Effect of flue gas desulfurization waste on corn plants

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Abstract
The results of this research indicated that any increase beyond 1% FGD waste to soils an amendment would not be ideal for corn plants. However, other crops should also be tested for the phytotoxic effects of FGD wastes.

Introduction
Flue gas desulfurization (FGD) waste results from the addition of limestone and/or dolomite to the coal either before (in the case of fluidized bed combustion) or after (in the case of flue gas desulfurization) combustion. These wastes are typically a combination of ash and various Ca, Mg, and S compounds (Sajwan *et al.* 1999). Similar to fly ash these wastes also contain several trace elements (Sajwan *et al.* 1999). Like fly ash, FGD sludge contains high concentrations of soluble salts and high pH (Sajwan *et al.* 1993). As with fly ash, the principal concerns with FGD disposal include groundwater contamination from leachate, and elevated concentrations of trace elements in plants and soils in disposal area (Santhanam *et al.* 1979). It has been reported that that FGD waste could be used as a source of B and Se for soils deficient in these elements (Santhanam *et al.* 1979). This study investigated the effect FGD waste on biomass production and selected elemental uptake by corn plants.

Materials and methods
This study was conducted under greenhouse conditions. The FGD was collected from a Coal Fired Power plant in Cope, South Carolina. The FGD was weathered by flushing it through water periodically for over a month. The Ogeechee loamy sand soil (pH of 5.5) used in this study. The FGD was added at 0 (T1), 1% (T2), 2% (T3), 4% (T4), 6% (T5), 8% (T6), and 10 % (T7) by weight to 6 Kg soil in pots and blended thoroughly. The experiment was arranged in complete randomized block design with three replications. Pots were incubated for two weeks at field capacity moisture content. After two weeks of soil incubation corn seeds (*Zea mays L.,* var. Pioneer 3165*)* were sown in each pot. All the pots were maintained at field capacity moisture content throughout the six week growth period. Plant visual symptoms were also monitored for signs of any stress, growth abundance or lack of growth as a result of FGD applications.At the end of the six week growth period above ground plant parts were harvested, oven dried, weighed and analyzed for elemental composition.

Results and discussion
Dry matter yield of six-week-old maize started to decrease with the second dose of FGD (2%) and the lowest yield was obtained in treatment with the highest dose of FGD (10%). Increasing level of FGD caused a steady decline in dry matter yield, with the highest treatment (10%) approximately half the biomass of the control plants. No visual metal toxicity symptoms in plants were observed. Our preliminary assessment has shown that up to 1% FGD could be used as effective soil amendment. The chemical analysis of plant tissue indicated that As, B, and Se concentrations significantly increased as the FGD rate was increased from 1% to 10%. The As, B and Se concentrations increased respectively from 1% to 10% FGD applications. The Mo and Cr levels in plant tissue were below the detection limit.

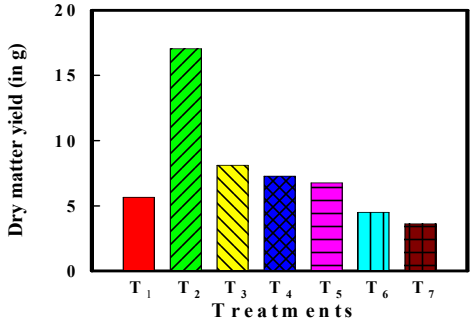

Figure 1. Dry matter yield under various FGD treatments.

Table 1. As, B, Se, Mo, and Cr in plant tissues under various FGD treatments.

Treatments	As	B	Se	Mo	Cr
	(----------mg/kg----------)				
T_1 (Control)	0.30	11.49	0.3	<1	<1
T_2 (1%)	1.95	38.25	1.0	<1	<1
T_3 (2%	2.06	52.73	3.13	<1	<1
T_4 (4%)	2.10	70.48	5.48	<1	<1
T5 (6%)	2.20	85.82	6.56	<1	<1
T_6 (8%)	2.68	182.47	12.81	<1	<1
T_7 (10%)	2.73	189.60	14.34	<1	<1

Conclusion

The results of this research indicated that any increase beyond 1% FGD waste to soils an amendment would not be ideal for corn plants. However, other crops should also be tested for the phytotoxic effects of FGD wastes.

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