ACTIVE SI AND COMPOST MIXTURE EFFECT ON SOIL-PLANT SYSTEM

Bocharnikova E.A.

***Inst. Phys.-Chem & Biol Problems in Soil Science RAS, Russia. E-mail: mswk@rambler.ru*

Composting is the decomposition process when microorganisms transform plant remains and other raw organic materials into stable humus-like substances. Some silicon compounds have been reported to be beneficial for stabilizing humic substances and accelerating microbial activity [1, 3]. In the soil-plant system, both humus substances and soluble silicon compounds have a positive influence on soil properties, soil fertility, and plant growth. The use of compost in combination with Si could lead to the formation of synergetic effect on the soil and the plant with more remarkable economical and environmental outcomes.

The aim of our investigation was to determine the effect of combined application of compost and active Si on barley growing on sandy soil (cultivated Spodosol). Compost from West Palm Beach landfill and amorphous silicon dioxide as a source of active Si were applied to the soil in the greenhouse test. Design of the experiment included the following treatments: control, compost (at the rate 2 t/ha), silicon dioxide (at the rate 1 t/ha), and mixture of compost and silicon dioxide. All materials were applied before planting. After 1 month, the soil samples were analyzed for Corg (alkaline-extractable), monosilicic acid Si (water-extractable), CEC, pH (water) by standard and elaborated methods [4]. Weight and height of roots and shoots were measured. The total content of Si in the plant tissue was analyzed by Elliot and Snyder method [2].

The results obtained have shown that the application of compost provided increased organic carbon, improved CEC and pH in the soil while the application of silicon dioxide didn't impact organic carbon but increased soil soluble silicon and improved CEC and pH (Table 1). The effects on CEC and pH became more significant when both materials were used together: CEC was increased from 2.3 to 6.3 meq/100 and pH – from 5.6 to 6.9. It should be noted that the combined use of compost and Si resulted in higher concentrations of organic carbon and monosilicic acid as compared with the separate applications of compost or silicon dioxide. More remarkable effect of the mixture of compost and silicon on the soil properties promoted better growth of barley plants.

Table 1.- Effect of compost and active Si on selected soil properties

	Corg, %	Monosilicic acid, mg Si/kg of soil	CEC, meq/100	pH
Control	0.5	8.12	2.26	5.6
Compost	0.7	8.67	4.56	6.3
Active Si	0.5	13.42	3.15	6.4
Compost+active Si	0.8	14.23	6.27	6.9
LSD_{05}	0.1	0.21	0.20	0.1

The applications of active Si, compost or mixture of compost and active Si had a positive influence on the weight and growth of barley (Table 2). Silicon dioxide more significantly improved growth of barley as compared with compost. The combined application of the both materials had synergetic influence on barley. The weight and height of plants were increased by 70-80%, while the separate application of both materials provided increase in these plant parameters only by 20-25%. The maximum effect was detected for the weight of roots (increase by 112%) and weight of shoots (increase by 85%). The height of roots was increased by 74% and height of shoots was increased by 51% (Table 2). The content of total Si in the plant tissue was increased under the applications of tested materials or their mixture.

Table 2.- Effect of compost and active Si on barley growth and plant Si

	Height, cm		Dry weight, g		Total Si, %	
	roots	shoots	roots	shoots	roots	shoots
Control	15.4	24.7	0.08	0.28	1.54	0.80
Compost	18.6	30.2	0.11	0.33	1.67	0.94
Active Si	22.3	30.3	0.15	0.42	2.56	1.56
Compost+active Si	26.8	37.3	0.17	0.52	2.76	1.78
LSD_{05}	0.4	0.4	0.06	0.06	0.15	0.15

Our data has shown that the mixture of active Si (amorphous silicon dioxide) and compost has synergetic beneficial effect on soil properties and plant growth. It is well known that the stability of soil organic matter is enhanced as affected by active forms of Si (monosilicic acid and polysilicic acids) [1]. On the other hand, the organic matter has a positive influence on the mobility of silicon substances [1, 4]. This phenomenon could be used for improving soil fertility and plant productivity. Probably, it would be more efficient to mix silicon compounds with organic substances before composting process.

References

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