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EFFECT OF DIFFERENT AMOUNTS OF NANO IRON OXIDE POWDER AND URBAN SOLID WASTE COMPOST COATED SULFUR ON SOME PHYSICAL PROPERTIES OF SALINE-SODIC SOIL

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ABSTRACT

Most of studies using urban solid waste compost showed that due to high organic matter content this organic fertilizer has an important role on physical and chemical properties of soil. Nano iron oxide powder also helps to adhere soil particles and makes better aggregate formation. In this research, the effects of different amounts of nano iron oxide powder and urban solid waste compost coated sulfur on infiltration rate, particle density and mean weight diameter of aggregates (MWD) of a saline-sodic soil in a randomized block design (factorial) was studied. Treatments were nano iron oxide powder at two levels (0 and 20 mg/kg) and urban solid waste compost coated sulfur at two levels (0 and 15 ton/ha) each with three replications. The effects of nano iron oxide and urban solid waste compost coated sulfur on physical properties of a surface soil (0-15 cm) were studied in plots of 4 m^2 after harvest of sunflower plant. Results showed that application of urban solid waste compost coated sulfur led to a significant increase in infiltration rate, MWD and a significant decrease in bulk density of soil. Nano iron oxide treatments resulted in a significant increase in MWD and a slightly increase in soil infiltration rate, but did not show remarkable effect on soil bulk density. Interaction effect of urban solid waste compost coated sulfur and nano iron oxide showed that their application at a time resulted in higher infiltration rate, significant decrease in bulk density and significant increase in MWD in studied soil.

KEYWORDS: *Nano iron oxide, Compost, Physical properties, Saline-sodic soil*

INTRODUCTION

Nanoparticles due to the size effects, surface effects and high surface free energy can be used as bonding factor for soil particles. Iron oxides also affect soil structure and fabric, often being responsible for the formation of aggregates and cementation of mineral particles. Fe (hydr) oxides are also important as cementing agents in soils. Much of the structural evidences in soils, particularly in the lower horizons, is due to cementation by Fe minerals [1].A primary benefit of urban solid waste compost (USWC) is the high organic matter content and low bulk density [2, 3]. Application of urban solid waste compost at 30 and 60 ton/ha increased the aggregate stability of soil through the formation of cationic bridges thereby, improving the soil structure [4]. Another study showed that the addition of mature urban solid waste compost to a silt loam, increased aggregate stability [5]. Many workers concluded that application of urban solid waste compost consistently increased soil organic matter content and soil C/N ratio to levels greater than those of unamended soil [6, 7, and 8] thereby improving soil structure because of lower soil bulk density and increasing aggregate stability of soil.

EXPERIMENTAL

A field experiment was conducted in plots of 4m^2 during 2009-2010 in Qom region to study the effect of different amounts of nano iron oxide powder and urban solid waste compost coated sulfur on infiltration rate, particle density and mean weight diameter of aggregates (MWD) of a saline-sodic soil in a randomized block design (factorial) with three replications. After preparation of beds and before addition of nano iron oxide powder and urban solid waste compost coated sulfur to soil, soil sampling was performed in 0-20 cm to determine the physico-chemical properties of control soil. After sunflower harvest, again soil from each plot was sampled from 0-20 cm to determine some soil physical properties such as, bulk density, infiltration rate and MWD of different treated soils. Data obtained were analyzed statistically by using SAS version 9.1 and Excel and treatment means were compared using Duncan Multiple Range Test (DMRT) at α = 5%.

RESULTS AND DISCUSION

Results showed that application of urban solid waste compost coated sulfur led to a significant increase in infiltration rate, MWD and a significant decrease in bulk density of soil. Application of 15 ton/ha USWC coated sulfur resulted in a significant decrease in soil bulk density compared to 0 level of USWC, similar results were reported by He et al. [2] and Soumare et al.[3].

Nano iron oxide treatments resulted in a significant decrease in MWD and a slightly increase in soil infiltration rate, but did not show significant effect on soil bulk density. Application of 20 mg/kg nano iron oxide powder resulted in a significant increasing in MWD compared to 0 level of nano iron oxide powder, similar results were reported by Schwertmann et al [1].Interaction effect of USWC coated sulfur and nano iron oxide showed that their application resulted in higher soil infiltration rate, significant decrease in bulk density and significant increasing in MWD of studied soil. Increasing in USWC coated sulfur from 0 to 15 ton/ha with 20 mg/kg nano iron oxide led to the highest increment in infiltration rate and MWD and significant decreasing in bulk density of soil (Table 1). This increasing trend was observed with increasing in USWC coated sulfur from 0 to 15 ton/ha with increase in nano iron oxide from 0 to 20 mg/kg (Table 1).

Table 1: Interaction of USWC coated sulfur and nano iron oxide on some soil physical properties

USWC (tons/ha)	Nano iron oxide (mg/kg)	Bulk density (g/cm^3)	MWD (mm)	Infiltration rate (cm/h)
0	0	1.26 a	1.70 d	3.2c
	20	1.24 a	1.85 c	3.2 c
15	0	1.09 b	2.60 b	11.4 b
	20	1.09 b	2.88 a	13.5 a

Numbers by the same letter in each column has not significant difference (Duncan test, $P \leq 0.05$).

CONCLUSION

The amendments application of USWC coated sulfur and nano iron oxide powder improved physical properties of studied saline-sodic soil. This improvement was proportional to the application rates of USWC coated sulfur and nano iron oxide. Our results indicating that applications of USWC coated sulfur combined with nano iron oxide powder led to higher infiltration rate and MWD and a significant decrease in bulk density of saline-sodic soil.

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