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Screening Fresh Oranges With UV Study Pinpoints New Value of Detection Tactic

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Fresh, deliciously sweet navel oranges, on display at your local supermarket, may have been quickly inspected with ultraviolet (UV) light when they were still at the packinghouse. Usually, the purpose of this special sorting and screening is to see if circular spots—which glow a bright, fluorescent yellow and may be about the size of a quarter or larger—show up on the fruit's peel.

More often than not, these spots, which scientists refer to as "lesions," are telltale indicators of the presence of microbes that cause decay, namely *Penicillium italicum*, responsible for blue mold, or *P. digitatum*, the culprit behind green mold.

It isn't the microbes that are fluorescing under the packinghouse UV lamps. Instead, it's tangeritin, a natural compound in citrus peel oil. When the peel is damaged, such as by decay, tangeritin moves closer to the peel surface, or perhaps seeps out of it, becoming easier for UV to detect.

The characteristic "fluorescence signature" of the decay lesions is easily recognized by packing-line workers who monitor the fruit as it speeds past them on a conveyor belt. All navel oranges that display this distinctive pattern are promptly culled—an established practice that dates back more than 50 years in California citrus packinghouses.

But studies by plant physiologist Dave Obenland and plant pathologist Joe Smilanick—both with the Agricultural Research Service in Parlier, California—suggest that other, less-studied patterns of fluorescence on navel orange peels may warrant more attention. Fluorescence in the form of specks, smears, smudges, or blotches, for example, may indicate the presence of cuts, punctures, or other peel wounds that might not be visible to the naked eye, yet may pave the way to attack by decay microbes.

To learn more about these less-familiar patterns, the researchers sampled about 5,000 navel oranges over a 2-year period. For the study, navel oranges sampled at two California citrus packinghouses were sorted by fluorescence level—zero, sparse, moderate, or high—noted during UV screening. Next, the oranges were evaluated twice under normal light—not UV. The first time was within 24 hours after UV screening and sorting; the second was after the oranges had been stored at 59ºF for 3 weeks.

As expected, fruit with high fluorescence developed further decay and peel-quality problems during storage—but so did many of the oranges that had only moderate fluorescence.

Taken as a whole, the findings suggest that packers might want to expand UV screening to take several fluorescence levels and patterns into account when sorting navel oranges. Many of the patterns that the researchers investigated, such as glowing specks no bigger than the tip of a ballpoint pen, might be quickly and easily detected with modern UV-equipped machine-vision sorters.

The idea of expanding UV use to include more than detection of the classic decay signature is not new. But the Parlier study, though preliminary, is likely the first to present as detailed a look at this approach.

ARS and the grower-sponsored California Citrus Research Board, in Visalia, funded the research.

Obenland, Smilanick, ARS plant pathologist Dennis Margosan at Parlier, and ARS statistician Bruce Mackey at Albany, California, documented the UV findings in a 2010 peer-reviewed article in *HortTechnology*.—By **Marcia Wood,** ARS.

Top: During ultraviolet (UV) screening at citrus packinghouses, navel oranges that display the characteristic "fluorescence signature" associated with the presence of blue or green mold are typically culled. *Middle:* Oranges with less-studied patterns, such as blotches, may also warrant attention, ARS research has shown. *Bottom:* ARS plant physiologist Dave Obenland examines oranges under UV light at a citrus packinghouse.

This research is part of Quality and Utilization of Agricultural Products, an ARS national program (#306) described at www.nps.ars.usda.gov.

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DAVID OBENLAND (D2927-1)

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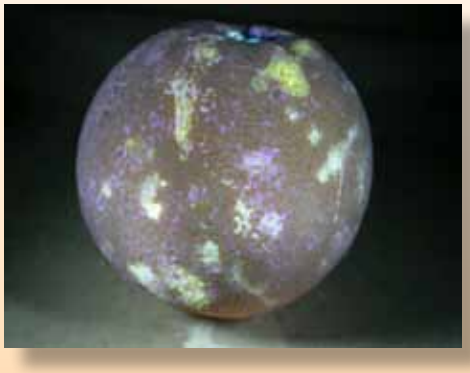

JEANNETTE WARNERT (D2928-1)

Breed Matters

Selecting Rams for Rangeland Production

PHIL PURDY (D2929-2)

Columbia rams.

MICHELLE MOUSEL (D2931-1)

PHIL PURDY (D2930-2)

Suffolk rams.

In western states, where almost half of U.S. sheep are produced, the Suffolk ram is commonly used as the "terminal sire"—an animal with the best genetics to sire lambs for meat production. However, concerns about the ability of Suffolk-sired lambs to survive from birth to weaning, and then to harvest, raised some doubts about the Suffolk's value as a terminal sire.

Western producers are challenged by diverse management systems and production environments. Therefore, they need a comprehensive evaluation to help identify terminal-sire breeds best suited for their operations.

Scientists at the Agricultural Research Service's U.S. Sheep Experiment Station (USSES) near Dubois, Idaho, examined four breeds used to produce market lambs. The team, which included scientists from Virginia Tech, Ohio State University, and the ARS Roman L. Hruska U.S. Meat Animal Research Center (USMARC) in Clay Center, Nebraska, studied critical performance traits of lambs sired by rams of Columbia, Suffolk, and Texel breeds and by a composite breed developed at USMARC. Scientists evaluated lamb survival from birth to weaning; growth before and after weaning; changes in body composition, such as fat and muscle relationships; efficiency of growth; and carcass merit and value.

From Birth to Weaning

"Our objective was to evaluate U.S. sire breeds side by side in an extensive rangeland production system," says ARS geneticist Tim Leeds. "Does breed of ram affect whether a ewe will become pregnant, how many lambs a ewe will produce, and performance of the progeny from birth until weaning?"

Scientists first determined the effects of ram breed on ewe reproduction, lamb survival, and lamb growth through weaning. They mated approximately 20 rams per breed to 574 Rambouillet ewes over a 3-year period. More than 1,800 lambs, produced from almost 1,000 matings, were subsequently evaluated.

"Breed of sire affected lamb growth from birth to weaning, but not survival," Leeds says. "As suspected, Suffolk-sired lambs were larger at birth, so they grew faster—gaining 3 to 6 pounds more before weaning—and their survival was as good as or better than that of the other crossbred lambs."

Suffolk Gains in Other Traits

After weaning, lambs were fed a high-energy diet in a feedlot and weighed weekly. Ultrasound measurements were taken every 2 weeks to determine fatness and muscle development during the feeding period.

"Suffolk-sired lambs had the most rapid gains, were 10 to 16 pounds heavier, and had the most desirable leanness at the end of the postweaning feedlot trial," says David Notter, professor emeritus in the Department of Animal and Poultry Sciences at Virginia Polytechnic Institute and State

Left: Technician Tracy Northcutt uses diagnostic ultrasound to determine fat level and muscle development of lambs.

University. "They were equal or superior to lambs sired by the other breeds in growth, fat depth, and loin muscle area."

"Columbia-sired lambs had the least amount of back fat and the smallest loin muscle area compared with lambs produced by the other breeds," adds USSES geneticist Michelle Mousel. "Producers want to see larger loin muscle. But Columbia's leanness could be an advantage for consumers."

DAVID NOTTER (D2940-1)

DAVID NOTTER (D2941-1)

Top: Texel rams. **Bottom:** MARC composite rams.

Breeds were also examined for feed efficiency, which refers to how well lambs convert feed into growth, says USSES geneticist David Kirschten.

"Suffolk-sired lambs were the most efficient during the study," Kirschten says. "They required between 5 and 8 percent less feed per unit of growth during 90 days in the feedlot than the other three breed crosses. Columbia-sired lambs required more than 15 pounds of additional feed compared with lambs from the other sire breeds at comparable body weights and rates of gain."

After lambs had reached prescribed market weights, carcass value and organ weight were evaluated with the help of Ohio State University scientists, who harvested animals and cut meat into marketable products.

"Because Suffolk-sired lambs were heavier at birth, weaning, and at completion of the feedlot trial, they also had heavier carcass weights, more kidney fat, and larger loin muscle area, although pound for pound, Texel-sired lambs were as well muscled as the Suffolk-sired lambs," Mousel adds.

Going Head to Head

Even though Suffolk-sired lambs were a cut above the three other crossbred groups for most traits, the other sire breeds still may have something to offer, according to scientists. Each sire breed has its own distinctive characteristics. For example, Texel-sired rams can be used to produce heavily muscled lambs that are ready for market at younger ages than Suffolk-sired lambs. Columbia-sired lambs may be marketed at older ages than Texel-sired lambs, without becoming too fat. USMARC composite-sired lambs may be ready for market at an intermediate age, size, and degree of fatness and muscling.

"Producers can use information from this study to help select sire breeds that will complement their production systems and improve the market value of lambs," Mousel says. "The take-home message is to know what weaning and market weights you want, what to feed your lambs, what type of environment they're reared in, and what breed of ewe you are going to use."

"Because the Columbia didn't do nearly as well as the Suffolk, Columbia breeders may need to adjust their selection criteria, focusing more on growth and muscling if they wish to compete with the Suffolk as a specialty terminal-sire breed," Notter says. "But producers also value the dual-purpose capability and wool quality of the Columbia and may prefer to use it as both a maternal and sire breed."

The USMARC composite, developed as a genetic resource rather than a terminal-sire breed, has been surpassed by purebreds in terms of performance potential, Notter says. But it may have some use in stressful production environments that favor a lamb with intermediate growth potential that can be marketed at an intermediate weight.

"The Texel has a role to play typically if animals are harvested at lighter weights or under less intensive feeding," he says. "It might also have value in developing germplasm for future use."

Potential for New Breeds

Scientists are developing new germplasm resources based on crosses among the Suffolk, Columbia, and Texel breeds. They hope to capture the growth traits of Suffolk, muscling traits of Texel and Suffolk, and fleece traits of Columbia and incorporate those traits into a higher performance terminal-sire breed that produces large, heavily muscled, efficiently growing lambs with all-white pelts.

"All-white pelts, which are used to produce high-quality apparel, are usually more valuable than pelts with dark colored fibers," says recently retired USSES research leader Greg Lewis.

"We can use breed diversity in terminal crossbreeding systems to improve production efficiency," Lewis says. "The recent data can be used to select terminal-sire breeds to accomplish specific production and marketing objectives and to develop composite genetic lines that incorporate the most favorable traits of different breeds. Composite genetic-sire lines that are suitable for challenging rangeland production systems have the potential to compensate for deficiencies in the current breeds."—By **Sandra Avant,** ARS.

This research is part of Food Animal Production, an ARS national program (#101) described at www.nps.ars.usda.gov.

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