Alternate Markets for Dedicated Grass Energy Crops

Growing renewable biomass feedstocks like perennial grasses (switchgrass and miscanthus, for example) that can be converted into energy (electricity, liquid transportation fuels, or heat) is becoming a real opportunity for farmers in the northeastern United States. Such grass crops require low nutrient inputs and little maintenance, are usually harvested after senescence in the off-season of conventional crop production, provide land and/or wildlife conservation value, and can be grown on marginal land, reducing “food versus fuel” competition. Despite these advantages, so far few commercial energy producers in the region process grass crops. Until these energy markets become more accessible to farmers growing perennial grass crops, most growers need to find or create alternate, nonenergy markets for their product to make money.

Why look for nonenergy markets if the endgame for these crops is energy? Nonenergy markets can be considered a supplement or bridge to future energy markets, creating current demand for grass crops. Producers have an opportunity to learn the ins and outs of managing these crops, and more acreage can be planted in the process. As production meets demand in these intermediate markets, high-producing regions become attractive potential sites for commercial energy production/conversion facilities.

Perennial grass energy crops include, for example, switchgrass, a native warm-season grass, and giant miscanthus, a sterile, nonnative, rhizome-propagated grass. Both grow well on marginal land, are deep rooted and highly productive, require little nutrient input and maintenance, are harvested annually, and persist for 15 to 20 years before requiring replanting. Though yields vary with site and management factors, switchgrass has been documented to yield 4 to 6 dry tons of material per acre, and miscanthus 8 to 12. These grass crops are usually mowed and baled in the field; the product marketed from these crops is the straw material itself, which can be left whole, chopped, or densified (pelletized or briquetted, for example). Even standing grass, due to soil and wildlife conservation benefits, has value.

Animal Bedding Markets
Animal bedding is a well-established market for grass material. Perennial grasses have been used as bedding for a variety of livestock, including dairy cows, horses, and poultry. Whole grass straw, chopped grass, and pellets are all used in this market. Grass pellets tend to be more absorbent than sawdust, wood shavings, wheat straw, and many other conventional bedding materials. Nonpelletized straw material, whole or ground, is also favorably reviewed in dairy operations. Some Pennsylvania farmers using switchgrass straw for large animal bedding have noted that it tends to last longer and be more absorbent than their formerly used bedding materials. Miscanthus is more likely to be chopped and used in compost-bedded pack systems because of its woodier stems. Grass straw for large animal bedding has been recently sold in Pennsylvania for up to a farm-gate price of $80 to $100 per dry ton, though market prices vary according to local factors.

Poultry production can also benefit from the use of perennial grass straw. Chopped switchgrass straw used in chicken production has been observed to hold feces effectively and can sometimes be reused if fluffed, making it last longer than conventional bedding materials. Lower incidence of foot pad dermatitis, and therefore higher foot quality, has also been observed in chickens bedded on switchgrass, adding value to a product with a significant Asian market.

Grass Pellets as an Absorbent Material
The high absorbency that makes grass pellets an excellent bedding material is a valuable trait in other markets as well. One example of an absorption application for this product is in natural gas drilling operations, though many other possible absorption applications exist. In this case, grass pellets have been used to absorb wastewater extracted with drill cuttings. In this market, even fine-particle, loosely packed, or “fluffy,” pellets that may be less suitable for some other pellet uses are well designed for fluid absorption. Though some extra processing on the farmer’s part (pelletizing the grass material) is required for this market, the product has high value and can have been sold for a delivered price of about $200 per dry ton.
Perennial Grass Compost and Mulch

Compost and mulch are common inputs in landscaping that are also valuable in fruit, vegetable, and mushroom production. Mulch made from perennial grasses may provide added value, especially to organic produce, because it is low input and provides some conservation value before it is harvested. Mushroom production is a large and well-known market to which perennial grass crops are well suited; it consumes 400,000 tons of straw material in Pennsylvania annually. Especially for growers in the state’s southeastern counties, this is a valuable market where grass material can sell for $80 to $100 per dry ton, even with minimal processing.

Fiber, Fill, Packaging, and Biomaterials

Fiber products made from biological materials enjoy higher market value due to “green” consumer interests. Perennial grass straw can be and has been incorporated into these markets.

When thinking of fiber markets requiring robust product structure, traditional items that come to mind are wood products like plywood and oriented strand board, bamboo products including flooring material, and other similar products. The perennial grass miscanthus, which grows in the form of fibrous canes, has similar strength and aesthetics in such applications. Miscanthus and other grass canes can be pressed together with adhesives to produce boardlike materials.

Ground grass material can be used as a feedstock for producing packaging materials similar to particleboard or incorporated into bio-plastic composite products. Perennial grasses can also be further processed into a pulp that functions similarly to wood pulp and can be used to create paper products like napkins and high-value compostable products like plates and flower pots, to name only a few applications.

Even minimally processed straw can be valuable as a filler material. For example, within a net of biodegradable “sock” material, chopped grass straw makes a “green” silt sock that can be left on site to naturally degrade over time. With many miles of these socks used in road construction, pipeline installation, and countless other applications, demand is high in this market, and perennial grasses can sell for this use for up to $200 per dry ton, even with minimal processing required for straw chopping.

The category of fiber markets is incredibly broad; opportunities to introduce perennial grass material into it are numerous and perhaps not yet fully explored.

Living Material” Land Value Markets

Because of the conservation value associated with nutrient runoff prevention and carbon sequestration due to extensive root systems, even standing, unharvested grass can have market value. For example, perennial grasses are maintained in spray fields near hot spots of hog production in North Carolina as a waste management strategy to prevent waste effluent runoff. In this case, grass standing on the stem is valued at over $60 per ton without the added expenses associated with harvesting and processing. Similar waste management scenarios in other sectors could benefit from this practice as well.

Growth characteristics of perennial grasses, including extensive root infiltration, high root turnover, and annual nutrient recycling, can actually help rehabilitate soils on which these crops are planted. Maintaining switchgrass for a number of years on poor-quality land has been observed to improve soil quality, potentially increasing future yields of other crops on these sites, should the farmer choose to take the grasses out of production.

For More Information

This fact sheet focuses on a few nonenergy markets for two perennial grass crops, switchgrass and miscanthus, but other agriculturally produced plants certainly have a place in bioenergy markets and many of these nonenergy markets as well. Price estimates are based on limited anecdotal evidence for 2014.

A more detailed biomass market overview can be found in Market Opportunity for Lignocellulosic Biomass (Ruamsook and Thomchick 2014). Visit www.newbio.psu.edu for more information on production and use of a selected subset of bioenergy feedstocks.

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