IOWA STATE UNIVERSITY
OF SCIENCE AND TECHNOLOGY

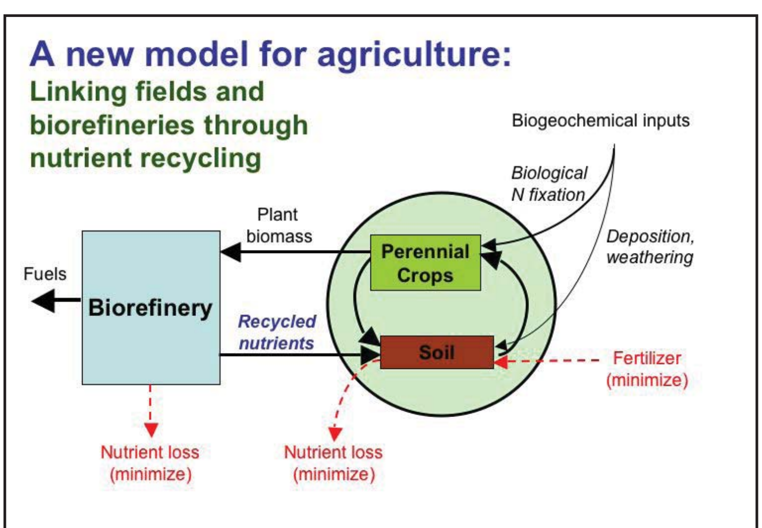
Sustainable Biomass Feedstock Production: Integration of New Cropping Systems with Advanced Biomass Conversion Technologies

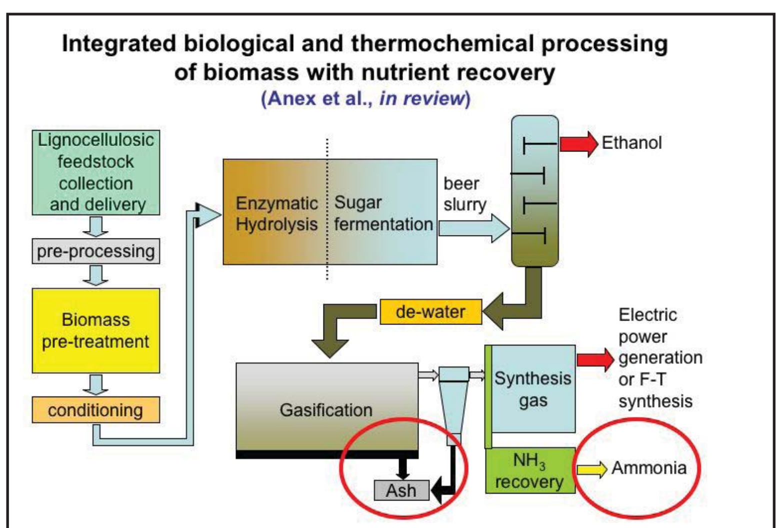
Emerging markets for liquid fuels and other industrial products made from crop biomass have the potential to create important economic opportunities for Iowa farmers and rural residents. However, removing large amounts of crop residue from agricultural fields to produce these products also has the potential to increase soil erosion, degrade soil organic matter, reduce soil fertility, and increase requirements for energy-intensive fertilizers. This is especially true for production strategies that rely on summer annual crops like corn. To address these challenges, we are investigating two types of alternative cropping systems and associated management practices that might be used to generate large amounts of biomass feedstocks for bio-based industries while better protecting environmental quality.

Photo from NREL-DOE.

In one field experiment focusing on annual species, we are comparing a single crop per year of corn with double-crop sequences composed of winter- and summer-adapted biomass crops. We are using triticale, a cross between wheat and rye, as the cool-season crop; it is planted in October and harvested for biomass the following June. Following triticale harvest, we plant three different warm-season crops: corn, sorghum-sudangrass, and crotalaria, a legume that can fix large quantities of atmospheric nitrogen. These double-crop sequences could be incorporated flexibly into existing corn-soybean systems and should provide soil cover and active root systems throughout the year, thus reducing soil erosion and nitrogen losses. Our hypothesis is that producing two crops in one year will generate more biomass at lower environmental cost than will a single crop of corn.

In a second field experiment focusing on perennial species, we are comparing biomass production, carbon storage, and nutrient use efficiency by four grasses that show particular promise for biomass production: switchgrass, Indiangrass, eastern gamagrass, and big bluestem. As an added dimension of the experiment, we are (1) recovering nitrogen, as gaseous ammonia, and other nutrients, as ash, from grass biomass that is processed into liquid fuel, and (2) assessing the impacts of applying the recovered materials back to biomass production plots. Our hypothesis for this experiment is that recycling nutrients between biorefineries and crop fields could significantly reduce economic and energetic costs associated with fertilizer use. As with the double-crop sequences, we expect that perennial grasses used for biomass production will sequester more carbon and permit less soil erosion and nitrogen leaching than summer annual crops like corn.





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