Grass for Fuel

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Cattle producers generally think of grass as something to feed animals for meat or milk production. However, current research indicates that grasses may offer excellent opportunities for both heat and power production in the future.

Current use of grass for power production

American agriculture is completely dependent on high inputs of petroleum for energy use in farm equipment. However, much of the world's agriculture utilizes animal power for draft and transport purposes with the fuel being grasses and some crop residues. India and China, with 2.32 billion people or 39% of the world's population, utilize 103 million water buffalo, 20 million horses, and 12 million mules as draft animals. India also has 80 million cattle, mainly used for draft purposes. Many other countries also rely heavily on animal power. Thus, grasses are the fuel that powers 'living tractors' producing food for well over one-half the world's people.

Why should the USA be interested in using grass for power production?

Obviously, the USA in not interested in utilizing animal power for agriculture since mechanized production does it so well with fuel from petroleum. The main problem is that the USA imports over one-half of its growing petroleum needs, creating a $66 billion annual oil trade deficit. Since over 65% of the world's petroleum reserves are located in the Middle East, USA imports are subject to uncertainties in these politically unstable countries. In addition, vehicle emissions from petroleum account for 60% of urban air pollution. If dependable supplies of clean renewable energy could be developed in the USA, there would be economic, health, and national security benefits to our country. Since 1978 the U.S. Department of Energy has had a bioenergy development research program at Oak ridge, TN, cooperating with a number of states. The Crop and Soil Sciences Department at the University of Georgia has a cooperative program in breeding and management for biomass fuel production.

Biomass co-firing with coal for electricity production

Dry grass (biomass) is mixed at 20% by weight (about 50% by volume) with coal and co-fired in coal boilers to produce electricity. The advantages are lower cost and reduced carbon dioxide and sulfur emissions into the atmosphere, resulting in much cleaner air. Large-scale trials are in progress in Alabama and a number of other locations.

Ethanol alcohol production from plant biomass

In this process, gasification and combustion of the grass in a closed container produces carbon monoxide and hydrogen which is then fermented, resulting in ethanol. At present, 10% ethanol is added to gasoline to make 'gasohol' which boosts fuel octane by three points. In the future, it is expected that pure ethanol will be burned in vehicles either directly or through fuel cells currently under development. This is a clean-burning fuel that reduces smog and carbon monoxide emissions. Most USA ethanol production today is from corn grain, producing one billion gallons annually. This is not a particularly efficient feedstock because of the high nitrogen inputs for this crop. Grass biomass offers cheaper feedstock for ethanol production.

Potential for ethanol production in the southeastern USA

Switchgrass, a summer perennial grass native to the USA, has been one of the most productive plants for ethanol production. This deep-rooted bunchgrass, growing 8 to 10 feet tall, is tolerant of poor soils and drought, producing high yields with low inputs of fertilizer (100 lb N/acre and little or no phosphorus). Research in Alabama and Georgia has given production of over 10 tons/acre dry matter but 5 to 8 tons/acre are more likely in commercial plantings of the currently available Alamo variety. Breeding lines selected in Georgia has yielded even more. Yields of switchgrass are higher in the southeast than in other parts of the USA because of our longer growing season. Productivity of forests is only about one-half that of switchgrass. In southern Georgia, napiergrass has yielded even more than switchgrass.

An alcohol plant will produce about 100 gallons of ethanol/ton of switchgrass. If the yield per acre is 6 tons/acre, this will be 600 gallons of ethanol/acre. Switchgrass sold at a conservative price of $30/ton to the alcohol plant should yield about $80/acre return to the grower after deducting input costs of fertilizer and harvesting. These figures are conservative as substantially higher yields are possible, based on our research. Grass can be harvested once or twice a year with conventional forage choppers or baled in round bales and stored for processing.

An alcohol plant producing 20 million gallons/year will require about 3,500 acres of switchgrass if that is the sole biomass processed. However, other materials can be used such as poultry litter, cotton gin trash, peanut hay, or forestry wastes to supplement switchgrass acreage. Federal loan guarantees up to 80% of the cost are available for building such a plant.

Benefits of switchgrass production for ethanol production

1. Providing increased land and job income from rural agricultural development.
2. Providing annual income to owners of poor crop land as compared to that from forestry.
3. Land has a perennial grass cover throughout the year, protecting soil and water supplies.
4. Low input of fertilizer and no pesticides so there is little adverse effect on environment.
5. Switchgrass is an excellent accumulator of carbon both above and below ground, reducing atmospheric carbon dioxide pollution.
6. Provides wildlife habitats.

A new grass crop?

Ethanol production from switchgrass offers the potential of clean renewable energy production for our country but also offers opportunity for farmers and much needed income in depressed rural areas. It is a possibility that should be given careful consideration.