

Organic and Bio Fertilizers as a Good Substitute for Inorganic Fertilizers in Medicinal Plants Farming

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Abstract: medicinal plants are very important in modern civilization in order to obtain natural active substances, known as secondary metabolites. The production of natural substances by plants is affected by genotype and environmental conditions. Continuous usage of inorganic fertilizer affects soil structure. Hence, animal and plant manures, compost and vermicompost can serve as alternative to mineral fertilizers for improving soil structure and microbial biomass. Bio fertilizers such as plant growth promoting rhizobacteria (PGPRs) and mycorrhiza are microbial inoculants consisting of living cells of micro-organism like bacteria and fungi which may help in increasing crop productivity. Organic fertilizers in comparison of the chemical fertilizers have lower nutrient content and are slow release but they are as effective as chemical fertilizers over longer periods of use.

Key words: compost, vermicompost, plant growth promoting rhizobacteria, mycorrhiza, organic manure.

INTRODUCTION

Medicinal and aromatic plants use by 80% of global population for their medicinal therapeutic effects as reported by WHO (2008).

Many of these plants synthesize substances that are useful to the maintenance of health in humans and other animals. These include aromatic substances, most of which are phenols or their oxygen-substituted derivatives such as tannins. Others contain alkaloids, glycosides, saponins and many secondary metabolites (Naguib, 2011).

Organic fertilizers are obtained from animal sources such as animal manure or plant sources like green manure. Continuous usage of inorganic fertilizer affects soil structure. Hence, organic manures can serve as alternative to mineral fertilizers for improving soil structure (Dauda *et al.*, 2008) and microbial biomass (Suresh *et al.*, 2004). Composting is a biological process in which organic biodegradable wastes are converted into compost for use as a soil conditioner and an organic fertilizer (Popkin, 1995). Vermicomposting is a simple biotechnological process of composting, in which certain species of earthworms are used to enhance the process of waste conversion and produce a better end product (Gandhi *et al.*, 1997). These are also used to provide biological control against various plant pathogens (Hoitink and Grebus, 1994). The addition of municipal solid waste compost to agricultural soils has beneficial effects on crop development and yields by improving soil physical and biological properties (Zheljazkov and Warman, 2004).

Bio fertilizers are microbial inoculants consisting of living cells of micro-organism like bacteria, algae and fungi alone or combination which may help in increasing crop productivity. Biological activities are markedly enhanced by microbial interactions in the rhizosphere of plants (Tilak and Reddy, 2006). The plant growth promoting rhizobacteria (PGPRs) can influence plant growth directly through the production of phytohormones and indirectly through nitrogen fixation and production of bio-control agents against soil-borne phytopathogens (Glick, 2003). *Azospirillum* species are nitrogen-fixing organisms, capable of forming an associative relationship with the roots of several economically important crops (Vande Broek and Vanderleyden, 1995). Studies indicate that *Azospirillum* promotes plant growth (Cohen *et al.*, 2007).

Researchers showed better response of some plants inoculated by PGPR and mycorrhiza (Vittal Navi *et al.*, 2006). Arbuscular mycorrhiza fungi (AMF) are well known to improve phosphorus uptake in their host (Toussaint, 2008).

Organic fertilizers have been known to improve the biodiversity (Enwall *et al.*, 2005; Birkhofer *et al.*, 2008) and may prove a large depository for excess carbon dioxide (Lal, 2004).

Organic fertilizers in comparison of the chemical fertilizers have lower nutrient content and are slow release but they are as effective as chemical fertilizers over longer periods of use (Naguib, 2011).

Effects of Organic and Bio Fertilizers:

In a study, vermicomposted coirpith and coirpith composted with microorganisms were used as a growth medium for growing the medicinal plant *andrographis paniculata*. The results indicated that vermicomposted coirpith could be helpful for the reclamation of soils from industrial sites in a small scale nursery (Vijaya *et al.*, 2008).

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An investigation with the roots of *Asparagus racemosus* grown under organic manures- cowdung, compost and vermicompost without using mineral or chemical fertilizer showed that the total phenol and total flavonoid content was highest in the plants from vermicompost treated soil. The antioxidant activity was highest in the plants from compost treated soil (Saikia and Upadhyaya, 2011).

Dry yeast and compost tea were used in growing medium of borage plants. The results revealed that 20L./ fed. (feddan=4200 m²) of compost tea significantly increased plant height, fresh and dry weight of aerial parts and flowers and number of branches and suckers, Adding dry yeast at the rate of 6 g/L. was the most effective on growth parameters and oil% (Ezz El-Din and Hendawy, 2010).

In an Egyptian experiment, some organic fertilizers (Compost, Chicken and Sheep manures) were used for growing of *Thymus vulgaris* L. Results indicated that (20m³ compost combined with 10m³ chicken or sheep manure) were superior in most cases of growth characters and yields. The highest value for thymol was obtained from 30m³ Compost combined with 10m³ Sheep manure treatment (Ateia *et al.*, 2009).

An Iranian investigation revealed that inoculation of *Ocimum basilicum* roots with plant growth-promoting rhizobacteria (PGPR) improved growth and accumulation of essential oils. Treatments were *Pseudomonas putida* strain 41, *Azotobacter chroococcum* strain 5 and *Azospirillum lipoferum* strain OF. In comparison to the control treatment, all factors were increased by PGPR treatments. The maximum Root fresh weight (3.96 g/plant), N content (4.72%) and essential oil yield (0.82%) were observed in the *Pseudomonas* + *Azotobacter* + *Azospirillum* treatment. All factors were higher in the *Pseudomonas* + *Azotobacter* + *Azospirillum* and *Azotobacter* + *Azospirillum* treatments (Ordookhani *et al.*, 2011).

An experiment with application of saline water in addition to bio and organic fertilization on geranium plant revealed that peanut compost slightly increased plant fresh and dry weights. The oil percentage decreased at high salinity level of 6000 ppm but at 3000 ppm the oil percentage reached 0.4 when treated with (half dose of compost+Bio) and 0.6% when plants were supplied with full dose of peanut compost compared to the control (Leithy *et al.*, 2009).

An investigation with marjoram (*Majorana hortensis* L.) indicated that the use of combined treatment of bio-fertilizers gave better results for all studied traits. The oil percentage and yield per plant for three cuttings was almost twofold higher on fresh weight basis as a result of aqueous extracts of compost at low level + bio-fertilizers compared with control. The chemical composition of marjoram essential oil did not change due to the fertilization type or level (Gharib *et al.*, 2008).

Poultry manure application significantly increased the herbage, essential oil content and dry matter yield in *Java citronella* plants (Adholeya and Prakash, 2004).

The percentage of essential oil, fresh and dry matter of marjoram plants positively responded to increased levels of composted manure compared with chemical fertilizer (Edris *et al.*, 2003).

By increasing levels of compost fertilizer to *Sideritis montana* L., vegetative growth and major components of essential oils increased (El-Sherbeny *et al.*, 2005).

Oil production in mint plants increased when plants were grown with biosolid (Scavroni *et al.*, 2005).

In an Iranian experiment, the effects of different levels of vermicompost and irrigation were evaluated on morphological characteristics and essential oil content of "Goral" an improved German chamomile. The results indicated that the vermicompost application improved plant height, early flowering, flowers dry weight, anthodia height and diameter significantly. The highest essential oil yield detected in 10% vermicompost and irrigation 4mm per two weeks. This experiment revealed that 15% vermicompost plus 2 mm irrigation per two weeks was the best treatment to produce the flower yield in Goral cultivar of German chamomile in organic system (Azizi *et al.*, 2008).

An investigation was conducted to evaluate the response of *Dracocephalum moldavica* L. (dragonhead) to various plant densities and compost applications. Compost had a positive effect on vegetative growth and induced essential oil accumulation (Hussein *et al.*, 2006).

Conclusion:

In conclusion, application of organic and bio fertilizers as substitute for inorganic fertilizers in order to grow the medicinal and aromatic plants, should not be considered as a simple objective and short term benefits, but as a mean to improve environmental conditions and human health.

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