Solid Earth Discuss.,
doi:10.5194/se-2016-122-AC6, 2016

Interactive comment on "Effects of Spent Mushroom Compost on Physicochemical Properties of Degraded Soil" *by* İlknur Gümüş and Cevdet Şeker

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Received and published: 21 November 2016

Title, Abstract, Materials and methods , Results and Discussion: Changes have been made by referees stated. The separation of Result and Discussion are not mentioned by the Solid earth. Effects of Spent Mushroom Compost Application on Physicochemical Properties of Degraded Soil Abstract Land and laboratory studies show that the application of organic amendments into the soil improves the physicochemical properties of it. The study aims to explore spent mushroom compost (SMC) application on the properties of a weak-structured and degraded soil. The approach involved establishes a pot experiment with spent mushroom compost applications (control, 0.5C1 content (-33 kPa) for 21, 42, and 62 days. SMC applications into the

soil significantly increased the aggregate stability (AS) and decreased the modulus of rupture. SMC increased soil EC, with all treatments having EC values well below the upper limit of 4000 μS cm-1, as suggested for agricultural soils. Application of SMC at the rate of 1organic carbon (SOC) contents of the degraded soil at all incubation periods (p<0.05). The results obtained from this study clearly indicated that the application of spent mushroom compost reduces the modulus of rupture and increase of total nitrogen and soil organic carbon content. Keywords: Aggregate stability, modulus of rupture, soil aggregation, soil structure, mushroom compost Introduction Soil quality is defined as the capacity of the soil to function within natural or managed ecosystem and land use boundaries, to sustain biological productivity, to promote the quality of air and water environments, and to maintain plant, animal and human health (Doran et al., 1997; Karlen et al., 1997). Physical and chemical attributes are the main indicators used to assess soil quality (Bone et al., 2014; PazâAĔŸ RFerreiro and Fu, 2013; Pulido ĔĞ Moncada et al., 2015). Soil quality is threatened by intensive management of the available urbanization and agricultural land, and by the increase in human activities (PazâAĔŸ RFerreiro and Fu, 2013). Soil quality is another important aspect closely related ĔĞ to soil degradation. Soil degradation decreases land productivity (Yu and Jia, 2014). Degradation of land can be divided into three types: arid, semi-arid, and sub-humid dry areas from various factors, including climatic variations and human activities (Yu and Jia, 2014). Soil degradation problem is particularly serious in the Mediterranean areas, where the effects of anthropogenic activities add to the problems caused by prolonged periods of drought and intense and irregular rainfall (HuesoâAĔŸ RGonzález ĔĞ et al., 2014). Vegetation degradation, land use change, and soil degradation factors that causes soil carbon and nitrogen losses (Moreno et al., 2016; Peng et al., 2015). The reduction in soil structure is considered as a form of soil degradation (Chan et al., 2003), and is always with regards to land use and soil crop management practices. Physical properties of soil include soil structure degradation occurs mostly due to C2 the decrease in soil organic matter caused by excessive soil cultivation (Grandy et al., 2002). ÂÿSeker and Karakaplan (1999) reported that the loss of organic matter is generally associated with a decrease in soil porosity and wet aggregate stability, as well as the increase in soil strength indices. Soil water movement and retention, crusting, root penetration, crop yield, erosion, and nutrient recycling are influenced by soil structure (Bal et al., 2012; Bronick and Lal, 2005; Seker, 2003). Organic materials are important soil additives that help to improve soil physical, chemical, and biological properties. Organic materials can improve the fertility of soil and soil amelioration (Wu et al., 2014). Besides good yield, these organic materials have been beneficial for soil chemical and physical fertility and stability that are possible due to organic matter (Mukherjee et al., 2014). Sustaining the productivity of soils is important, particularly in semi-arid regions (such as Turkey) where there is low input of organic materials (Gümüs and ÂÿSeker, 2015). Mushroom cultivation has recently become very popular in Turkey, and is a promising new industry, with many new businesses developing every year. Mushroom production in Turkey is separated into two components: compost production and mushroom cultivation. Compost application to agricultural soil has been widely practiced as one of the approaches to improve crop productivity and soil fertility (Jaiarree et al., 2014). Spent mushroom compost can be used in organic farming to improve soil water infiltration, water holding capacity, permeability, and aeration. Composts provide a stabilized form of organic matter that improves the physical properties of soils by increasing both nutrient and water holding capacity, total pore space, aggregate stability, erosion resistance, temperature insulation, and the decreasing apparent soil density (Shiralipour et al., 1992). The objective of this study is to indicate the effects of SMC application to degraded soil with specific emphasis on aggregate stability, the modulus of rupture, electrical conductivity (EC), nitrogen, and organic carbon. Materials and Methods Soil was collected from a plot in the Agricultural Faculty of Selçuk University experiment station (0-20 cm soil depth) near the Konya SarÄscalar-Village located in central Anatolia, Turkey (latitude of 38 ′ âŮę 05' 56" N, longitude of 32âŮę 36' 29" E, 1009 m above mean sea level). The climate is C3 semi-arid, with an annual precipitation of 379.38 mm, an annual mean temperature

of 11.5 âUËŻeC, and an annual mean evaporation of 1226.4 mm (MGM, 2015). Soil ËŽ moisture and temperature regimes are xeric and mesic, respectively, according to the climate data (Staff, 2006). Soil was classified as Fluvisol (Staff, 2006). The soil sample used in this study has certain problems, such as insufficient seedling emergency, low aggregate stability, crusting problem, and low organic matter content (Bal et al., 2012). The area has a typically rain-fed attribute with cultivation practices and various crops such as grains, sugar beet, and corn with fruit trees of various ages. A portion of the land is located in the fruits trees of different ages and types. The spent mushroom compost (SMC) used in the present study were obtained from private companies dealing with mass mushroom production located in Konya, Turkey. Results and Discussion Aggregate stability (AS) Aggregate stability values of the soil treated with different doses SMC application was measured after 21, 42, and 62 day's incubation periods, respectively (Fig 1). The effects of SMC application on soil aggregate stability values were significant by statistically. Generally, aggregate stability increased with SMC applications. These results may be explained by aggregate stability and soil organic matter that are two parameters and indicators for sustaining soil productivity. Aggregate stability is a key factor of soil fertility (Abiven et al., 2009). The recovery in aggregate stability of such physically degraded soils is important, as those studied was expected to follow the incorporation of any cementing agent, such as SMC (Curtin and Mullen, 2007). Aggregate stability decreased at 42 and 62 days of incubation periods in all SMC rates, when compared to a 21-day incubation period. These results may be explained by the decomposition of soil organic matter (Carrizo et al., 2015; Seker, 2003). Aggregate size distribution and stability can be used as an indicator of soil condition or degradation (Boix-Fayos et al., 2001). Soil organic matter was suggested to be the most important factor in determining soil aggregate stability as significant positive relationships between these two parameters (Aksakal et al., 2015; Candemir and Gülser, 2010; Cerdà, 1998). Organic matter shows a direct relationship with aggregate stability (Cerdà, 1998). In addition, the aggregate stability of the soil C4 samples decreased due to the mechanical mixing of the pots contents to simulate repeated cultivation (Seker, 2003). Soil modulus of rupture All the SMC applications resulted in significantly lower modulus of rupture at 21st and 42nd days, except for the 62nd day incubation (Fig 2). In general, soil modulus of rupture decreased with the increasing application rates of SMC. The effects were especially due to the high organic matter contents of SPM that improved soil structure mechanically (Gümüs and ÂÿSeker, 2015; Seker, 2003). The SMC used in the study contains significant amounts of organic substances. These results may be explained through the formation of aggregates during the incubation periods. The modulus of rupture was reduced because of the increase in organic amendments, which allowed less cohesion among the soil aggregates (Seker, 2003). Organic amendments are known to decrease bulk density and particle in soil (Moreno et al., 2016). EC The EC values significantly elevated with increased SMC application (Fig 3). Soil EC values gradually increased with incubation periods significantly, and the magnitude of such increase was higher in the SMC-amended soil than the control soil. The increasing EC values in an experiment for different doses of SMC application may be explained by the high content of solutes nutrient composition of organic fragments, and the remains from the materials during incubation periods (Yilmaz, 2010). EC can serve as a measure for the presence of nutrients for both cations and anions (Roy and Kashem, 2014). Soil organic carbon (SOC) The effects of SMC on SOC values of the soil are shown in Fig. 4. The SOC values significantly increased SMC application. Investigation performed at incubation periods revealed that soil SOC existentially increased in response to the increment in SMC dose, and the strongest effect were obtained with the doses 4differences in SOC values, depending on incubation periods and rates of SMC was noticed. SOC content of soil increased with the increasing amendment rates of SMC (Fig 4). Thank you for your attention.

Please also note the supplement to this comment:
http://www.solid-earth-discuss.net/se-2016-122/se-2016-122-AC6-supplement.pdf

Interactive comment on Solid Earth Discuss., doi:10.5194/se-2016-122, 2016.