Sewage sludge effect on organic matter of soil with plants of *Vicia faba* and *Secale montanum* inocoloum with Arbuscular Mycorrhizal fungi

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Abstract: In the recent years use of sewage sludge as a fertilizer has become prevalent in agricultural lands, because of it is cheap. Sewage sludge is source of nutritional elements.The aims of present study were to Sewage sludge effect on organic matter of soil with plants of *Vicia faba* and *Secale montanum* inocoloum with Arbuscular Mycorrhizal fungi. The experiment was conducted in controlled conditions was completely randomized design and factorile test. Three levels of sewage sludge (0, 100 and 200 ton/ha) , two levels of mycorrhiza (with and without mycorrhiza) and two plant (Secale montanum and Vicia faba) in three replicated were used. Organic matter content were measured. . The data were analyzed using statistical software (SPSS). The result showed that as the added sewage sludge is increased , organic matter content is increased both mycorrhizal plants and control ones, but organic matter was much higher in mycorrhizal plants. As the added sewage sludge in soil that treated by 100 ton/ha, organic matter content in plants tissues increased but organic matter in plants tissues were higher in mycoorhizal plants than nonmycorrhizal ones.With increase sewage sludge in soil in treated by 200 ton/ha, organic matter content in treated soil and plants tissue Secale montanum and Vicia faba are increase. Contents of organic matter were higher colonized plants than control ones.

Keywords: Sewage sludge , organic matter, Arbuscular mycorrhizal,

Introduction

Arbuscular mycorrhizal fungi are a natural constituent of the soil of most ecosystems .They interact with the root of more than 80 % of terrestrial plants and can be considered functional extensions of plant roots considerably enlarging the volum for nutrient up take(Harrison 1999). Arbuscular mycorrhizal (AM) fungi provide an attractive system to advance plant-based environmental clean up. During symbiotic interaction the hyphal network functionally extends the root systems of their hosts. AM fungi occur in the soil of most ecosystems including polluted soils by acquiring phosphate micronutrients and water and delivering a proportion to their hosts they enhance the nutritiona state of their hosts. Identifying the most sustainable disposal route for Municipal solid waste (MSW) remains an important issue in almost all industrialised countries due to a range of legislative, environmental and economic and social drivers (Adani et al., 2000). European Union (EU) Council Directive 1999/31/EC (EC, 1999) on the landfill of waste has set down strict mandatory targets for reduction in the amount of Biodegradable Municipal Waste

(BMW) reaching landfill. The EU directive also states that no waste may be deposited in landfill without it first being treated in some way. Mechanical Biological Treatment (MBT) is a generic term for the treatment and separation of mixed solid wastes into reusable and recyclable fractions. Thermophilic composting can be used to treat the residual organic fraction from the MBT process, to produce a stabilised compost-like substance (Binner and Zach, 1999). Whilst according to EC (1999), this is suitable for landfill, it is desirable to find alternative uses for this mixed waste 'compost'. As soil organic matter levels have declined to critical levels in many regions of the world (Dregne, 2002), it is advantageous to use this 'waste' organic matter to replenish soil reserves. However, this application must occur without unduly increasing the loading of contaminants onto unpolluted soils (Tandy et al., 2008) Sequential extractions such as those proposed by Tessier et al. (1979) and Ure et al. (1993) can be used to investigate changes in the speciation of heavy metals during the composting process (Greenway and Song, 2002), and should provide a more accurate measure of risk to the environment than that of total levels.

It is widely accepted that no single chemical extraction procedure can truly represent the phytoavailability of individual heavy metals in soil ([Tandy et al., 2005] and [Menzies et al., 2007]). Consequently, other techniques such as microbial biosensors and plant bioassays can be used to assess the risk of compost-borne heavy metals entering the food chain (Tandy et al., 2005). Whilst 'standard' plant species can be used as bioindicators of metal availability/toxicity and can provide an immediate measure of phytoavailable levels of heavy metals, this approach is somewhat limited by the wide genetic variability in metal accumulation that exists both within and between species (MacNair, 2002). An alternative approach for assessing phytoavailability is to use metal hyperaccumulator species such as *Thlaspi caerulescens* which have a high demand for metals. These plants are capable of tolerating high metal concentrations, and in the case of the *T. caerulescens* Ganges ecotype, high levels of Cd and Zn in particular.

Biological wastewater treatment processes produce large amounts of surplus sludge. Proper waste treatment and final disposal methods are important for reducing excess sludge. Traditional sludge disposal methods include landfilling, incineration, and agricultural use. In recent years, many countries have developed a series of regulations that forbid the landfilling of solid wastes with high organic matter content due to land consumption and landfilling leachate pollution. Incineration seems to be a good option for sludge disposal. Therefore, the only option left for sludge disposal is land use. The disposal method appears to be an economical and promising option because sludge can supply crops with large amounts of organic matter and inorganic nutrients and improve soil structure. Compared with landfilling and incineration, land use for sludge as organic fertilizer is a more sustainable alternative. Nevertheless, a large number of heavy metals in sludge exceed Chinese legal standards (GB4284-1984) and can become a constraint for sludge application in agriculture in China. Unlike organic pollutants, heavy metals are persistent environmental contaminants that cannot be destroyed. Thus, removing heavy metals from sludge before composting is a necessity for achieving more sustainable sludge treatment.

Biosorption is the property of same biomaterials as bacteria, yeasts, fungi, agricultural wastes, etc., to bind to and to concentrate metals from aqueous solutions and it includes metal uptake by active (metabolically mediated uptake) and passive modes (physico-chemical pathways). This process is very promising due to its ecofriendly nature, excellent performance and low cost. The high affinity, rapid metal uptake and maximum loading capacity are some of the important factors to consider when selecting a biosorbent .

reported that the fungi symbiosis will be useful in phytoremediation of heavy metals. Muneer et al. (2007), showed that the isolated yeast can be exploited for bioremediation of chromium-containing wastes, since they seem to have the potential to accumulate the toxic metals from the environment.

Phytoremediation is a cost-effective technology for environmental cleaning if native plants were applied in each polluted areas. We need new and variable accumulator plants for phytoremediation in different climates, so new studies are still necessary to find new accumulator plants for using in different conditions

Materials and methods

The experiment was conducted in controlled conditions was completely randomized design and factorile test. Three levels of sewage sludge (0, 100 and 200 ton/ha) , two levels of mycorrhiza (with and without mycorrhiza) and two plant (Secale montanum and Vicia faba) in three replicated were used. Organic matter content were measured. . The data were analyzed using statistical software (SPSS).

This experiment was in year 2010-2011 in greenhouse of Faculty of Agriculture,Shahid Chamran University, located in Ahvaz. due to study of the Sewage sludge effect on organic matter of soil with plants of *Vicia faba* and *Secale montanum* inocoloum with Arbuscular Mycorrhizal fungi.

Soil sample collected from the farm of Faculty of Agriculture,Shahid Chamran University. One sample of the soil (depth 10-15 cm) was taken and sieved through a 1cm sieve. Then Sample of dried sewage sludge sieved through a 1 cm sieve. The physical and chemical characterizes of soil and sewage sludge estimate in labratury.

Statistical analysis: To detect a significant difference in the experimental groups and control ones, analysis of variance (ANOVA) followed by the least significant difference test (LSD) that was performed between studied groups (Chehregani et al., 2005). Each data was represented as the means±SD of samples for experimental groups and for control ones.

Results and Discussion

According to the results one of effect the sewage sludge is increased of organic matter in soil. Zaeri (1380) reported that added sewage sludge to soil cause of increase the organic matter in soil.

Table 1:

	df	SS	MS	P valu
plant	1	۰/۲۱۹	۰/۲۱۹	**۳۰/۴۹۹
mycorrhiza	1	۰/۰۱۸	۰/۰۱۸	ns۲/۵
Sewage sludge	2	۱۷/۳۰۲	۸/۵۱۶	**۱/۱۸
mycorrhiza × plant	1	۰/۰۰٤	۰/۰۰٤	ns۰/۵۸
sewage× plant	2	۰	۰	ns۰/۰۱۴
sewage × ۱mycorrhiza	2	۰/۰۰۲	۰/۰۰۱	ns۰/۱۳۶
sewage ×mycorrhiza ×plant	2	۰/۰۰۷	۰/۰۰۳	ns۰/۴۶
Error	24	۰/۱۷۳	۰/۰۰۷	

p<0/01**، p<0/05* and ns (non significant)

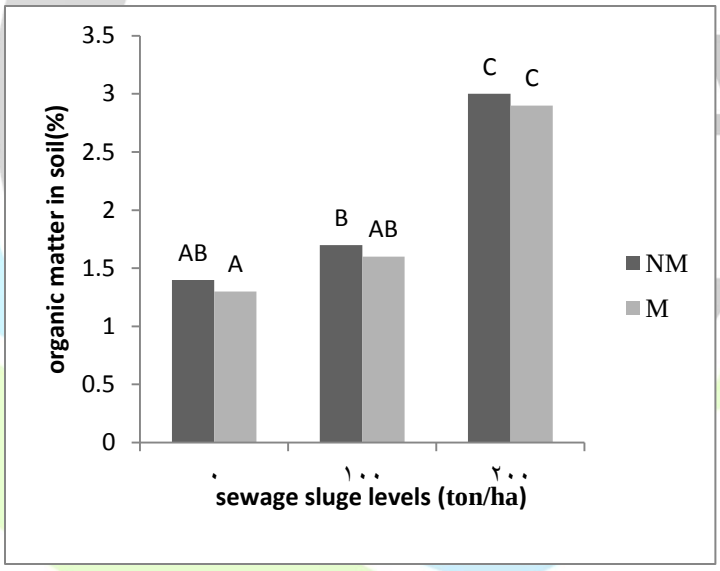

Fig.1: Effect of different levels sewage sludge on contnt of soil organic matter in soils treated with sewage sludge with(M) and without(NM) present of Arbuscular mycorrihza fungi in Vicia faba

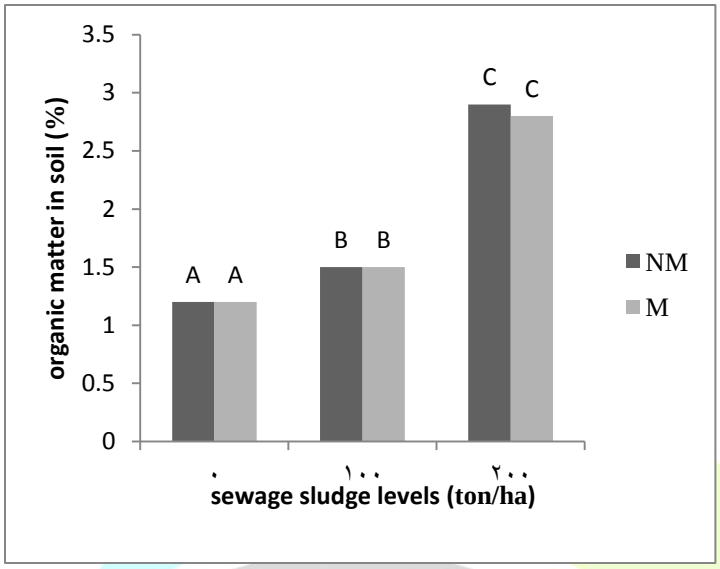

Fig.2:Effect of different levels sewage sludge on contnt of soil organic matter in soils treated with sewage sludge with and without present of Arbuscular mycorrihza fungi in Secale montanum and Vicia faba.

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