

Case Study: Biomass Grass Pellets on the Farm

WOOD CREST FARM'S WILL BRANDAU HAS BEEN GROWING SWITCHGRASS AND MAKING PELLET HEATING FUEL.

Farm-based production of grass pellets for energy is an interesting new opportunity for farmers in the Northeast. Perennial grasses, such as switchgrass, can be grown on marginal land and made into biomass pellets on the farm.



Switchgrass field next to barn at Wood Crest Farm

These pellets can be used as heating fuel for homes, as well as for other purposes. In many parts of the Northeast, farm land is available that is either abandoned or of marginal quality, and is not suitable for food crop production. While hay equipment is widely available in the region and can be used to harvest and handle biomass grasses, specialized pelleting equipment is also needed. Costs and the knowhow related to those systems need to be understood in advance so that farmers can know if grass pelleting will work for them.

This case study analyzes the operation at Wood Crest Farm in Wapwallopen, PA, where switchgrass is grown and pelletized. The analysis covers all aspects of the operation, from crop establishment to marketing, and provides a detailed analysis of costs as well as tips from the farmer on successful operation.

Production of grass-based pellets has proven to be challenging but feasible at Woodcrest Farm. It takes time to learn how to grow, harvest, and pelletize switchgrass, and there are things about the crop that are different from traditional crops. After the crop is harvested, pelletizing switchgrass successfully is a significant challenge, and there are many details that must be carefully controlled if one is to produce pellets.

Wood Crest farm grows 40 acres of switchgrass on fair to good land in eastern Pennsylvania. The fields are harvested each spring using a rotary flail mower and large round baler. The bales are kept outside (tarpred or in the open air), and used to make pellets throughout the year. Pelleting is done in a barn with a PTO-driven bale grinder, diesel hammer mill, and 55 hp diesel-powered flat-plate die pellet mill.

After spraying or burning the weeds, switchgrass was initially planted using a no-till drill. The cultivar used at Wood Crest Farm is “Cave-in-Rock,” but a small amount of big bluestem, Indiangrass, and wildflower seeds were also included. Field operations are similar for switchgrass as for other grasses, though experience has shown that it is important to leave 6 to 8” of stem on the plant so that the stems bend over when driven on, and do not poke up through the tires. Mowing weeds during the first year was an important activity to help the switchgrass establishment. By the second year, the switchgrass plants were sufficiently established such that only limited spot spraying was needed to reduce weed pressure.

After the first year, the crop had not grown enough to make harvesting worth the effort. After the second year, a partial harvest (~60% of full yield) was possible. Beginning with the third year, the fields have produced well and show no signs of losing productivity, even in the 9th year. There was no fertilizer added to the fields during this time— switchgrass’ fertilizer requirements are modest and there may have been a surplus of nitrogen accumulated in the soil over the years.

Mowing and baling take place in the spring, after the danger of frost passes and before new switchgrass starts growing. The grass is left in the fields over winter to fully dry before spring, and to allow the nutrients to leach back into the ground. Baling switchgrass is a challenge, because chaff has a tendency to clog the baler, requiring the farmer to stop periodically to clear the belts.

Some researchers have reported switchgrass yields of up to and over five dry tons per acre. This may be possible in some locations, but experience at Wood Crest Farm has been that the yield from switchgrass is much lower – more like three dry tons per acre, with yields varying by field. Three dry tons per acre corresponds to about 11 large round bales or 160 small square bales per acre.

Open air storage of the bales results in some spoilage as the outer layer of the bales can get wet and rot. However, losses at Wood Crest Farm have been manageable – on the order of 10%. Tarped bales tend to perform better.



Bale grinder and hammermill



Ground switchgrass for pelleting

Successful pelleting requires a great deal of patience and attention to detail – finding the right combination of moisture content, particle size, and operating conditions is a long learning process, and it is not easy to automate. The rate of pellet production also tends to be much lower than the rated capacity of the mill. In the case of Wood Crest Farm, typical pellet production for switchgrass is only about 12% of the machine’s top rated output.

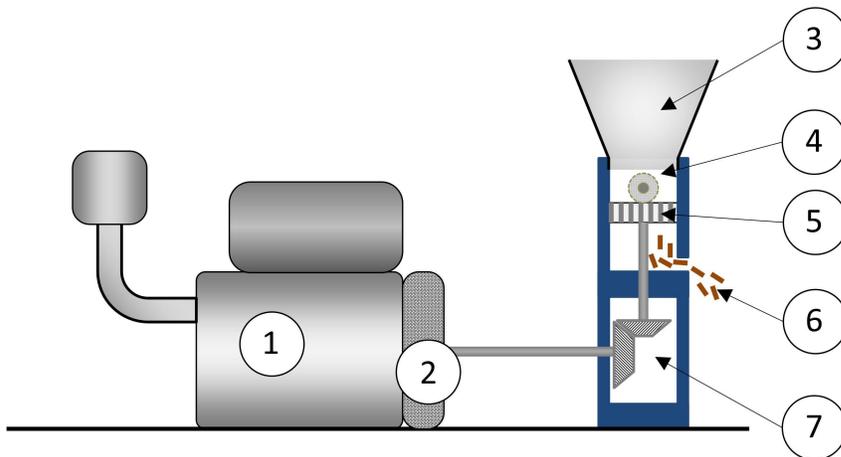
In the pelleting process, feedstock is loaded into the infeed hopper and forced through to the die where the heat and pressure of the machine presses the switchgrass into a cylindrical shape and the natural lignin of the switchgrass starts to melt, acting as the glue that binds the pellets.



Pelletizer



Cooling Rack



1 – Diesel engine, 2 – Clutch, 3 – Infeed hopper, 4 – Rollers, 5 – Die, 6 – Pellets exiting pelletizer, 7 – Gear box

Startup costs at Wood Crest Farm were limited, because the land and barn were already owned, and equipment was purchased second hand. The total paid for tractors, baler, rake, mower, and pelletizing equipment was about \$44,000. Variable startup costs for planting establishment totaled about \$200 per acre.

Variable Startup Costs	per acre
Site Prep Cost	\$72.11
Planting Cost	\$60.37
Establishment Cost	\$72.33

Total: \$204.81

The total cost of production for pellets at Woodcrest Farm is estimated to be about \$88 per ton. However, labor costs are not included in this amount, and land costs in the analysis are only equal to the taxes due on the land. Space in the barn for operating the pelletizer is also used without cost. If these resources were not available, the cost of the pellets would be much higher. This highlights an important point, that the available resources at a farm can have a big impact on the viability of a pelleting operation.

Variable Operating Costs	per acre	per ton of pellets
Harvest	\$41.23	\$15.27
Storage	\$3.36	\$1.24
Pelleting	\$194.95	\$72.20
Total Operating Cost	\$239.54	\$88.72

Most of the costs associated with producing switchgrass pellets are related to the fuel cost for running the field equipment and the pelleting equipment. As a result, efficient use of equipment is important for keeping costs down.

If labor were included in the cost analysis, it would have a big impact on the bottom line. For example, a labor rate of \$10 per hour would more than double the total cost of pellets. The biggest user of labor is the pelleting process, which accounts for about 95% of all hours worked. Because of this, it would be very useful if the pelleting process could be automated or if the throughput rate of the pelletizer could be increased. So far, that has not proven to be practical at Wood Crest Farm.

Marketing is also a big challenge for grass pellets. The pellets are not suitable for most wood pellet stoves, so it may take quite a bit of effort to develop a market for the product. In addition to pellets, Wood crest Farm sells baled and ground switchgrass for a variety of uses to diversify their market and increasing income. Some of the operation’s best customers are farmers who use the switchgrass for animal bedding or mulch. The moisture absorbency and consistency of the switchgrass makes it an attractive product for those uses.

This case study is intended to provide practical guidance to farmers interested in growing switchgrass and producing pellets on the farm. Keep in mind, however, that every farm is different, and costs and labor can vary considerably from farm to farm. In addition, productivity of fields and pelleting equipment can vary a great deal. Lastly, a farmer’s experience and skill can have a big impact on costs and performance. However, the information in this report provides some practical experience-based information that should be useful for farmers planning to try pellet production as a business venture.

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For more information: read the Northeast SARE project report titled, “On-Farm Production of Biomass Grass Pellets - A Case Study of Woodcrest Farm, Wapwallopen PA”

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