Corn, Beans, and Burgers: Field Crops in the Food System

Toward a Sustainable Agriculture, University of Wisconsin-Madison, Center for Integrated Agricultural Systems.

Projected Outcomes:

1. Students will know how the principal field crops from Iowa contribute to their food systems.
2. Students will begin to understand how the field crops from Iowa fit into the world food system.
3. Students will begin to appreciate the complexity of the relationship between crop production and food distribution.

Background/Lessons
Introduction

We all know agriculture is about growing food, but sometimes the connections between crops and food are pretty indirect. This section uses two activities (Activities 1 and 3) to build student understanding of the relationship between field crop production and the food we actually eat. To prepare for the first activity, ask students to bring a week's itemized grocery receipt or shopping list and selection of ingredients labels to class.

What are our principal field crops?

The principal field crops in Iowa are:

Crop	Acres in Iowa
Corn (grain or seed)	13,709,408
Soybean	9,301,594
Corn (silage)	392,304
Alfalfa, hay, etc.	656,367
Wheat for grain	13,518
Potatoes	1,028

Data from tables 1, 37, and 38 in USDA, NASS, 2012 Census of Agriculture, State Level Data

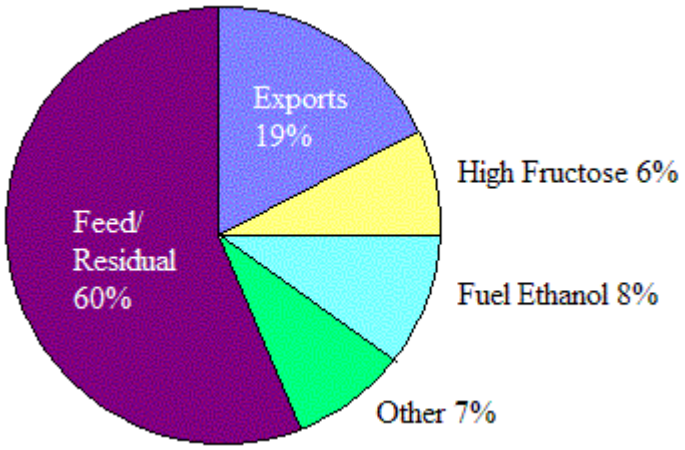
More than half of the cropland in Iowa is in field crop production. 90% of Iowa's cropland is planted to just 2 crops: corn, alfalfa, and soybeans. How are these crops used? Where did they go?

How Do We Use These Crops?

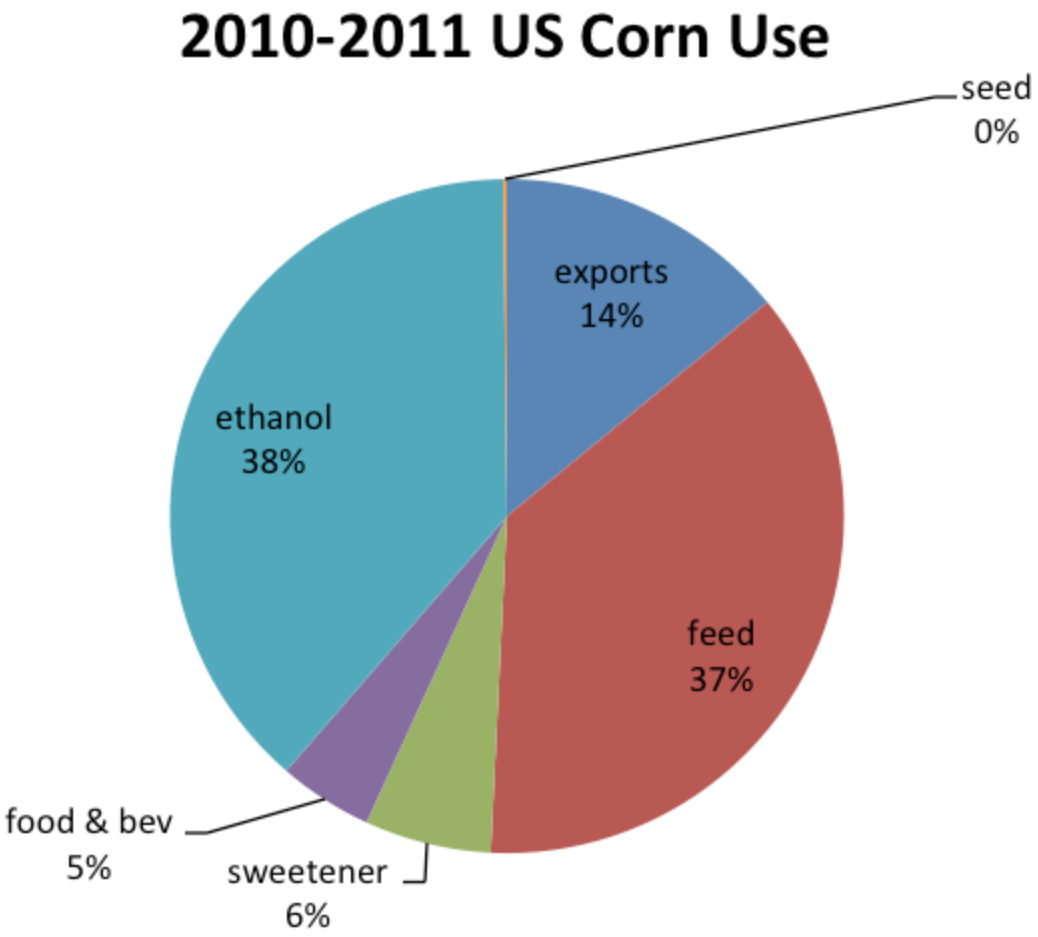
Activity 1: The Crops on Our Plate

Corn:
All the silage corn is used to feed livestock, primarily dairy cows.

Most grain corn also goes to feed livestock. In 2009, American farmers harvested about 13 billion bushels of corn grain. Iowa produced about 19% of the U.S. corn crop- around 2.4 billion bushels. For many years corn use was quite stable, with about 75% going to feed livestock in the US and other countries, 8% going to fuel ethanol, and more than 6% going to sweeteners. Since 2004, however, the portion of the corn crop used for ethanol has more than tripled to 27 to 30 percent in 2009 and 2008 and the portion used directly for feed has dropped to about 40 to 45 percent. A substantial portion of the by-products of ethanol production (distillers' grains) are fed to livestock, so the corn used for ethanol also contributes to animal feed.



2010-2011 Corn Use by Segment



Based on data in USDA ERS Feed Grains Database: Yearbook Tables 4 and 31, accessed June 2012.

Activity 2: How Much Corn is 2 Billion Bushels?

About 15 to 20 percent of grain corn in the US is exported. Most corn exports are used to feed livestock. Japan is the leading importer of US corn, followed by Mexico. (Japan takes about 30% of our corn exports, and Mexico and South Korea combined imported another 30% in 2010-2011).

About 50 percent of grain corn is used for seed, industrial uses, and food in 2008. The major industrial use is for ethanol production (about 38% of the tiotal 2010 grain crop). The main food use is for sweetener (for example in soft drinks, jams and jellies, and a wide range of processed foods). Corn Refiners Association Statistics Less than 5% of the US grain crop goes to human food other than sweetener.

Soybeans:

A little over half of the US harvest is crushed for oil, and the residue, called soy meal, is fed to livestock. Oil goes primarily to edible uses (shortening in baked goods, frying oils, salad oils, margarine, coffee creamers, mayonnaise, etc.) and accounts for about 60% of the vegetable oil used in the US. The rest

goes to industrial uses (diesel fuels, inks, pesticides, soaps, shampoos, and detergents, etc.) Use of soybean oil for biodiesel has increased from about 2 million gallons in 2000 to more than a billion gallons in 2012 and now accounts for between 20 and 24% of the total soybean crop. SoyStats 2013.

In 2013 about 45% of harvest was exported (some used for oil & livestock feed; some for human food, esp. in Asia)

About 3% of the soybean harvest used in US is not crushed for oil and goes to seed, feed, human food, and industrial uses. Human food examples include soymilk, tofu, roasted soy nuts, infant formula, soy sauce, edamame. Standard high yield soybean varieties are not suitable for many non-oil human food uses.

Alfalfa:
All of the alfalfa is used to feed livestock, primarily cows (both beef and dairy).

Activity 3: A Look at Processing and Distribution

One of the main ingredients in carbonated soft drinks is high fructose corn syrup (HFCS). What are the steps between the corn growing in the field and the can of soda on the grocery store shelf?

Let's trace back how the corn got into one example can of soda.

Conclusion
Field crops play a major role in our agricultural system. Just three species, corn, soybeans, and alfalfa account for well over half the cropland in Iowa.

The primary use of these crops is for livestock feed. Other uses include fuels and industrial ingredients, and oils, sweeteners, and stabilizers for processed foods.
The portion of the field crop harvest that goes to human food is mostly heavily processed. Most consumers know little about what activities and companies are involved in the production of the processed foods they buy, and that information is not easily accessible. Also, because grains are pooled and marketed globally it is not possible to track a particular farm's grain to an end food product if it is marketed in the general commodity pool.

Because field ccrops are so dominant, the ways they are reaised, handled, and marketed will have a major impact on the sustainability of our agricultural environment and economy as well as our food system.

Activity 1: The Crops on our Plates

Purpose: Have students analyze the contribution of major field crops to their diet.

Advanced preparation: Ask students to bring a week's itemized grocery receipt or shopping list and some ingredients labels to class. You can use the sample grocery receipt in the curriculum, but the exercise will have more impact if the students use lists from their own families.

Estimated time: 15 to 30 minutes

Divide the students into small working groups.

Make sure each group has at least one grocery list to work with.

Ask students what they think the major field crops of their state are. Explain that 3 crops (field corn, soybeans, and alfalfa) account for more than 87% of Iowa's cropland.

Ask students to:

1. Identify which items in the week's gorceries come from the 3 major field crops (note: sweet corn is considered a vegetable and is not included in the corn acreage.) You may wish to remind students that sweeteners, oils, and emulsifiers in processed foods are mostly derived from corn and soybeans. They can refer to the labels they brought in to get an idea of the role of these ingredients.
2. Estimate the percentage of their diet supplied by the 3 major field crops, based on their findings from the grocery list.
3. Assess the nutritional contribution of field crops to their diet.

Have each group share its findings with the class and use class discussion to draw some broader conclusions.

Suggested points to cover include the following:

- Little of the food we eat is directly supplied by our principal field crops.
- Field crops indirectly contribute to the food we eat as livestock feed used to produce dairy products, eggs and meat, and as ingredients in processed foods.
- Corn sweeteners and starches, soy oil and stabilizers, and other additives derived from field crops are typically present in small quantities and add little nutritional value to a diet.
- For most people in the Midwest, foods derived from field crops account for less than half of their diet- why is that when well over half of cropland is devoted to these crops? (One reason is that we lose 75% to 90% of the nutritional value of the field crops when they are fed to animals because it goes to keeping the livestock alive. Another reason is that Iowa export animal products and import vegetables and grain products from human consumption).
- Ask if students can think of examples where principal field crops are also a major direct component of the local diet. (Rice in much of Asia, corn in Mexico and Central America, to a certain extent wheat in the US high plains).

- Do students' findings track with national statisics on use of field crops? (see Background, How we use these Crops).

Activity 2: How much corn is 2 billion bushels? (optional)
Purpose: Give students better feel for the amount of corn produced. Short exercise in math problem solving.
Advance preparation: None
Estimated time: 10 minutes

Ask students to figure out the answer to the following question:

Iowa's annual corn harvest is usually around 2 billion bushels. If you loaded semi trucks with 2 billion bushels and lined them up bumper to bumper, how far would they stretch?

According to the Iowa Department of Transportation, a large semi holds around 910 bushels, and 879 large semis lined up bumper to bumper would stretch around 11.5 miles

Answer: The line of trucks would stretch 29,206 miles, or more than the circumference of the earth (which is a little under 25,000 miles). Luckily, most grain is transported much more efficiently in railroad cars and on barges.

Activity 3: A Look at Processing and Distribution
Purpose: have students explore the complexity of processing of field crops and learn how hard it is for consumers to find out where their food comes from and who controls processing and distribution.

Advanced Preparation: Have each small group bring an example of a food containing one or more of the principal field crops to class. Or develop a list of foods containing field crop ingredients (see http://www.soystats.com/2003/Default-frames.htm for information on soy products and www.iowacorn.org/cornuse/cornuse_6.html for examples of foods with corn-based ingredients).

Estimated time: 15 minutes

Break students into small groups. Assign each group a different food derived at least in part from one of the state's main field crops. If students have brought sample foods to class, have the groups use those items.

Show students the sample flow chart for a soft drink.

Ask each group to identify the steps and actors involved in moving the field crop(s) to the final product for their food item. Ask them to develop a "field to plate" flow chart for it and present the chart to the class.

Your students will probably have trouble filling in the flow chart. Most people know very little about food processing and distribution, and the information is difficult to obtain. This even applies to many people employed in food processing, as well as the general public.

Students can begin by brainstorming what the likely processing and transportation stages are and what companies might be involved. If time allows, they can follow up these guesses with research. They can try looking on the internet, they can try to contact the company listed on the product label, and/or they can try to track the product back from the point of purchase. In the amount of time students have available, they will probably only be able to get general information, not specifics about the origin of a particular food item.

In many cases, companies are reluctant to share detailed information about the processing and movement of their products, though they may publicize generic production information. For example, development of the flow chart for the path of corn to high fructose corn syrup to soda in a grocery store took about 50 phone calls over a period of months. A few company spokespeople shared information willingly, but others failed to return phone calls or refused outright to divulge the information.

Why do this exercise if students won't get the answers?

They will begin to think about the various stages in the food system.

They will learn that food does not simply arrive at the grocery store straight from farms, but that in between it is handled by a number of different people, even if it is difficult to find out who exactly those people are.