

The Many Problems with Ethanol from Corn: Just How Unsustainable Is It?

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of Fuel Ethanol Produced from the U.S. Midwestern Corn”

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Let Us Count the Ways

1. Corn is a complex engineered biosystem with a myriad of energy inputs and outputs. Just collecting these inputs and outputs is a lengthy and tedious process, full of potential inconsistencies, which is why various scientific opinions are prone to error of judgment and manipulation.
2. Corn erodes soil 18 times faster than it can reform.
3. Corn is the largest U.S. crop (70 million acres generates 130 bushels/acre). The U.S. produces 44% of the world's corn; Canada produces 1%. 6 million acres of corn is now used to generate approximately 1% of U.S. fuel requirements. One gallon of ethanol is equivalent to .65 gallons of gasoline. Note that it takes 22,000 Btu to create a gallon of gasoline, which has 120,000 Btu, whereas it takes 98,000 Btu to make a gallon of ethanol, which contains 76,000 Btu.
4. Approximately 99% of U.S. corn is fertilized, requiring more fertilizer than any other crop. Nitrogen fertilizers, herbicides and pesticides are all made from fossil fuels, as is the diesel fuel, gasoline, LPG, natural gas, electricity, transportation and irrigation used to grow and transport the corn.
5. The USA consumes 140 billion gallons of fuel annually. Ethanol now provides approximately one percent of that amount, and the USA goal to generate 5 billion gallons of ethanol from corn annually, which is about 3% of the total.
6. Ethanol can be blended with gasoline in various amounts, or it can be used without gasoline, although its toxic emissions of acetaldehyde and other carcinogenic aldehydes are then substantially increased. According to a reports prepared for the California Environmental Policy Council by investigators at the Lawrence Livermore Laboratory and a University of California at Berkeley, when ethanol is used as an oxygenate for reformulated gasoline, it increases the Reid Vapor Pressure (RVP) and volatility of gasoline. This results in higher emissions of smog-forming Volatile Organic Compounds and aldehydes, the major constituent of which is formaldehyde. Although even short-term exposure to formaldehyde can be fatal, irritation of the eyes and mucous membranes typically occurs before fatal levels are achieved. However, long-term exposure to even low levels of formaldehyde may cause respiratory difficulty and eczema. Formaldehyde is classified as a human carcinogen by OSHA and has been linked to nasal and lung cancer, with possible links to brain cancer and leukemia.

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7. Because ethanol is a toxic and hazardous substance, its use is regulated by OSHA, DOT, NFPA and NIOSH. Ethanol must be handled with extreme caution because it can enter the blood stream from breathing the fumes, or by penetration through the skin or mouth. Exposure can irritate the eyes, nose, mouth, and throat. As such, protective clothing, including gloves and splash-proof chemical goggles and face shields should be worn by anyone coming in contact with ethanol.
8. People are advised not to eat, smoke or drink where ethanol is handled, processed, or stored since the chemical can easily be absorbed. Moderate exposure can cause headaches, eye and skin irritation, nausea, and drowsiness, whereas higher levels of exposure (over 1000 parts per million over an 8-hour period) can cause shortness of breath, genetic mutations, damage to the liver and central nervous system and unconsciousness. Exposure to ethanol levels of over 3300 ppm can result in death.
9. Ethanol land requirements: Approximately 50 gallons of ethanol are produced per acre of corn. Thus 2.8 billion acres of land would be required to generate 140 billion gallons of fuel used in the USA annually, which is more than 5 times all of the cropland that is actually and potentially available for all crops in the USA.
10. Ethanol water requirements: 371 gallons of water are needed to produce one pound of corn. $371 \times 56 \text{ lbs per bushel} = 20,776$ gallons are needed per bushel of corn. One bushel of corn will provide approximately 2.5 gallons of ethanol, thus each gallon of ethanol requires 8,310 gallons. An additional 30 to 37 gallons of water are consumed to manufacture ethanol from corn per gallon of ethanol. Source: Corn Chemistry and technology handbook, 2002. $\times 1.5 =$ approximately 50 gallons of water per gallon of gasoline equivalent. $8,310 + 50 = \mathbf{8,360}$ **gallons** of water are needed per equivalent gallon of gasoline in the form of ethanol. 140 billion gallons of gasoline are consumed in the USA annually, times 8,360 gallons of water, divided by 325,851 gallons per acre foot (AF), equals 3.59 billion AF of water annually. Note that the USA currently consumes approximately 500 million AF per year. Thus to displace gasoline with ethanol would require over 6 times more water that is currently used for agriculture and all other purposes. Thus making ethanol requires over 3,340 times more water than making hydrogen. By contrast, it takes approximately **2.5 gallons** of water to make an equivalent gallon of gasoline in the form of hydrogen. Thus less than one million AF of water would generate all of the fuel now consumed annually in the USA.
11. Corn growers receive over \$10 billion annually in taxpayer subsidies.
12. Who primarily benefits from ethanol production? Major agribusiness corporations, such as Archer Daniel Midlands (ADM), Cargill, and A.E. Stanley.
13. Who are the primary losers from ethanol production? American taxpayers, and the ecological life-support systems of *Spaceship Earth*.



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