Enogen™ Corn Technology Q&A

What is Enogen technology?
The Enogen™ brand is the name for Syngenta's breakthrough corn amylase technology, the first biotech corn output trait for ethanol production. Corn hybrids with the Enogen trait from Syngenta produce a high-value specialty grain that will benefit consumers, growers and the renewable fuels industry by improving the overall efficiency and productivity of corn ethanol production while reducing its carbon footprint and providing a critical technological bridge to future breakthroughs in cellulosic ethanol.

What are the unique performance characteristics of Enogen corn?
Enogen corn will bring significant bottom line benefits to ethanol producers and increase overall industry efficiency at a critical time. The product will reduce energy and water use in ethanol production plants and increase ethanol output while significantly reducing a production plant's carbon footprint.

Enogen corn also represents a milestone in bridging to cellulosic ethanol technology. We can meet the challenge of developing cellulosic technologies by improving enzymes and genetically expressing them in plants. With Enogen technology, Syngenta has demonstrated the viability of this approach and is investing in future innovations across a number of key crops. We believe success with Enogen technology will help move the biofuels industry more rapidly toward second-generation biofuels.

How does Enogen technology work?
In traditional ethanol production, enzymes such as alpha-amylase and gluco-amylase in liquid form are added to grain to provide a fast, safe and economical transformation of starch to sugars. What Syngenta has done with corn amylase is express the enzyme directly in the grain. This makes starch conversion much more efficient and the more efficient the starch conversion, the more efficient the process is to produce ethanol. This improves the overall productivity of the dry grind corn ethanol production process in ways that cannot be achieved with liquid enzymes.

What is the approval status of corn amylase?
In 2007, the U.S. Food and Drug Administration (FDA) completed its consultation process for corn amylase, meaning it is approved for human and animal consumption just as conventional corn. Enogen corn has undergone rigorous evaluations, including an assessment of allergenicity following methods recommended by several regulatory authorities, international organization and the scientific community. This research was evaluated by the FDA and other regulatory organizations around the world.

Where is Enogen corn approved?
As of mid- 2011, the Enogen corn amylase trait (Event 3272) is approved for:

- Import into Australia, Canada, Japan, Mexico, Korea, New Zealand, Philippines, Russia and Taiwan
- Cultivation in Canada and the U.S.

How was the Enogen trait developed? Is it a Bt?
Unlike corn traits for insect protection, Enogen corn is not a Bt. The original source of the organism used in Enogen corn was natural marine hydrothermal systems. Syngenta then refined the amylase enzyme to be used in ethanol production. State-of-the-art tools were used to confirm the similarity of this amylase enzyme with existing amylases, which are ubiquitous in nature; they are even present in human saliva, so they are very well understood.

How does Enogen corn benefit ethanol producers?
By enabling expression of an optimized alpha-amylase enzyme directly in corn, the Enogen corn amylase trait improves dry grind ethanol production in a way that can be easily integrated into an ethanol plant's existing infrastructure. For example, in a 100-million gallon plant, efficiency improvements enabled by Enogen has been shown to save 450,000 gallons of water, 1.3 million KWh of electricity and 244 billion BTUs of natural gas while reducing carbon dioxide emissions by 106 million pounds.

How does Enogen corn benefit corn growers?
The Enogen corn system provides corn growers an opportunity to participate in growing a value-added specialty crop for a contracted premium over the commodity market price of corn.

What is the yield performance of hybrids with the Enogen trait?
Based on Syngenta strip trial results, the hybrid performance has been shown to be equal to or better than other commercial hybrids on the market with similar maturity and trait package.

How does Enogen corn impact the environment?
Enogen corn increases ethanol production efficiency and reduces energy and chemical use in the production of ethanol from corn. Using a Department of Energy model, Syngenta has calculated that plants using grain containing the Enogen corn amylase trait could reduce the environmental impact of ethanol production by 10 percent or more by reducing water, electricity and natural gas use.

Is Enogen corn suitable for non-ethanol uses of corn?
Syngenta has done extensive research on the effects of the Enogen trait on end uses of corn and has concluded that more than 98 percent of corn uses are either impacted positively (dry grind ethanol) or have no impact at all. For the roughly two percent of corn that is used for food or industrial starch, some concentration of the Enogen corn trait, depending on the specific process, can have a thinning effect on the desired starch functionality and is not recommended to be used above the no effect level in those processes.

What are the economics of Enogen corn from the grower's point of view? What does a bag of Enogen corn seed cost (or what's the cost relative to a high performing traited corn for broad acre application)?
Enogen corn seed will be priced to the grower the same as other hybrids—based on the performance potential of the genetics. Growers will receive a premium when they sell their grain to authorized ethanol production plants. This is an incentive for them to manage their crop in the closed production system. The premium reflects the value to ethanol producers in terms of lower production costs.

Will Enogen corn be widely available to corn growers?
No. Enogen corn is not commodity corn. It is a high-value specialty grain for the very specific use of dry grind corn ethanol plants, similar in many ways to other specialty grains such as white corn, waxy corn or high oil corn. Like those products, Enogen corn will be produced, managed and used in a rigorous, contracted closed production system using the best-in-class grain management systems available. Initially, it will be positioned with a small number of licensed ethanol plants in a limited area of the Western Corn Belt. Its market introduction will be much more targeted than historical input traits like Bt corn.

Where can I get more information?
Visit www.enogen.net.