



Broadening the Horizon

More and more innovative thinkers in the agricultural industry are looking beyond traditional markets and focusing on finding new uses for age-old commodities like grains and oilseeds.

By Julie McNabb

THE WIDESPREAD BELIEF that there is a real need to enhance the economic viability and competitiveness of agriculture is resulting in new processes and uses for agricultural products.

Innovative processes are being created and existing ones adapted for the manufacture of new products such as nutraceuticals, pharmaceuticals, value-added foods, non-food products and bio-based products, all from traditional agricultural commodities. The following is a primer to what's currently in the product pipeline.

Funky Pharmaceuticals

As new technology allows for the development of innovative vaccines, crops have joined the fight against infectious diseases. The animal health division at Dow AgroSciences is leading the way in the development of plant-made vaccines. The company has received the world's first regulatory approval for a plant-made vaccine for prevention of Newcastle Disease in poultry. The company's Concert Plant-Cell-Produced System utilizes plant cells instead of whole plants in a secure, bio-contained environment. This new technology is also being used to develop innovative vaccines for horses, dogs, cats, swine and cattle, and could someday help to fight human diseases as well.

Others in the Pipeline:

- Scientists at the Roswell Park Cancer Institute in Buffalo, New York, are developing an edible potato vaccine against hepatitis B.
- SemBioSys Genetics Inc. has signed an agreement with Cangene Corporation, a biopharmaceutical company, for the processing and purification of its plant-produced insulin.

Functional Foods

As more emphasis is placed on healthy living, more and more consumers are turning to foods with value-added benefits such as high antioxidant broccoli and carrots with more vitamins.

Seminis Inc. is working with other researchers to develop a broccoli with higher levels of the cancer-fighting agent sulforaphane. The super broccoli contains 3.4 times more sulforaphane and has been developed by traditional plant breeding methods. (To learn more visit www.seedworld.com/readmore.)

Seeds of Change, a vertically integrated seed and food business, is also using plant science to create value in its products for farmers, processors and consumers. "There are a number of nutritional characteristics in food like more antioxidants and vitamins like lycopene, betacarotene and vitamin A – these are things we're very much working on," says Seed Director Marc Cool, adding that high antioxidant broccoli and carrots, restored to their natural colors of purple, yellow and white, are on the company's radar screen. "We have a couple of colored carrots which are higher in certain vitamins; we don't have a commercial broccoli yet; most things we have are two to three years away."

Others in the Pipeline:

- Monsanto is developing high-stearate soybean oil, a healthier solution for food products requiring solid fat for functionality such as margarines and shortenings; a low linolenic mid-oleic soybean oil that increases oxidative stability and improves shelf life and flavor; a soybean oil with lower saturated fats and increased monounsaturated fats; and enhanced oils with omega-3s.
- DuPont is working on high-oleic and high-stearic oil, as well as oils rich in omega-3s.

- The Soybean Export Council has identified several other potential soybean varieties that might lead to alternate uses including: varieties higher in beta-conglycinin leading to better emulsion for protein-based drinks; varieties lower in phytate leading to reduced pollution from animal feeding and reduced iron anemia; and varieties higher in isoflavone content which can help prevent certain cancers.
- The Food Futures Flagship in Australia is developing novel wheat varieties with a high proportion of amylose (a particular form of resistant starch), a low index and suitable food qualities for incorporation into breads, cereals and other foods; and has developed plants that produce DHA—a healthy omega-3 oil component currently only available from fish sources and vital for human health.

Booming Bio-products

Due to new emphasis on environmentally friendly products and reducing dependence on imports such as crude oil, there has been a recent boom of bio-products. By 2015, DuPont plans to grow its annual revenues by at least \$2 billion from products that create energy efficiency and/or significant greenhouse gas emissions reductions and nearly double its revenues from non-depletable resources to at least \$8 billion.

Making headlines recently is the company's polymer Sorona, which is on its way to becoming 40% bio-based, thanks to corn. DuPont's magic ingredient, called Bio-PDO, is being incorporated into Sorona for use in carpet and textiles, displacing petroleum-based propanediol (PDO). (To learn more visit www.seedworld.com/read more.)

Others in the Pipeline:

- Hytrel, a flexible polymer used in engineering resins and molded parts, is next on DuPont's list for becoming partially bio-based. With a corn derivative, it will be 30 to 70% renewable and available at the end of the year.
- The National Center for Agricultural Utilization Research is focused on converting agricultural commodities such as corn and crop residues into biofuels and chemicals, enzyme, and polymers and bio-products, and has developed a couple of industrial products available this year – a vegetable-based lubricant and a soy-based sunscreen.

Exciting Energy

With alternative fuels like ethanol and biodiesel gaining popularity, energy has already proven a successful alternate market for agricultural products like wheat, corn, canola and soybeans. Now the focus is on improving this already viable industry.

DuPont has been working since 2003 to develop advanced biofuels with properties that can help overcome the limitations of existing biofuels. The first product to market will be biobutanol, a type of alcohol that, like ethanol, can be made from corn and other crops and used to power automobiles. It's targeted for introduction this year in the United Kingdom.

Biobutanol is just the beginning of new solutions DuPont expects will tap into renewable energy. Bill Hitz, Research Director of Food and Feed Research in DuPont Crop Genetics Research and Development, says much of what his department does centers around making corn better for fermentation which will improve ethanol production. "We look at grain quality for corn and soybeans and try to make them more suited for end uses,"

he says. "For corn, that means making it better for fermentation."

Others in the pipeline:

- The fermentation biotechnology research unit of the Agricultural Research Service is looking at the viability of using waste from corn, such as the husks, as a more efficient material for ethanol production. Researchers are also looking at producing ethanol from the starch in peas.
- Renewable Alternatives has developed a process for converting glycerin, a byproduct of the biodiesel production process, into propylene glycol which can be used in unsaturated polyester resins, functional fluids such as antifreeze, pharmaceuticals, foods, cosmetics, liquid detergents, tobacco humectants, flavors and fragrances, personal care, paints, and animal feed.

While more research is needed, these innovative uses of agricultural products are expanding the horizon and leading to more options for the industry. SW

New Crop Potential

Terry Isbell, Research Leader of the National Center for Agricultural Utilization Research's New Crops and Processing Technology Research Unit, says there are several new crop initiatives with the potential to create bio-products in the pipeline:

- **Lesquerella** is a breakthrough specialty oilseed crop being grown commercially for the first time in the Southwest this season. "It has the potential to displace castor oil imports which would benefit multiple industries."
- **Cuphea**, a new crop in its second year of commercial production in the Midwest, has a number of potential commercial uses, but "the main application is the supply of lauric acid for detergents. In addition, the oil has been used in the development of a model diesel fuel and lubricant."
- **Pennycress**, an annual winter weed that grows in the Midwest, has the potential to be both a biodiesel resource and bio-based fumigant. The seed is 36-40% oil by weight, and long-chain fatty acids derived from its oil are similar to those of other biodiesel resources such as soybean and sunflower oils. "The biggest benefit of pennycress is that it shares the same crop fields as soybeans but it produces seed in the spring." So if farmers treated it as another crop, they could use their land to produce fuel in the winter from pennycress and food in the summer from soybeans." In addition, the meal can be used as a biofumigant so the entire seed would be used.