flower number was obtained at 8% which was significantly different when compared to other treatments on first harvest, while it was not significantly different when compared to 6% on second harvest, 4% and 6% on third harvest. The maximum flower fresh and dry weights were achieved on 8% which were significantly different when compared to other treatments on first and second harvest.

An experiment indicated that compost was higher in ammonium, while vermicompost tended to be higher in nitrates, which is the more plant-available form of nitrogen (Atiyeh *et al*., 2000). Vermicompost provides all nutrients in readily available form and also enhances uptake of nutrients by plants (Nagavallemma *et al*., 2004). The uptake of nitrogen, phosphorus, potassium and magnesium can improve when fertilizer was applied in combination with vermicompost (Jadhav *et al*., 1997).

Table 2: Effect of vermicompost rate on flowering characteristics of German chamomile

Vermicompost rate	FN1	FN2	FN3	FFW1	FFW2	FFW3	FDW1	FDW2	FDW3
Control (0)	2.97d	3.29c	0.79c	0.36d	0.80e	2.30c	0.26d	0.33d	0.33d
2%	2.60d	5.48c	10.12b	6.43d	14.63d	39.27b	1.60d	2.93cd	7.13c
4%	6.78c	22.86b	39.06a	22.80c	31.73c	68.07b	4.10c	5.43c	12.80b
6%	11.30b	42.46a	44.15a	42.90b	79.00b	130.60a	9.26b	16.43b	27.90a
8%	15.71a	46.07a	46.86a	57.93a	106.66a	149.80a	11.70a	20.13a	28.10a

Abbreviations: FN1, flower number at first harvest; FN2, flower number at second harvest; FN3, flower number at third harvest; FFW1, flower fresh weight at first harvest; FFW2, flower fresh weight at second harvest; FFW3, flower fresh weight at third harvest; FDW1, flower dry weight at first harvest, FDW2, flower dry weight at second harvest, FDW3, flower dry weight at third harvest; In each column, means with the same letters are not significantly different at 5% level of Duncan's new multiple range test

Vermicompost contains plant-growth regulators which increase growth and yield of the plants (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).

Besides, vermicompost can affect on soil physical properties (Wang *et al*., 2010). It improves soil structure, texture, aeration, and water holding capacity. The application of vermicompost favorably affects soil pH, microbial population and soil enzyme activities (Maheswarappa *et al*., 1999) which all of them can influence biosynthesis of compounds in plants. Vermicompost and organic fertilizers increased protein content of peanut and vitamin C in marionberry, strawberry and corn (Asami *et al*., 2003; Basu *et al*., 2008).

Conclusion

Under present experimental conditions, vermicompost at rate of 8% can be recommended as an efficient rate for obtaining the highest values of vegetative growth and flowering.

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