Paul C. And Edna H. Warner Endowment Fund for Sustainable Agriculture
Report Form

Growing perennial grasses for biofuels on marginal land amended with municipal waste biosolids and flue gas desulfurization gypsum

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Summary:

Field experiments were established at collaborating farmer's fields in Adams and Pike County, Southern Ohio. *Miscanthus giganteus* plugs were planted in June/July 2010 in sewage sludge and FGD gypsum amended plots. Initial soil samples were collected, processed, and analyzed for baseline data.

Objectives:

• To determine the effects of sewage sludge and FGD gypsum on survival, feedstock production, and nutrient requirements of *Miscanthus*

• To evaluate the effects of *Miscanthus* grown with added sewage sludge and FGD gypsum on emissions of GHG's (CO_2, N_2O, and CH_4), C sequestration and soil quality of marginal land.

What was done?

Initial soil samples were collected, processed, and analyzed as baseline data. *Miscanthus giganteus* plugs were planted in June/July 2010 in sewage sludge and FGD gypsum amended plots.

In year two of the study, *Miscanthus* will be harvested and the data on survival, ground coverage, plant height, root, and shoot biomass production will be collected. Plant samples will be analyzed for total C and N content by automated CN analyzer; total P, K, Ca, Mg, and S, micronutrients, and heavy metals to calculate annual nutrient removal, recycling, and accumulation. Field gas collection chambers will measure CO_2, CH_4 and N_2O emissions, and soil cores from each plot will be analyzed for carbon sequestration and soil quality changes.

What were the results?

Baseline soil data was collected and analyzed, further results are expected after the *Miscanthus* collection and analysis in year 2.

How have the results contributed or will they contribute sustainable agriculture?

Using our best land to grow crops for fuel is not a logical choice. Marginal quality land, such as reclaimed strip mine land and low quality sloping pasture or brushy land, is relatively low priced and may be suitable to grow bioenergy crops. Because the crops are not grown for food, applying municipal and industrial sewage sludge to improve soil quality poses no danger to human health. The Appalachian region of Ohio has about 640,000 ha of marginal land that may be suitable for bioenergy feedstock production. Bioenergy crops especially perennial grasses are fast-growing which tend to protect against soil erosion and could be commercially grown on most land that is not too steep or rough to be planted and harvested by machinery. Growing perennial grasses such as *Miscanthus* for biofuel on this land should provide a much greater net income than either grazing livestock or growing trees. Increasing the income from this land should increase its value, which will tend to keep it in farm production and improve the overall economy of the region.

Sewage sludge is nutrient-rich organic byproducts of wastewater treatment facilities that can be safely applied as a source of organic matter and nutrients to improve and maintain productive soils and stimulate plant growth. As municipalities nationwide face growing populations (meaning more waste), they are pleased with any opportunity to dispose of sewage sludge in a positive, productive way. Electric utilities with coal-fired power plants face a similar problem. The Clean Air Act Amendment of 1990, which restricts SO2 emissions from burning high S coal, has spurred the development of the flue gas desulfurization gypsum (FGD) systems. According to American Coal Ash Association, about 12.1 M Mg of FGD gypsum were produced in 2006. With many electric companies in the process of bring new scrubbers on-line, the annual production of FGD gypsum may double over the next 10 years. Applying sewage sludge and FGD gypsum on marginal soil to grow *Miscanthus* for bioenergy feedstock production will provide a valuable use for this waste product. Given the current trend in global energy utilization and climate change, our research will provide technical information needed to proactively foster the use of sewage sludge and FGD gypsum for *Miscanthus* plantation on low quality land in Appalachian Ohio and similar regions across the US. Our research will also indicate if this process can decrease emissions of greenhouse gases (GHG's) and enhance soil quality and carbon sequestration over time.