OPTIMIZING AGRICULTURAL MANAGEMENT TO MITIGATE CLIMATE CHANGE IMPACTS

ARS climate change research builds the science-based foundations for mitigating greenhouse gas emissions, reducing the effects of climate change on production, and helping to create adaptive and resilient production systems. Through transdisciplinary research approaches that integrate information and technology, ARS provides producers with options for increasing the sustainability of their production systems. The following FY 2020 accomplishments highlight ARS advances in developing new management approaches and decision support tools to reduce agriculture's carbon footprint and boost regional farmer incomes.

Managing Midwest dairy forage production systems to reduce carbon emissions. ARS researchers in Saint Paul, Minnesota, monitored carbon balances for 9 years on a large dairy. They found that, to achieve a net gain in carbon soil storage under alfalfa-corn silage production with conventional tillage and inputs of liquid dairy manure, more than 70 percent of the carbon removed from harvested corn or more than 30 percent from harvested alfalfa would have to be returned to fields. These findings will help develop decision aids to help dairy producers evaluate whole-farm tradeoffs in carbon management.

Reducing cattle methane emissions through altered diets. Researchers are investigating ways to reduce the methane that cattle produce as a natural byproduct of digestion. ARS scientists in Texas and Oklahoma found that cattle fed a high-quality hay diet produced less methane than when fed low-quality hay. ARS researchers in Texas and Iowa also showed that adding tannin-rich peanut skin, a common regional byproduct, to cattle diets can suppress methane production. This research identifies avenues for cost-effective mitigation of methane production from beef and dairy cattle.

Reducing our carbon footprint with renewable fuels. ARS researchers in University Park, Pennsylvania, showed that ethanol could be produced from barley with a carbon footprint less than half that of gasoline. ARS scientists in Mandan, North Dakota, and collaborators demonstrated that growing oilseeds in place of fallow in non-irrigated areas of the U.S. Great Plains reduces greenhouse gas emissions and could boost regional farmer incomes from $127 million to $152 million per year through jet fuel production. These results hold promise for farmers to diversify incomes through emerging renewable fuel markets.

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Decision tools to improve farm productivity and control greenhouse gas (GHG) emissions. ARS researchers in Fort Collins, Colorado, and university collaborators upgraded the DayCent model, which simulates carbon and nitrogen fluxes among the atmosphere, vegetation, and soil, to account for the effects of soil freeze-thaw and cover crops on GHGs. ARS researchers partnered with the American Farmland Trust to develop the CaRPE tool to relate crop and grazing land data with GHG emission data from DayCent. These tools will provide better estimates of and strategies to control GHG emissions.