



Imagine the possibilities

So, American farmers are good at growing corn. Very good, in fact. How does that fit in with today – or tomorrow? How will the growing productivity of family corn farmers be used? How can we take advantage of this crop and cultivate its economic value?

For many years, farmers saw their expanding ability to grow corn stacking up against slow-growing demand. They decided to do something about it, forming organizations that could promote research, technology and invest in new markets.

After all, less than 1 percent of the country's crop is sweet corn – the kind we eat frozen, from a can or fresh off the cob. A vast majority of the crop is field corn – yellow corn comprised of starch, fiber, protein and oil. Farmers knew if they could develop new markets based on those components, they could keep corn supplies from getting burdensome and stifling ingenuity.

Certainly feed for livestock and poultry has also been a critical and important market for corn – and still is. Ditto for corn exports. Yet demand from both of these traditional markets has remained consistent over the years even as corn production continued to expand more quickly. Corn farmers weren't the only ones getting better: Livestock and poultry producers themselves produce more meat, milk and eggs with fewer inputs, including fewer bushels of corn.

Unlocking the kernel

Fortunately, as our knowledge of corn production grew, so did our understanding of the individual kernel. We began to discover new ways to harness the components that make up the kernel. Once companies saw the capabilities, dozens of new products made from corn came to market.

Corn starch, for example, has dozens of uses. It is a thickening agent and anti-caking agent. It helps frozen foods maintain their texture. Roasted starch – dextrins – are found in hundreds of adhesive applications. You can find citric and lactic acid produced from corn in hundreds of foods and other products listed in the *World of Corn* at www.ncga.com.

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Another valuable use of corn is fuel ethanol. To make ethanol, only the starch portion of the kernel is converted to sugar and fermented – the rest of the kernel is returned as corn oil and high protein livestock feed, meaning we get multiple products from each kernel delivered to an ethanol plant.

Corn-based ethanol can be found blended with gasoline in most fuels sold today, making ethanol the most successful renewable fuel in history and delivering tremendous benefits to the entire country. In 2010, U.S. ethanol production supported thousands of jobs, added more than \$16 billion to federal, state and local government tax revenues and displaced more than 445 million barrels of imported oil. As the sector continues to grow, so will these positive developments.

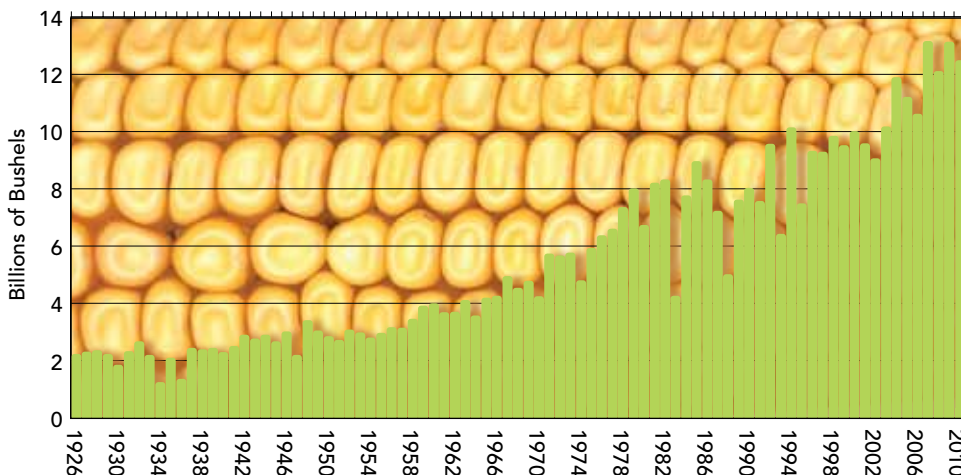
Farmers saw that corn production was growing faster than demand. They knew that developing new markets would keep supplies from getting burdensome and stifling ingenuity.

Like corn farmers, ethanol producers are also getting more efficient. An article in the scientific journal *Biotechnology Letters* noted ethanol production has seen a 28 percent reduction in energy use, a 32 percent reduction in water use and a 5.3 percent increase in ethanol yields all in less than a decade.

A recent report from the U.S. Department of Agriculture noted corn-based ethanol has a net energy ratio of 2.3 to 1, meaning for every unit of energy it takes to make ethanol, 2.3 units of energy are produced as ethanol. Every year, that figure grows simply because corn and ethanol production gets more efficient. A study in the *Journal of Ecology* noted that between 10 and 19 gallons of ethanol are produced for every gallon of petroleum used in the entire “corn to ethanol” production life cycle.

Helping keep energy costs down is important because farm products like corn represent only a little more than 11 percent of retail food prices, according to a new report from USDA. Nearly 33 percent of each food dollar is spent on food processing, packaging and transportation – all energy intensive activities – and actual energy costs.

U.S. CORN PRODUCTION



More than 12.4 billion bushels of corn were produced in 2010 – a 38 percent increase over what was harvested in 2002. The tremendous growth in yields and production allows corn to be used in new ways, including ethanol, fibers and bioplastics.

Corn is incredibly versatile and our ability to grow it so successfully allows us to use it in a number of non-traditional ways – from ethanol to bioplastics.

Corn-based ethanol is a growing success – yet farmers know it is just the beginning. Soon, more ethanol may come from corn cobs and other agricultural biomass, and thanks to corn-based ethanol leading the way, fuel markets will be ready.

Another petroleum replacement

You can find corn-based plastics in a growing number of utensils, gift cards, safety seals, bags, plant containers, weed barriers, water bottles and more. These versatile plastics are compostable, meaning that over time they will break down completely when composted. Characteristics vary between different forms of bioplastics, allowing them to be combined and create new products. The opportunities are endless.

Others take these corn bio-materials and spin them into fabrics, again replacing oil-based polyester and nylon. These materials are soft on the skin and have a number of performance advantages. Alternatively, tough, stain resistant corn-based fibers are spun into carpets.

Yet these petroleum-replacing products are just the first wave. Research underway now will result in greener chemicals for industrial applications, replacing their oil-based counterparts.

Yes – there is a trend here. Corn is incredibly versatile and our ability to produce it so successfully allows us to use it in a number of non-traditional ways. All it takes is a little imagination and ingenuity.



Jon Holzfaster | Paxton, Nebraska

Fuel and feed from the same bushel

Some of Jon Holzfaster's corn ends up at a corn-based ethanol plant – and the cattle in his cattle feeding operation couldn't be happier for what they get in return.

"That return is distillers grains – a feed ingredient produced by corn ethanol plants," explained Jon, a farmer from Paxton, Nebraska. "Ethanol plants only use the starch in the kernel of corn, so the rest of that kernel comes back as livestock feed," he said. "Cattle love it and they perform very well when it is in their feed."

Ethanol, essentially, is a two for one bargain. "We get fuel and feed, not one or the other," said Jon, who holds a degree in ag economics from the University of Nebraska.

Jon also practices precision agriculture on his farm, which provides many benefits. "My fuel supplier called wanting to know what he could do to get our business back," he said. "The fact was, we hadn't switched suppliers. We were simply saving so much fuel that it was having a visible impact on his revenue."

Jon uses "strip-till" practices, a type of conservation tillage that involves preparing a narrow seedbed and applying seed and fertilizer precisely using satellite-based technology that is accurate to less than an inch. "We're preparing the ideal environment for the seed as we till, fertilize and plant in one pass – and that saves time and fuel," he said.

A third-generation farmer, Jon said farmers have changed with the times through a combination of necessity and technological advancement.

"We're more efficient than ever. We're using less fuel and traveling across the land fewer times. We have better genetics to help us optimize yields from existing acres and our use of chemicals has decreased dramatically," he said. "In this respect, the good old days are actually happening right now."