

Cultural practices on farms can boost antioxidants

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"In the past, I'd say (nutrition) was completely ignored, and now I'd say it's growing in importance in variety selection and consumer selection," said David Gombas, with United Fresh Produce Association.

The nutrition trend's potential remains to be seen, but Gombas believes he's noticed a growing emphasis on healthier fresh products during the past five years.

"It's a big ship to turn," Gombas said. "But in the next five years, I think you're going to see branding of fruits and vegetables for their high nutrient content."

Gombas believes growth in the organic and GMO-free sectors, perceived by some consumers to be healthier options, are indicators that the timing is right to breed for nutrition.

As for the need for fresh foods with enhanced nutrition, scientists note Americans face an obesity crisis, but aren't necessarily meeting dietary goals. It's estimated less than 5 percent of Americans meet their daily recommended allowance of potassium, for example.

Failure to launch

Researchers cite a myriad of reasons why enhancing nutrition hasn't thus far been a necessity in the fresh food industry.

Hayes points out that nutrition is complex, and society's understanding of which attributes are desirable, and the appropriate doses, is constantly evolving.

"Unfortunately, nutrition has been an expensive and shifting target," Hayes said.

Hayes also notes fruits and vegetables generally already do a good job of delivering nutrition and promoting a balanced diet may be a simpler path for the industry than developing "super foods."

Hayes' colleague at OSU, vegetable breeder Jim Myers, warns produce could essentially evolve into pharmaceutical products, with similar side effects. Myers, however, acknowledges the industry has ample room to improve nutrition before reaching that point.

"I think there is some growing trend to recognize that nutrition is important and you can breed for it," Myers said. "Right now, I think that type of breeding is happening in smaller companies or public breeding programs, such as mine."

Myers sees greater potential for nutrient-enhanced varieties in the fresh market than in the processed market, which values uniformity.

In 2011, Myers' program released Indigo Rose, a purple tomato variety high in anthocyanin — a pigment with anti-inflammatory, antioxidant and antibacterial properties not normally found in abundance in tomatoes. The variety also had high fruit-rot resistance.

Myers pitched Indigo Rose to California processed tomato growers, who rejected it as too unusual. Home gardeners comprise the current market for Indigo Rose.

Mike Thornton, superintendent of University of



Idaho State University researcher Mike Thornton cuts open a new potato selection from the university's breeding program that researchers hope is high in beneficial nutrients.

Idaho's Parma Research & Extension Center, sees logistical challenges in awarding an enhanced-nutrition premium in commodity crops, which are typically commingled. Labeling would also create problems, as nutrition facts generally represent a composite for a class, such as potatoes, rather than specific data from a given variety raised in a specific region during a certain season, Thornton said.

Victor Raboy, a research geneticist with USDA's Agricultural Research Service in Aberdeen, Idaho, believes the potential for a yield hit is the main reason why breeding for nutrition has "taken a back seat."

"Many nutritional-quality traits are negatively correlated with yield and productivity," Raboy said.

Raboy isolated the first gene expressing low phytic acid in corn and barley. Phytic acid can't be digested, but it's known to bond with zinc and iron in the intestinal tract, often contributing to mineral deficiencies. Animals fed low-phytate seed also seem to enjoy a health boost. Yet the product has found no market.

"A farmer is not going to grow low phytic acid corn if they're getting 5 to 10

percent less yield, because they're getting paid for corn," Raboy said. "The low phytic acid corn is so much more nutritious, but there's less yield."

Meat and potatoes

Thornton and Roy Navarre, a research geneticist with the Prosser, Wash., USDA-ARS facility, have been central in the effort to step up nutrition in potatoes.

The researchers are starting the third year of a project funded by the Oregon, Washington and Idaho potato commissions to evaluate advanced breeding lines from the states for key vitamins and nutrients, such as zinc, iron, vitamin C, B vitamins and antioxidants. They're also evaluating how growing locations and conditions affect nutrients.

One new potato variety, Targhee Russet, has been consistently high in vitamin C, though Thornton admits yield, resistance and tuber quality were the main drivers behind its release.

Thornton explained colorful spuds are often the most nutritious, as their pigments are high in antioxidants.

They've found cultural practices on farms can also boost antioxidants. Heavi-

er soils with a lot of organic matter, for example, tend to yield more colorful and antioxidant-rich spuds. They're also experimenting with growth regulators to produce smaller spuds, concentrating antioxidants.

Thornton has worked with a few companies, such as Wisconsin-based Tasteful Selections, that have specialized in small, colorful spuds for enhanced nutrition.

"Within the last five years, I would say there's been a lot more of this research going on," Thornton said.

Bernie Hansen, founder of Kansas-based NBO3, markets fresh meat, eggs and dairy products with elevated levels of heart-healthy Omega 3 fatty acids. He buys enriched Omega 3 milk from dairies willing to feed their cattle a special flax-heavy diet. Most of the dairies report improved animal health, Hansen said.

He also buys back dairy cows once they're past their prime, marketing the meat at a premium as Great-O beef. A few months ago, USDA granted Hansen the right to make a health claim with his beef.

Hansen argues improving nutrition is the food industry's responsibility and should be the norm rather



Courtesy of OSU

Oregon State University barley breeder Pat Hayes has been working for about a decade to breed food barley varieties with higher amounts of beta-glucan, a heart-healthy fiber.



John O'Connell/Capital Press

Organic food, including multi-colored carrots marketed for greater nutrition, fills the shelves of the Pocatello Co-op in southeast Idaho. Some food industry officials say the growth in the organic market demonstrates that consumers are demanding foods bred for enhanced nutrition.

relegated to a niche market.

"Having healthier food shouldn't just be for people who have more expendable cash," Hansen said.

Kansas State University economics professor Sean Fox has studied consumer response to Great-O products. He's found consumers are willing to pay about \$1.85 per pound extra for Omega 3-enhanced steak, about the same premium enjoyed by steak marketed as locally produced or guaranteed-tender.

"That gives me a sense of how big a market segment there might be for Omega 3 enrichment — similar to the locavore market, which is still relatively small," Fox said.

Big ag and nutrition

Often, it takes government intervention for enhanced nutritional crops to gain a foothold.

Raboy recalled a corn mutation discovered years ago by his post-doctoral adviser, elevating levels of lysine, an essential amino acid with antiviral properties.

"There was huge excitement about it, and then huge disappointment because it wasn't going anywhere," Raboy said.

Though abandoned in the United States, research on the lysine corn mutation continues in Mexico, where the government has stepped in to address a general lysine deficiency among its population.

Government influence is also behind an ongoing effort in the United States to develop new soybean varieties with healthier fats.

To increase the shelf-life of soy cooking oil, the industry has been treating it with hydrogen gas. These partially hydrogenated oils create unhealthy trans fats

as a byproduct. In 2003, the government mandated labeling of trans fats. Early this year, the government removed the "generally recognized as safe" status of partially hydrogenated fats.

Kristin Bilyeu, a USDA-ARS research molecular biologist in Columbia, Miss., has been conventionally breeding for soy higher in oleic acid — a healthier fat also found in olive oil. She's managed to shift oleic acid content in soy from 25 percent to 80 percent.

Pioneer and Monsanto have also been working on healthier soybeans.

A Monsanto spokesman said the company's Vistive Gold soybean is closest to commercialization and is undergoing trials in Indiana, Ohio and Michigan. He said it provides stable oil without hydrogenation, with no trans fats and less saturated fat, while also delivering higher yields.

Developed through genetic engineering, the line is scheduled for release in 2016.

Monsanto also has a soybean containing elevated Omega 3 fatty acids in the advanced stages of development.

J.R. Simplot Co. spokesman Doug Cole believes the industry has experienced a "new wave of products that have health benefits direct for consumers."

Nonetheless, consumer research tells Simplot, a major processor of potatoes, the public is more concerned about reducing food waste.

Cole said Simplot has experimented with beta-carotene enrichment, but "it remains to be seen whether we'll commercialize that."

"The technology exists to increase levels of other vitamins, and Simplot is investigating that," Cole said.

DOE to announce proposal early next year

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Also, DOE likely will bow to the economic reality that the requirements would be too expensive for smaller dairies, Susewind said.

Susewind estimated DOE could exempt about one-quarter of the state's smallest dairies and still regulate the vast majority of cows.

DOE hasn't defined "small dairy." The U.S. Environmental Protection Agency classifies a dairy with fewer than 200 mature cows as a small confined animal feeding operation.

Environmental groups supported DOE's earlier assumption that clay-lined lagoons automatically lead to groundwater pollution. If the DOE softens that stance, it should require regular groundwater tests around la-

goons, Puget Soundkeeper Alliance lobbyist Bruce Wishart said.

"There is one direction the pollutants are going, and it's downward," he said. "The question is how long it takes to get" to groundwater.

DOE contends that the only way to prevent leaking is to double line the lagoon with watertight material and install a leak-detection system between the layers. As proof, DOE cites on-the-ground studies and Darcy's law, a fundamental rule of hydrology.

The dairy industry argues that such liners would be cost-prohibitive and do little to protect the environment. It contends that seeping manure may contaminate soil immediately beneath the lagoon, but it's an unscientific leap to then assume the pollution au-

tomatically reaches groundwater.

DOE's proposed rules also would place new restrictions on how near to ditches manure could be spread and require a sharp increase in soil testing to guard against applying too much manure.

DOE plans to announce a formal proposal early next year and have a final rule in place by mid-year.

Under the October proposal, 450 to 500 dairies would face an "additional innumerable volume of requirements," Gordon said.

Thurston County dairyman Chris Doelman told the Senate Agriculture and Natural Resources Committee that he wants to continue his family's 50-year business, but said DOE's proposal was "discouraging."

"I want to dairy farm, and I

know I can do it environmentally (sound)," he said. "With this looming out there as a potential, I might not be able to."

Soil testing and buffers loom as major issues, but manure lagoons have been the main point of contention so far between DOE and the dairy industry.

Senate Agricultural and Natural Resources Chairman Judy Warnick, R-Moses Lake, said she called for Friday's meeting after attending a dinner at the dairy federation's annual convention. "Our entire conversation that evening was about cow manure," she said.

Lawmakers questioned Susewind, but have no direct control over the outcome. DOE is acting administratively, citing its authority under state law and federal Clean Water Act.

Rainfall accounts for 30 percent of water needs of Oregon crops

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which the state would experience a range of temperature increases and changes in precipitation, she said.

A full report on Oregon's anticipated water needs in 2050 is undergoing final editing and will soon be made public, she said.

OWRD is also planning to address growing water demand by assisting with feasibility studies and other plans for water supply development, Lovellford said.

Earlier this year, the Oregon legislature authorized roughly \$55 million in water supply development loans and grants.