



Energy and Bioproducts

PHOTO: USDA

Developing affordable, environmentally friendly biofuels and bioplastics

Using renewable sources like crops and crop residues, tree bark and manure to produce transportation fuels, heat and electricity can help meet demand for energy while reducing reliance on fossil fuels and lowering greenhouse gas emissions. Similarly, biobased alternatives to plastics are necessary to reduce our reliance on petroleum and minimize pollution. Reusing agricultural and forestry wastes also provides a cost-effective, environmentally friendly alternative to disposing of wastes. Land-grant universities across the United States are developing innovative, cost-effective biofuels and other biobased products.

Successful examples include:

- An Extension agent in **Georgia** coordinated contacts between two local dairy farmers, the City of Eatonton and a large international energy/climate management corporation to produce biogas from dairy cow waste. The farms will receive 20% of the revenue generated by the sale of the biogas for estimated revenue of about \$45,000 per farm. The solids that remain after biogas processing will be returned to the farms for use or sale as fertilizer, with a potential value of \$5,000 to \$10,000 annually per farm. Digesting dairy cow waste will also help farmers satisfy waste management requirements with minimal labor and expense.
- Developing land for both solar photovoltaic power and agriculture could provide 20% of total electricity generation in the United States with an investment of less than 1% of the annual national budget and minimal impacts on crop yield, according to **Oregon** State University researchers. Furthermore, wide-scale installation of agrivoltaic systems could reduce carbon dioxide emissions by 330,000 tons per year in the U.S. That's the equivalent of removing 75,000 cars from the road each year. Agrivoltaic systems could also create more than 100,000 jobs in rural communities.

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- **Ohio** computer models showed that it takes about half as much energy to produce jet fuel from pennycress than from canola or sunflowers and one-third as much energy as soybean oil production. These findings are important as policymakers and scientists consider ways to reduce greenhouse gas emissions related to air travel. Pennycress is also an appealing candidate because it requires less fertilizer, fewer pesticides and no-tilling, and it can be grown as a winter cover crop between corn and soybean crops, providing additional revenue to farmers.
- A study by **Georgia** scientists revealed that it would be economically viable to convert the oilseed crop *carinata* into sustainable jet biofuel at an industrial scale biorefinery if aviation fuel prices are above minimum thresholds.
- As part of a **multistate** project on water scarcity, researchers estimated the impacts that drought may have on the amount of water available for oil and gas production and power plant cooling. Researchers also examined the impacts of hydroelectric energy production on water availability.
- Data from the National Animal Nutrition Program, a **multistate** research project, helped determine how byproducts from biofuel grain production can be used in animal feed. Reusing byproducts not only reduces waste it can also lower costs for both the biofuel and livestock industries.
- Researchers at Purdue University in **Indiana** designed and demonstrated new energy-efficient technology for next-generation electrified agricultural machines like tractors.
- Biochar is a charcoal-like particulate created by heating organic material like crop residues, woodchips and manures. **Michigan** State University showed that biochar can immobilize organic pollutants in soils to decrease uptake by crops and prevent release to bodies of water.
- Plastic production has increased 200-fold since 1950, and most plastic waste is disposed of in landfills. Plastic waste is a major pollutant in the world's oceans. Extension educators in **California**, **Minnesota** and **New York** developed curricula to introduce youths to the prevalence and impacts of plastics in everyday life and show them how scientists and engineers are developing bioplastics that are better for the environment.
- In **Tennessee**, information and training convinced farmers to transition from plastic to biodegradable mulches, which can reduce landfill waste, prevent air pollution, and improve soil.
- Researchers in **Virginia** are working with other universities to advance education, Extension and technologies for cultivated meat, also known as cell-based or lab-grown meat, which will help ensure future food security and provide consumers with new ways to experience their favorite meat dishes. The project's ultimate goal is to help achieve a 40% increase in American agricultural production with a reduction in environmental footprint by 50%.