

Consequences of drought stress on biofuels

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From field to fuel. The switchgrass conversion process. Credit: Matthew Wishiewski

Plant-derived sustainable fuel sources could contribute to near-term U.S. energy security and independence. However, weather conditions could greatly affect crop yields. In this study, researchers examined the effect of weather on biofuel production by comparing switchgrass and corn stover harvested after a year of major drought and after 2 years of normal precipitation. They found that the plants produced more sugar, but the sugar changed during pretreatment and produced toxic compounds rather than the desired fuels.

The study is the first linking changes in rainfall and other conditions during crop growth to potential detrimental effects on biofuels. The work underscores the need to develop production systems that can tolerate sugars produced under stress and turn those sugars into the desired biofuels.

In response to the 2012 severe Midwestern drought, soluble [sugar](#) accumulated in switchgrass at significantly [higher levels](#) in comparison to non-drought years. The sugars were chemically changed during the pretreatment stage, the step that opens up the physical structure of the plant cell wall. The soluble sugars chemically changed by reacting with the ammonia-based pretreatment chemicals to form highly [toxic compounds](#) known as imidazoles and pyrazines. The formation of toxic compounds during the pretreatment stage inhibited conversion, the final step where intermediates such as sugars are fermented into biofuel by microorganisms, such as the microbe *S. cerevisiae*.

However, it may be possible to overcome this issue by 1) removing the soluble sugars before pretreatment or 2) using microbial strains resistant to the toxic effects of imidazoles and pyrazines. This study demonstrates that while there are benefits to growing bioenergy crops on marginal lands to avoid competition with food crops, the plants grown there may experience higher levels of stress resulting in deleterious impacts on microbes during [biofuel production](#). To develop sustainable biofuel [production systems](#), the deleterious effects of stress, such as fluctuations in precipitation and water availability, must be mitigated. This research helps to provide an understanding of the effects of drought stress on switchgrass.

More information: Rebecca Garlock Ong et al. Inhibition of microbial biofuel production in drought-stressed switchgrass hydrolysate, *Biotechnology for Biofuels* (2016). [DOI: 10.1186/s13068-016-0657-0](#)

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