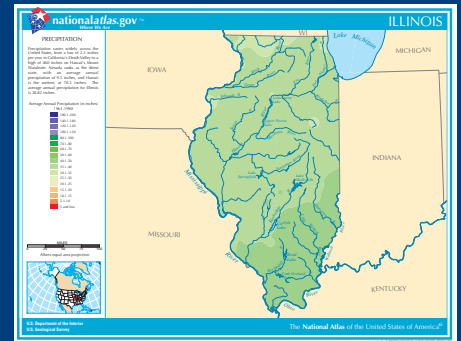




UNIVERSITY OF ILLINOIS
EXTENSION

Ethanol



Water Use for Ethanol Production

Conflicting reports in the media and common misperceptions exist about water use for ethanol production. Let's take a look at water used to grow corn and for ethanol production.

Corn Production

Just like a lawn or flowers in a garden, all plants, including corn, need water to grow and thrive. Although water availability and needs can vary by region of the country, Illinois' rainfall usually provides all of the water needed to grow crops, like corn, soybeans, and wheat. Illinois averages 32-48 inches of rainfall each year. Corn needs approximately 20-25 inches of rainfall to produce average yields. Corn is deep-rooted and is relatively efficient at water use during its peak growth, but if you were to apply most of the water for a corn crop through an irrigation system, it would require the

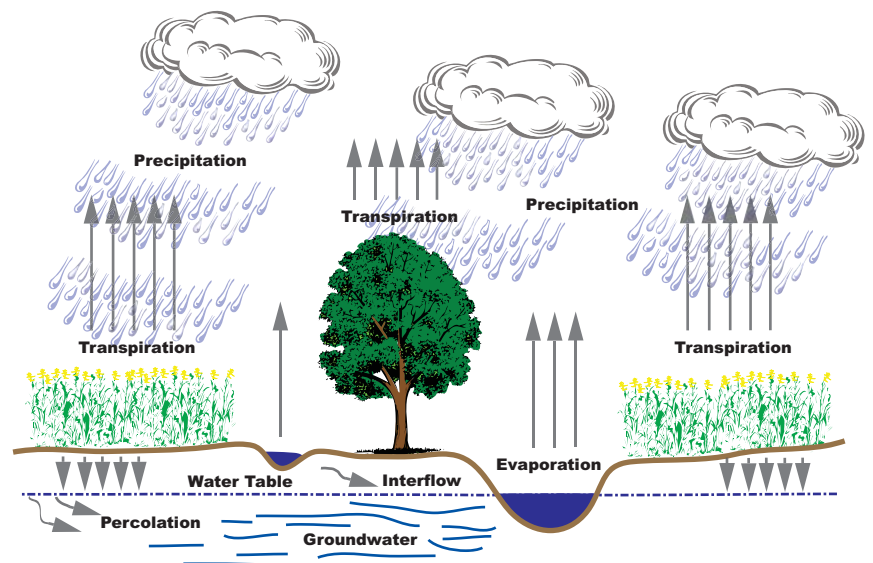
equivalent of 7 to 10 inches of rainfall. Only about 2 percent of the land in Illinois is irrigated to supply additional water to corn.

But crops don't absorb or use all of the rainfall. Some of the water drains away from the plant and isn't used. Water also evaporates from the soil and especially from the leaves of the plant during evapotranspiration, which puts the water back into the atmosphere. The U.S. Geological Survey reports that an acre of corn gives off 3,000 to 4,000 gallons of water in the transpiration process each day.

Raindrops keep falling on my head...

1 inch of rain
per acre =
27,154 gallons
of water

Source: U.S. Geological Service



University researchers and seed companies are also working to modify corn plants, so the plants can tolerate lower amounts of water (drought stress) without affecting corn yields. In the future corn may only need about 15 inches of rain¹ to produce average yields, instead of 20-25 inches of rain currently needed.

Water needed to grow corn in Illinois falls naturally as rain, while water used to produce ethanol usually is pumped from a water source, such as a river, lake, or underground aquifer. The amount of water pumped from these sources has been a cause of concern for some consumers and communities. Let's take a look at water usage to produce ethanol.

Ethanol Production

Ethanol production facilities have improved their water efficiency over time. They currently use approximately three gallons of water to produce a gallon of ethanol. This is down from 5.8 gallons of water: 1 gallon of ethanol in 1998 and 4.2 gallons of water: 1 gallon of ethanol in 2005². Experts predict that emerging technologies and improved processes will reduce water usage to two gallons within a short timeframe.

Also, not all of this water is used once and discharged. Most of the water is reused within the plant, while some evaporates during the heating and cooling processes. Improvements and efficiencies continue to be discovered and implemented.

Some of the water also leaves the plant in Distillers Grains, which is a by-product of ethanol. Distillers Grains, which can be used fresh or dried, are currently used fresh ("wet" distillers grains) to feed dairy and beef cows. Dried distillers grains are fed to swine and poultry in lesser proportions.

Water is an important resource. It is a consideration and part of the permitting process when ethanol plants are built. A typical ethanol plant capable of producing 40 million gallons of ethanol per year, could use up to 330,000 gallons of water per day or 120 million gallons of water per year. This is equivalent to water used by a town of 5,000 people or a standard-sized golf course. The average home uses 107,000 gallons of water per year. An average person uses 50 gallons of water each day.³

Resources:

Water Implications of Biofuels Production in the United States, National Academies of Science, October 2007. http://www.isws.illinois.edu/iswsdocs/wsp/biofuels_brief.pdf

Illinois Agriculture, U.S. Department of Agriculture, National Agricultural Statistics Service, Illinois Field Office, March 2008. http://www.nass.usda.gov/Statistics_by_State/Illinois/Publications/Farmfacts/farmfact.pdf

Updated info from 2007 Census to be available 2/4/09 - Census of Agriculture – Table 33 Specified Crops Harvested - Yield per Acre Irrigated and Nonirrigated: 2002. http://www.agcensus.usda.gov/Publications/2002/Volume_1,_Chapter_1_State_Level/Illinois/st17_1_033_033.pdf

U.S. Department of Energy | Energy Efficiency and Renewable Energy | Clean Cities: <http://www1.eere.energy.gov/cleancities/>

Fuel Economy Guide (U.S. Department of Energy and U.S. Environmental Protection Agency): <http://www.fueleconomy.gov/>

Governors' Ethanol Coalition: <http://www.ethanol-gec.org/>

REET – Greenhouse Gases, Regulated Emissions, Energy Use in Transportation Model, Argonne National Laboratory: <http://www.transportation.anl.gov/pdfs/TA/264.pdf>

National Corn Growers Association: <http://www.ncga.com/>

Renewable Fuels Association: <http://www.ethanolrfa.org/>

U.S. Environmental Protection Agency:

- Alternative Fuels: <http://www.epa.gov/otaq/consumer/fuels/altfuels/altfuels.htm>

- Renewable Fuels Standards Program: <http://epa.gov/otaq/renewablefuels/>

U.S. Geological Service: <http://ga.water.usgs.gov/edu/earthrain.html>

University of Illinois at Urbana-Champaign, College of Agricultural, Consumer and Environmental Sciences, Agricultural and Consumer Economics – farmdoc: Corn-Based Ethanol in Illinois and the U.S.: A Report from the Department of Agricultural and Consumer Economics, University of Illinois, November 2007 http://www.farmdoc.uiuc.edu/policy/research_reports/ethanol_report/index.html

Water Comparisons

Water used in other industries:

Product	Gallons of water
1 gal. of gasoline =	2 to 2.5
1 gallon of ethanol =	3
1 can of fruit =	9.3
1 gallon of paint =	13
1 lb of sugar =	14
1 lb of plastic =	24
1 lb of synthetic rubber =	55
1 lb of cotton =	101
1 Sunday newspaper =	150

Source: U.S. Grains Council/U.S. Environmental Protection Agency

References

¹Source: Monsanto, Syngenta and Pioneer Hi-Bred International

²Water Use by Ethanol Plants: Potential Challenges, Institute for Agriculture and Trade Policy: <http://www.agobservatory.org/library.cfm?refid=89449>

³Sources: Renewable Fuels Association/National Renewable Energy Laboratory/Media



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