

# Transgenic Alfalfa Yields New Products

Imagine a world of well-fed pigs and poultry without the environmental hazard posed by their waste.

Such a thought is bringing a smile to Agricultural Research Service and University of Wisconsin researchers. They've joined forces to solve the pressing animal waste disposal problem by developing a special type of alfalfa and a way to harvest its valuable enzymes.

ARS agricultural engineer Richard G. Koegel, who is at the U.S. Dairy Forage Research Center in Madison, Wisconsin, has designed processes to separate three important components from alfalfa.

But this isn't ordinary alfalfa. It's genetically altered alfalfa the university researchers created that yields industrially valuable enzymes not normally found in alfalfa.

Phytase is one of these components. Hog and poultry producers know the value of phytase, because it can reduce the need for costly phosphorus supplements in rations. Phytase frees grain-bound phosphorus so it can be used by nonruminants such as chickens and pigs.

Improving phosphorus utilization in these animals can decrease its excretion in their manure. Each year in the United States, hogs and poultry excrete about 30 million tons of manure containing 460,000 tons of phosphorus.

Phytase made by fermentation has been shown to increase animals' phosphorus uptake by up to 42 percent. Phytase extracted from the transgenic alfalfa is expected to be cheaper than either traditional supplements or phytase made by fermentation.

Feed is the most costly part of raising hogs and poultry, and phosphorus supplements cost about \$3 per ton of feed. Alfalfa-produced phytase may cost only half this much. [For more on phytase, see "Mutant Corn Has Low Phytic Acid," *Agricultural Research*, December 1996, pp. 12-14.]

In addition to phytase, the transgenic alfalfa yields proteins and

xanthophyll—a pigmenting substance used by the poultry industry to give yellow color to egg yolks and poultry skin.

"The equipment used to extract alfalfa juice isn't terribly complicated. But it's critical to produce a uniform, concentrated product suitable for storage and shipping," says Koegel.

"We beat the fresh alfalfa in a mill with high-speed rotating hammers to rupture the cell walls and then pass it through a continuous press, which expresses juice. Farmer cooperatives and commercial livestock-producing companies are likely to own this equipment."

Although the equipment Koegel is now using is stationary, he says similar equipment could be designed for field use.

"We are challenged, though, to produce a stable, concentrated product. Xanthophyll oxidizes and quickly deteriorates if not processed and stored properly. We're working on methods to extract and concentrate phytase and xanthophyll at lower cost and with a less energy consumption," says Koegel.

The alfalfa juice also provides new sources of human dietary protein. Koegel and others previously designed an extraction system that is now used by several villages in northern Mexico to enhance the largely grain-based, protein-deficient diets there.—By

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**Agricultural engineer Richard Koegel expresses juice from transgenic alfalfa containing the enzyme phytase and xanthophyll, as well as proteins suitable for human consumption.**