Research Unit: Mid-South Area's Southern Regional Research Center's Sugarcane Research Unit (SRU)

Location: Houma, LA

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Research Project: Development of Energy Cane and Related Grass Species for an Integrated Feedstock Production System

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Introduction:

With its long growing season, the Southern US can be a significant contributor to the goal of producing biomass to meet the energy needs of the nation. The longer growing season also presents an opportunity for an individual grower to produce an assortment of related feedstocks that may allow for a continuous delivery of these feedstocks to both sugar-based and/or ligno-cellulosic based biorefineries. This would be especially advantageous to growers and processors if these feedstocks were closely related so that changes in cultural and harvesting practices and the conversion processes would be minimal. To insure optimum, consistent, and more importantly profitable yields in an integrated system, high yielding and related feedstocks will have to be identified, the geographic range of adaptation of these feedstocks established, and cultural and harvesting practices developed.

Key Accomplishments:

ARS scientists at the SRU released two high fiber sugarcane varieties, HoCP 91-552 and Ho 00 – 961, in 2007 as "energy canes" for the biofuels industry. Both have higher biomass yields, based on several years of field testing and machine-harvesting, than conventional sugar cane varieties under Louisiana's temperate climate. In addition, we have identified seven candidate energy cane varieties for further testing. These wild cane x sugar cane hybrids have significantly higher biomass yields and appear to be more cold-tolerant than commercial sugar cane varieties. To document the range of geographic adaptability, vegetative cuttings of these candidate energy canes were sent to ARS cooperators in Booneville, Arkansas; Tifton, Georgia; and Canal Point, Florida (for planting in North Florida) and university cooperators in Auburn, Alabama; Starkville, Mississippi; and Beaumont, Texas in the fall of 2006. The field planting and establishment of plots for yield testing in 2008 is being coordinated by SRU scientists to insure consistency across locations.

SRU scientists also evaluated four sweet sorghum and two sorghum x sudan hybrids as companion sugar/biomass producing crops that can be harvested in late summer to early fall with conventional sugar cane harvesting equipment.

When doubled-drilled on a conventional 6-ft wide sugarcane beds in early April and harvested 140 days later, biomass yields of 12 tons/acre were obtained.

Other scientific expertise or capabilities already available at the RU that could be applied to bioenergy research:

Breeders at the SRU have been developing varieties for the Louisiana sugar cane industry since 1926. To induce flowering in Louisiana's temperate climate photoperiod facilities have been built that allow the SRU's breeders to make approximately 1000 crosses each year. Since sugar cane in Louisiana is grown the furthest from the equator than any other area of the world, major emphasis of the crossing program continues to be on increasing cold tolerance. To this end, we have been incorporating genes for cold tolerance using a wild species of cane collected from high elevations in Asia. The process requires several backcrosses to high sugar producing varieties to get a new sugar cane variety with commercially acceptable sugar yields. These early-generation hybrids, in addition to having more cold tolerance, often produce biomass yields significantly higher than either the wild or commercial sugar cane parent used in the cross. The yield potential of these high fiber - low sugar containing "energy cane" hybrids not only in Louisiana but in surrounding states is being evaluated.

In an attempt to infuse additional cold tolerance into sugar cane, ARS scientists are also making crosses with near relatives of sugar cane (*Miscanthus* and *Erianthus*). Both *Miscanthus* and *Erianthus* are high biomass yielding perennial grasses that can be grown and harvested just like sugar cane. Optimal harvest dates (late winter through spring) appear to differ from those of energy cane, which presents an opportunity to use these grasses in an integrated farming system. ARS scientists have begun yield testing of representative species of both *Miscanthus* and *Erianthus* under traditional sugar cane cultural and harvesting practices. Attempts at crossing sugar cane with both *Miscanthus* and *Erianthus* have been somewhat successful to date, and candidate hybrids are being selected for testing as potentially new feedstocks for the Southern U.S.

Once candidate feedstocks are identified, sustainable cultural and pest management systems must be developed for the various growing areas. The impact of the culture of these energy crops with respect to diseases, insects, weeds, soil health, etc. on the more traditional crops must also be determined. The SRU has agronomists, entomologists, physiologists, pathologists, and weed scientists on the staff that can assist in making these determinations. SRU scientists will also seek the collaboration of equipment manufacturers and agricultural engineers as research on the applicability of existing harvesting equipment will be needed. The Louisiana sugar cane industry can be used as a model, but modifications to cane harvesting equipment may be in order or the use of modified forage harvesters in lieu of sugar cane harvesters considered.