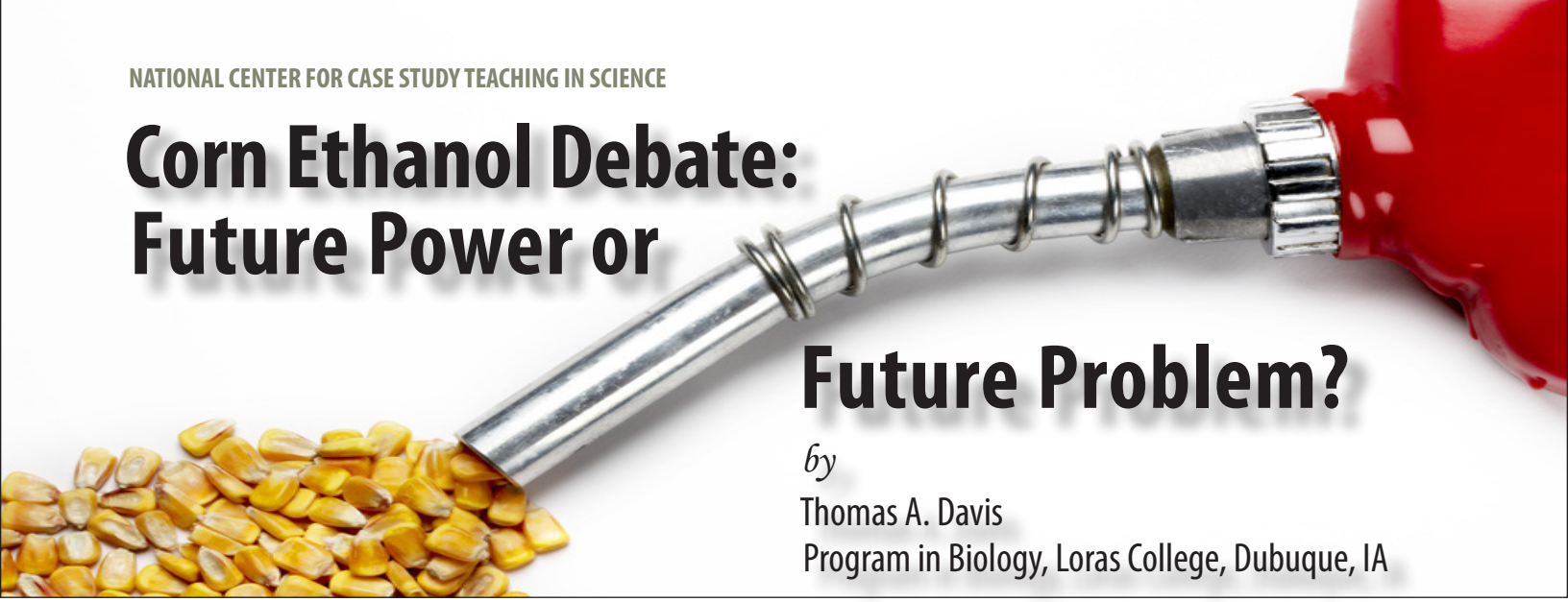
NATIONAL CENTER FOR CASE STUDY TEACHING IN SCIENCE

Corn Ethanol Debate: Future Power or Future Problem?



by
Thomas A. Davis
Program in Biology, Loras College, Dubuque, IA

Introduction

To what extent should corn be used for the production of ethanol? Are we better off producing corn for food or producing corn for fuel? These questions bring to the forefront several other more general key questions faced by environmental biologists, farmers, agribusiness people, land managers and food industry experts. What is the best way to mazimize crop yields on land with a limited capacity to produce? How should we balance the short term goals of adding jobs to the economy and maximizing profits with the long term goal of living more sustainably with the land at its natural productive capacity? These issues have been faced by many residents in areas that produce corn and the effects of these decisions have been felt at the local grain elevator as well as at the world stock exchange markets. What information do you need to know to be able to talk about these issues and make a decision about how to use corn to produce ethanol?

This case study uses a format called "intimate debate." There is no audience. Each student argues each side of the issue seated across from their opponents in pairs, and the session concludes with opposing teams reaching consensus.

- Pro: Corn *should* be used to make ethanol.
- Con: Corn *should not* be used to make ethanol.

Procedures

Prior to debate day, one team consisting of two students will present various pros after which another team of two students will present various cons. After these presentations, you should use your notes as the basis for gathering more detailed information on 3–4 of the most important pros and cons that you heard from the talks. You need to be able to talk about these important points on debate day. Examples of useful information to collect may include:

- price per bushel of corn in the last seven years;
- volume of ethanol produced per unit of corn versus per unit of other biomass fermentation;
- how much wildlife habitat has been lost from Conservation Reserve Program (CRP) land in the last six years due to increased corn acreage;
- number of jobs in corn ethanol industry produced in the last six years;
- amount of fertilizer used per acre or per county in the last six years;
- sources of and changes in size of Gulf of Mexico dead zone in the last six years;
- reduction in demand for foreign oil in last six years;
- biomass fermentation technology availability; and
- energy efficiency of corn ethanol production versus energy efficiency of other biomass alternative energy sources.

On debate day, your team of two will be randomly assigned to the pro side or the con side. Your team will be given an information sheet that lists the major arguments for your respective side; i.e., the pro groups only get pro arguments and the con groups only receive con arguments. Your instructor will inform you where to sit to start the debate.

First, each two person group will discuss their information and organize it around 3–5 major talking points (arguments) that they can make for their respective side. This general discussion should take 8–10 minutes. If you are a pro group you will be facing two students from a con group. This is repeated for all student groups.

To start the debate, the pro side of the argument will speak for four minutes to their con opponents. The students representing the con side may not interrupt. If you are on the listening side, be sure to take good notes because you will soon be arguing the pro side; listen carefully to the other side's remarks so that you have a good foundation for the later part of the debate.

At the end of four minutes, the instructor will call a halt. The students for the con side will then speak for four minutes to their pro opponents without interruption. Again, the pros should listen carefully and take good notes. The instructor will then call a halt when the time is up.

For the second stage of the debate the roles will be reversed; pro speakers will shift to the con side and vice versa. Teams will exchange their pro and con information sheets. The teams will get a new table assignment too. They will be speaking to a new pair of faces and from the opposite side of the issue. To start the second round of the debate, the new pro teams will have only three minutes to make their best arguments while the new cons listen. Then new con teams will have three minutes to make their arguments while the new pros listen.

For the last stage of this process, you will need to abandon your formal positions. In your group of four, you will come up with what you believe to be the best decision: use corn to make ethanol or not. You need to reach a group consensus on which side you support as a group. From the various arguments you just made for both sides, please write your four-person team consensus on the board and list 3–4 reasons why your team supported this end result. You will have about 10 minutes to do this.

After the debate, you will need to pick the side you support individually and write a two-page support paper that explains why you decided to support that side. This paper is due the class period following the debate day.

See the next sheets for lists of reasons that support the pros or cons of using corn to produce ethanol. These are the facts and statements on which you will need to do more of your own research before debate day. This new additional information will expand your knowledge and your confidence when you argue for or against this issue during the debate.

Pros/Advantages of Using Corn to Produce Ethanol

- Reduces our reliance on foreign oil imports.
- Overall, less oil used, less gasoline produced and used.
- Farmers get subsidized for producing corn for ethanol.
- Many agriculture jobs built around ethanol production in Midwest.
- Gasoline with ethanol burns cleaner that regular no ethanol gasoline, less emissions, lower greenhouse gas emissions.
- By products of ethanol production can be used as valuable form of cattle/livestock feed, corn oil and cellulosic ethanol.
- No-till conservation farming and soil conservation/erosion reduction methods can reduce corn production impacts.
- Ethanol is biodegradable; spills are far less worrisome and have lower effects on environment than oil spills.
- CO_2, another by-product of ethanol production, can be reused, repurposed in other products or industries.
- Few infrastructure changes (roads, trucks, pipelines) are needed to get ethanol to stations. We already have it!
- Corn is renewable, planted again and grown every year.
- Farmers have good options of selling corn for fuel (ethanol) or for food.
- Corn plants absorb tons of CO_2 and give off tons of oxygen every growing season.
- Ethanol has good high octane power production for use in high compression, newer, efficient vehicle engines.

Cons/Disadvantages of Using Corn to Produce Ethanol

- Using lots of land to produce only corn.
- Land taken out of land conservation programs for wildlife, loss of habitat, filling in wetlands in areas that have little wildlife habitat anyway.
- Large negative impacts on ecosystems including increased used of pesticide, herbicide, fertilizer, nutrient runoff, pollution of freshwater streams/rivers, contributing to the severity of the Gulf of Mexico dead zone.
- Takes corn away from use in food to be used in ethanol production, which increases food prices.
- Corn production requires substantial use of fossil fuels to power vehicles to plant, harvest and transport it.
- Corn ethanol uses one unit of energy for 1.3 units burned or expended, which makes it a very inefficient fuel.
- Corn is not a perennial plant; it needs to be replanted each year, stressing soil, water and land.
- Fields once used to produce other basic grains like wheat, barley and oats now produce corn; loss of food grain diversity.
- E85 fuel (85% ethanol, 15% gasoline) reduces gas mileage by 20–30% compared to E10 or E15 gas that is currently used.
- Ethanol absorbs water and is corrosive. Thus, it has a shorter storage and tank life than gasoline.
- The Midwest has the largest number of ethanol refueling stations in the country; very few elsewhere in U.S.
- Price of ethanol may vary widely year to year, maybe more than gas prices, due to variability in corn prices.
- Ethanol has lower energy content than gasoline, has less power when burned, thus higher gallons used and lower mileage.
- Corn ethanol production has a large carbon footprint from planting, growing, harvesting and transporting corn; add the CO_2 released by tractors and equipment that apply pesticides and fertilizers too.
- Constant soil disturbance by plowing and removal of all corn plant waste releases more CO_2 from soil over time.
- Corn is least efficient way to make ethanol: 300 gallons ethanol/acre compared to sugarcane (only grows in Texas), which produces 600 gallons ethanol/acre or cellulosic ethanol which produces 1200 gal ethanol/acre!
- U.S. government pays subsidies to farmers and ethanol plants to produce it taking money away from other needy programs.