procedure has been adopted by a lab in South Africa. It is expected to be in use in a guayule display planned for next year at Disney's Epcot Center in Florida.

Estimating What You've Got

ARS scientists Francis S. Nakayama and Stephen H. Vinyard in Phoenix collaborated with Cornish, Chapman, and statistician Linda C. Whitehand at Albany to develop a simple, reliable procedure for estimating latex levels in guayule samples.

The basic approach requires cutting branches into half-inch-long pieces, grinding them for precise periods in a blender, and filtering the resulting liquid, or homogenate. The liquid is spun in a device called a microcentrifuge to separate the creamy latex from the rest of the slurry. Then the latex is coagulated, dried, and measured.

"We estimate," says Nakayama, "that we're extracting at least 90 percent of the latex in each specimen without having to use harsh solvents."

The researchers anticipate that it won't be practical for latex producers to always process guayule shrubs immediately after harvest. Earlier studies already showed that guayule rubber levels decrease in storage, but the Albany and Phoenix scientists were the first to track changes in latex levels from both stored shrubs and stored homogenate.

Medium-size branches—those about one-fourth- to one-half-inch in diameter—consistently had more extractable latex than smaller or larger branches tested throughout a 5-week period. Stored branches retained all of their latex for 2 weeks. But homogenates didn't begin to lose latex until the beginning of the fifth week, "meaning that homogenate is the best option for processors who need to store the harvest for more than 2 weeks," says Cornish.

"Up until that time," says Nakayama, "it is probably cheaper to store the crop as whole shrubs, provided they are not allowed to dry out. Further studies will give us more details about the cost advantages of the two storage options."—By **Marcia Wood,** ARS.

This research is part of New Uses, Quality, and Marketability of Plant Products, an ARS National Program described on the World Wide Web at http://www.nps.ars.usda.gov/programs/cppvs.htm.

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Lactic Acid From Alfalfa

Lactic acid—a colorless or slightly yellow, syrupy liquid—is naturally formed by the fermentation of lactose, or milk sugar. Its name comes from the Latin word "lac," which means milk. Commercially, lactic acid can be made synthetically from chemicals or organically as a byproduct of corn fermentation.

Last year, ARS agricultural engineer Richard G. Koegel in Madison, Wisconsin, and University of Wisconsin researchers were the first scientists to make lactic acid from alfalfa. This accomplishment will give alfalfa an extra economic boost.

The USDA-Wisconsin research partnership has already produced several alfalfa-derived products, such as carotenoids and protein concentrates, worth from $1,000 to $2,000 per acre annually.

Lactic acid is commonly used as a food additive for flavor and preservation, but a new market for organic lactic acid exists for making biodegradable plastics. The current lactic acid market in the United States is about 50,000 tons per year, more than half of which is imported.

The alfalfa fibrous fraction, from which lactic acid is made, results when juice is expressed from freshly cut herbage to make other high-value products, including food- and feed-grade proteins and carotenoids.

ARS research with transgenic alfalfa also produced industrially valuable enzymes.

Instead of using chemical treatments, Koegel pretreated alfalfa fiber for 2 minutes in hot water at 430°F and 350 pounds-per-square-inch pressure. With hot-water pretreatment, hydrolytic enzymes, and a *Lactobacillus* bacterium, the researchers got lactic acid yields as high as 60 percent.

"Many microorganisms can ferment either five- or six-carbon sugars. The *Lactobacillus* bacterium that we used is an exception because it can ferment both," Koegel says.

Koegel is now attempting to boost lactic acid yields using the microbe without pretreatment. If this work proves successful, it may help lower industry's cost of production.

Growing alfalfa in some agricultural areas is preferred over corn and soybeans, which require more fertilizer and soil tillage that can lead to soil erosion. Another benefit: Alternating alfalfa with corn and soybeans reduces pesticide use and increases yield of corn and beans.—By **Linda McGraw,** ARS.

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