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EXAMINING SITE PRODUCTIVITY AND FERTILITY WHEN INTERCROPPING GIANT MISCANTHUS AND LOBLOLLY PINE

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Abstract: There is a growing interest in the production of dedicated biomass crops to be utilized as feedstock for bioenergy production. Perrennial grasses have been identified as attractive feedstock. Wide row spacing of loblolly pine plantations allows dedicated energy crops to be planted between tree rows through a practice known as intercropping. Utilizing between-row growing space for bioenergy feedstock production may maximize economic and biomass output from the land early in the rotation while still maintaining the long term production of traditional forest products.

Keywords: bioenergy, biomass, feedstock, forest management, forest products, perrennial grass.

BACKGROUND

There is a growing interest in production of dedicated biomass crops to be utilized as feedstock for bioenergy production. Giant miscanthus (*Miscanthus* × *giganteus*), a perennial, warm season grass related to the sugarcane family, is one potential high yielding, bio-energy crop. (Heaton, 2004, Lewandowski 200, and Lewandowski et al., 2003). The wide row spacing of loblolly pine (*Pinus taeda)* plantations allows the planting of dedicated energy crops between tree rows through a practice known as intercropping. Utilizing between-row growing space for bio-fuel feedstock production may maximize economic and biomass output from the land early in the rotation while still maintaining the long term production of saw timber.

GOAL

The goal of this project is to investigate how the long-term site productivity and sustainability is affected when intercropping miscanthus in a loblolly pine plantation. A detailed investigation into this method of feedstock production will facilitate the development of sustainable forest management strategies for intercropping.

Objectives

- Quantify the potential miscanthus biomass yield and pine growth early in the rotation of intercropped stands of miscanthus-loblolly pine.

- Examine the effect diminishing light levels caused by tree shading will have on photosynthetic rates and subsequent biomass yield of miscanthus.
- Examine the effect of soil pH and liming on miscanthus biomass yield.

METHODS

Site Description

The study site is a loblolly pine plantation located in Lenoir County near Dover, NC. The previous stand was a 1974 plantation with a site index (age 25) of 70. The soils are mapped as Pantego (Umbric Paleaquults) and Rains (Typic Paleaquults) soil series.

Site Preperation

Three rows of miscanthus plugs were planted May 2010 in the 20 ft of space between rows of trees in a one-year old loblolly pine plantation. Between-row planting preparation involved v-shearing the debris in between pine rows, as well as fertilization and herbicide treatment after miscanthus was planted. Treatments include intercropped miscanthus-pine plots (PM), pine only plots (P) without v-shear or herbicide treatment, and miscanthus only plots (M) with no planted pine and full v-shear of all debris and beds.

Biomass Assessment

Soil and pine/miscanthus tissue samples will be collected and nutrient analysis completed each year of the study. Miscanthus biomass yields will be measured by weight at intended harvest time (Fall) and tree height and ground-line diameter measurements will be collected at the end of each growing season (Winter). Tree data and miscanthus biomass yield, as well as soil and tissue nutrient status will be compared between treatments and throughout the stand rotation.

Shade Tolerance

Miscanthus shade tolerance will be investigated in a greenhouse study. Enclosures constructed using shade cloth of varying opacity will cover potted miscanthus throughout the 2011 growing season (March-October). Average photosynthetic active radiation (PAR) measurements of peak summer months will be collected for each shading treatment using permanent sensors connected to data loggers (HOBO products, Onset Computer Corportation, Bourne, MA). Plant stress due to shading will be measured by collecting data on CO_2 exchange, transpiration and stomatal conductance of miscanthus under each shade treatment. At the end of the growing season average biomass yield per plant by weight will be measured and compared between treatments.

Liming

The pH values in the soils of loblolly pine plantation are much lower than the typical values of current miscanthus research trials (i.e. the pH at the study site was 3.9). A liming rate study was installed at the same study site to examine the effects that varying lime rates might have on miscanthus yields. Liming may increase the prospective biomass yields of miscanthus when planting in acidic soil conditions.

POTENTIAL CONCLUSIONS

This study will examine the feasibility and overall practicality of a miscanthus-loblolly pine intercropped system as a means of sustainable bio-energy production.

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