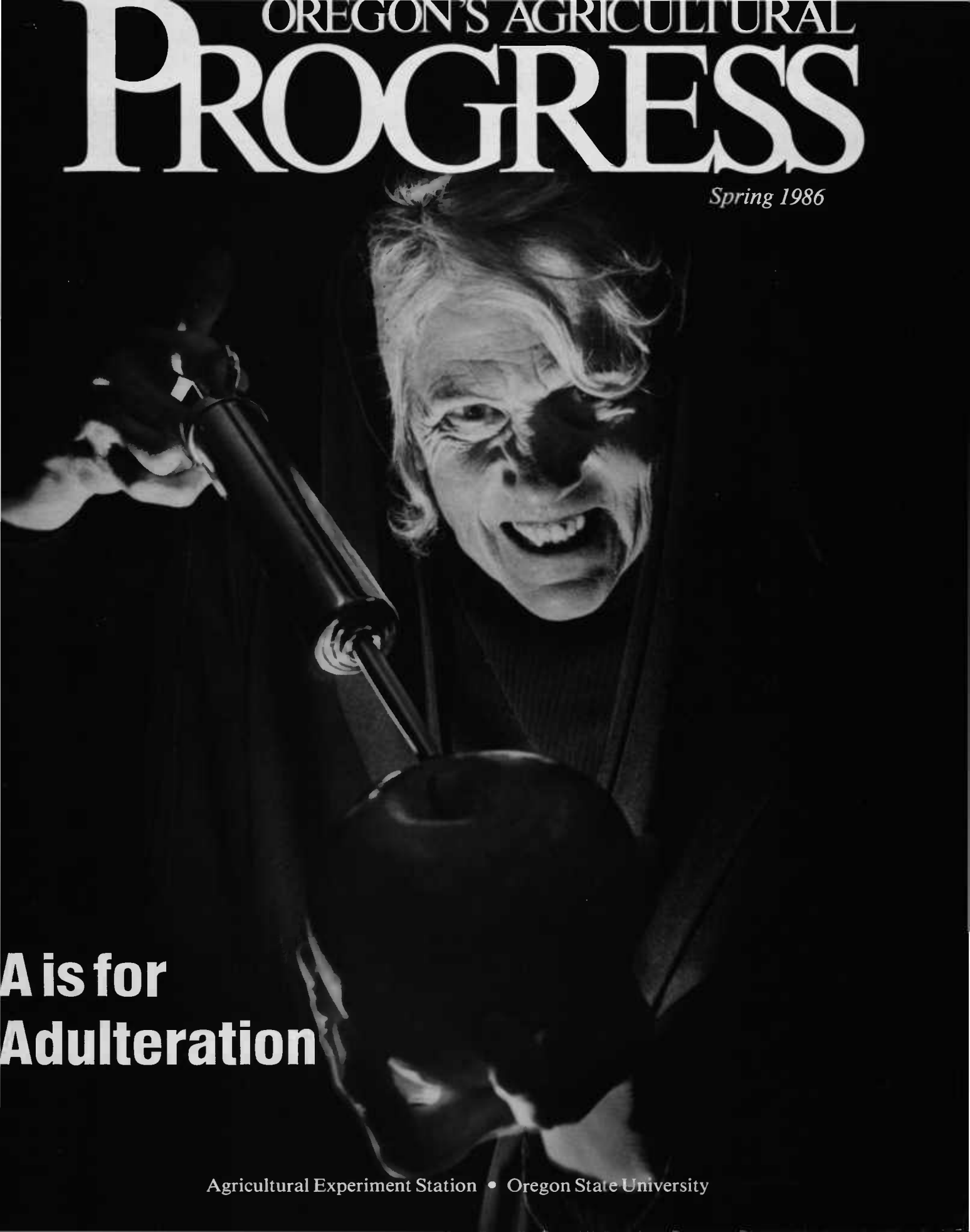
OREGON'S AGRICULTURAL

PROGRESS

Spring 1986



A is for Adulteration

Agricultural Experiment Station • Oregon State University

THE EDITOR'S NOTE

Recently, a reader wrote to ask how we pick the topics for articles in *Oregon's Agricultural Progress.* Lest wicked thoughts creep into your mind: it wasn't a nasty letter. She was just curious.

It seems like something that might interest other people. So I'm going to try to explain it here.

First, you need to know about what we call the "audience"—who the magazine is written for. It's for anyone interested in research done through the Agricultural Experiment Station at OSU. But the magazine is especially for taxpayers, who have a right to know how their money is being spent.

Taxpayers and their families are about as wide an audience as a publication can have. So our readers vary from kids in grade school to adults with graduate degrees in fields with names I can't pronounce. They work in jobs that range from farming the old-fashioned way with a horse and plow, to engineering in the high-tech electronics industry, to working at home raising a family (a 24-hour-a-day job). They live in Portland highrises and houses tucked away in remote little valleys east of the Cascades.

That has a big impact on how we pick topics. We have to play a guessing game to anticipate the interest of those varied readers. Filling the magazine with stories on research that is narrow in scope would be a sure way to put a lot of people to sleep. We try to slip articles into each issue on narrow, but important, topics for the readers interested in those fields. But we try to surround those with articles on topics we think will have broad appeal.

The entire process makes me think of Abraham Lincoln's famous observation that you can't fool all of the people all of the time (I substitute please for fool).

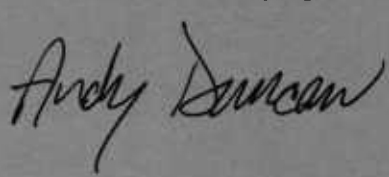
The diversity of the people who read *Oregon's Agricultural Progress* also affects how we deal with the topics we do pick. Whatever the subject, we have to try to keep the article simple, but not insultingly so. Believe me, that can put you—real quickly—in crossfire between thorough-minded scientists used to writing technical articles for other scientists, and readers with no desire to wade through a bunch of strange words.

Before I stop, let me use this issue as an example of what I've been trying to say.

You'll find three relatively long feature articles. One is about a "nematode" (that's not a frog-type creature) threatening the sheep industry. The research is important. But I bet the topic will appeal mostly to readers in the livestock business (maybe a few other curious folks).

I predict the other feature articles will appeal to a much wider section of readers. Those are about Oregonians' attitudes toward crime, and a scientist's "sleuthing" into how shady characters in the food business make money cheating competitors.

Go ahead: You be the judge.



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Cover: OSU food researchers are helping put the squeeze on processors who try to cheat their competitors and consumers. See page 8. (Cover and other photos in this issue by Dave King).

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AIRMAIL AZALEA

Today, if you're given, or buy, a potted plant like an azalea for a winter or spring holiday, it comes from the neighborhood florist and is already blooming.

But what if you live in the boonies with no florists around?

That's the question the people at Harry and David, a direct-mail firm in Medford, grappled with and then turned over to Bob Ticknor, a horticulturist at OSU's North Willamette Agricultural Experiment Station south of Portland.

"Basically, this is a variety trial," says Ticknor of his attempt to give people a new gift option for Christmas, Valentine's Day, Easter or Mother's Day—an Oregon azalea or similar potted plant sent by mail order and ready to burst into bloom.

"They (Harry and David) tried it and gave up the idea," explains Ticknor. "The big problem they encountered was excessive leaf drop. What I'm looking for are varieties I can force to be ready to bloom near the proper holiday and be shipped and arrive in good condition."

With a special test, Ticknor has found six or seven pink and red azalea varieties he thinks will stand up to the challenge.

"Knowing that Harry and David had this leaf drop problem," he says, "we set things up by getting our plants ready to ship, then putting them in the shipping boxes, taking them out every three days, shaking them real hard and counting the leaves that fell while we also assessed the overall quality.

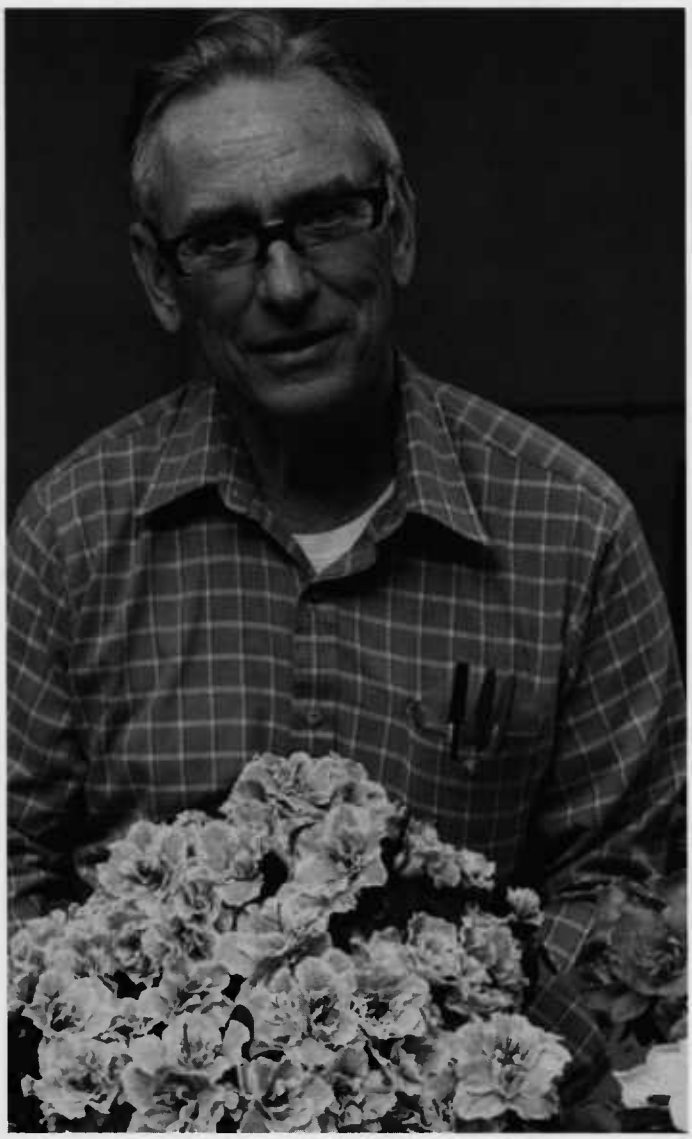
"Then we'd put them back in the box for another three days. We did this for 12 days. Basically we figure that it should take three days for shipping, but what with weekends or other layovers we took the test to 12 days just for safety's sake."

The goal is not to undercut neighborhood florists, says the researcher.

"There are somewhere around two million florist azaleas produced in Oregon every year by wholesale nursery operators (mostly between Salem and Portland). So this is just a way of increasing the marketing to perhaps hit a little part of the market that's not being covered at present," says Tichnor.

People in rural areas with no florists have few options now, he points out.

"You have your Aunt Susie who lives 100 miles out of Fargo and you want to send her a plant. Well, maybe next year you can call a retail, mail order outlet and they'll be able to send an Oregon azalea directly to her door."



Ticknor with a mail order azalea.

FARM SOFTWARE HITS THE RACKS

For decades, OSU has made agricultural research and other information available to farmers, consumers and others through printed material. The process just entered the computer age.

The OSU Extension Service is offering the public three software packages, including a computer program based on wheat research done at the Experiment Station's Columbia Basin Agricultural Research Center at Pendleton (see "Grain Brain," page 4, Winter 1980 issue, *Oregon's Agricultural Progress*).

The program, called PLANTEMP, takes into account the amount of solar energy falling on a field and predicts the rate of development of plants. It is based on the research of plant physiologist Betty Klepper and soil scientist Ron Rickman, who work at the Pendleton station. Klepper and Rickman are with the U.S. Department of Agriculture's Agricultural Research Service. Jerry Brog, a former OSU Extension Service agent, developed the software.

The other software packages are called ALFACHAR and WOOLPRO.

ALFACHAR combines a database of several hundred varieties of alfalfa with a program that picks the right variety for a particular grower's location, climate, soils

and other conditions. Dave Hannaway, an Extension agronomist, and colleagues in OSU's crop science department developed the software.

WOOLPRO is intended to simplify record-keeping associated with wool marketing. Tim Cross, an Extension computer coordinator, supervised development of the program.

The programs are for IBM personal computers and compatible machines. They sell for $25 each (plus $2.50 postage and handling) and may be purchased from the Bulletin Mailing Office, OSU, Corvallis 97331.

A RED PEAR

There's a new red-skinned pear, thanks to OSU researchers.

The tree was developed at the Southern Oregon Agricultural Experiment Station at Medford by several researchers. They include the late Professor Frank Reimer, who started the station's collection of more than 400 pear varieties; Porter Lombard, a horticulturist stationed on the OSU campus in Corvallis; and David Sugar, a plant pathologist at the Medford station.

The tree was named Cascade to preserve its link with the Pacific Northwest, says Sugar. It is being propagated by Carlton Plants, a Dayton, Oregon, company that has a patent pending on the variety. The limited number of trees initially sold are gone, but more will be available in the spring of 1987.

"Our station will receive royalties amounting to half the royalties assessed the purchaser on each sale, with a minumum of 20 cents per tree," says Sugar. "Royalties will be used to support research at the station."

Red pears are not new. Every pear company in the Medford area grows some, including Red Bartlett pears and other varieties.

"Red pears have an esthetic appeal that attracts the consumer," says Sugar, noting that he expects their production to rise significantly in the next 10 years.

But existing red pear varieties have at least some of the following drawbacks, according to Sugar: small fruit size, poor production or short storage life.

The Cascade, a winter pear, is large and has good storage qualities, tree production and taste.

Parents of the variety are the Red Bartlett and Comice pears. The Comice sets the standard for eating quality and the Bartlett was the first pear to have a red mutant.

The Cascade pear was developed at the Southern Oregon research station.

WEEVIL WANTS DOUGLAS-FIRS

A certain little weevil is getting the attention of Douglas-fir seed producers.

A study of the pest, called *Lepesoma lecontei,* by OSU entomologist Tim Schowalter shows early production of Douglas-fir seeds (cones) may be reduced as much as 6 percent by the insect. The seed loss translates into significant economic losses in western Oregon Douglas-fir seed production.

"The results of our study show this weevil to be previously unrecognized as a Douglas-fir cone predator," says Schowalter. "Obviously, people are becoming very interested in this."

Because the weevil attacks Douglas-fir cones early in the season, people may confuse the damage it does with other problems, says the researcher.

"Cone mortality, often approaching 90 percent of potential cone production, sometimes occurs during the early cone development time of April and May at low elevations in western Oregon," says Schowalter. "In the past, orchard managers have primarily attributed this to frost damage. But this year there was little or no frost damage and we were able to identify and quantify the damage done by *L. lecontei* (the weevil). It was surprisingly substantial."

Apparently, the weevil is widespread.

"We found it just about everywhere we pitfall-trapped for insects," says Schowalter. "We found it in Roseburg, Corvallis, the western Cascades and Coast Range mountains. Reports from the State Department of Forestry and Weyerhaeuser put it as far north as the Centralia area of Washington."

Schowalter has found that the estimated 6 percent average seed loss caused by the weevil is roughly equal to average seed losses attributed to each of the major known Douglas-fir seed destroying insects, the Douglas-fir cone gall midge and the Douglas-fir seed chalcid.

Figures given to Schowalter by managers of the U.S. Forest Service's Beaver Creek seed orchard near Corvallis, where he did the bulk of his initial study, suggest that a 6 percent seed loss on that 40-acre orchard translates into a $19,000 revenue loss in a good seed production year like 1985.

"There are control options that can be instituted at a place like Beaver Creek for about $1,000 that might be effective," says Schowalter. "This is a flightless insect, so control may be as simple as just banding the trunks of the trees."

But control measures haven't been tested yet. The Experiment Station scientist, and researchers from OSU's Forest Research Laboratory, are cooperating in studying the pest and how it can be controlled.

Entomologist Tim Schowalter examines Lepesoma lecontei, a weevil that damages Douglas-fir cones.

FISH PHOBIA?

Taking the boat, or a truck, probably is the best way for valuable young salmon and steelhead traveling down the Columbia River to avoid the dangers of dams and predators, an OSU researcher has concluded.

The Bonneville Power Administration and the Army Corps of Engineers asked Alec Maule, a research assistant in the fisheries and wildlife department, to evaluate the system used to collect young sockeye, chinook and coho salmon and steelhead trout and transport them around the series of dams along the Oregon-Washington border.

The young fish, called smolts, are collected at the McNary Dam at Umatilla, Oregon, the first dam below where the Columbia and Snake rivers join.

The fish are diverted through submerged passages within the dam and the current sweeps them into raceway holding areas. Then they're loaded onto trucks or, more commonly, barges and given a ride to a point below Bonneville Dam, helping them avoid predators and treacherous dam turbines.

Maule's objective was to find out how stressful the collection and transporting are on the fish. The researcher explains that the fish react to the stress by producing a chemical called cortisol that is similar to adrenaline.

Maule measured the level of cortisol in the blood. Based on his cortisol studies, he calculates that smolts collected and transported around the dams probably recover from the experience in one or two days.

In the short term, stress reduces smolts' resistance to disease, swimming ability and ability to regulate the concentration of salt in their blood—particularly important when they enter the ocean, Maule explained.

The bright electric lights near uncovered raceways at McNary Dam apparently scare smolts, which are accustomed to deep, dark water, Maule noted. In one experiment, the open raceways were covered with black plastic to block light. That reduced the cortisol level in smolts.

Overall, the study "indicated the McNary collection and transportation system caused a fairly mild stress that they get over fairly quickly," said Maule. "The system is about as good as you can get it."

The trucking and shipping of smolts started about eight years ago. Now, seven to eight million smolts are moved each year. That is about 50 to 70 percent of the smolts that reach McNary Dam. Previously, 15 to 20 percent of all smolts reaching each dam were lost because of injury from turbines, disease or predation.

About 1 or 2 percent of smolts trucked or shipped by barge die, Maule says. The number that die after release below Bonneville Dam is not known. However, sampling at the mouth of the Columbia suggests that more smolts reach the ocean when the fish are transported around the dams.

Fisheries and wildlife professor Carl Schreck supervised Maule's work on the project.

THE BIOCHEMISTRY OF BEER

Beer makers will use no hop before, or after, its time if some OSU researchers succeed in their work.

Breweries use the flowers of the hop plant to give beers distinctive aromas and flavors.

The OSU scientists are trying to identify the many chemical components in hops that affect aroma and flavor and find out how aging affects each of them.

The scientists are particularly interested in hop varieties with what brewers call "noble aroma," a spicy, herbal smell considered highly desirable.

An especially powerful instrument called a high resolution mass spectrometer is helping the researchers quickly analyze the chemical structure of oil compounds in hops, explains OSU agricultural chemist Max Deinzer.

"We're trying to identify specifically which chemicals are important for noble

aroma. Although we're not entirely sure, we think the key is a compound called humlene," said Deinzer.

He explains that several compounds produced by humulene, as it oxidizes during the aging process, seem related to noble aroma qualities.

Using beer from a pilot brewing plant at the Adoph Coors Company in Golden, Colorado, Deinzer and OSU agricultural chemist Kai-Cheong Lam are analyzing how hop flavor compounds change at various stages in the brewing process.

"The basic biochemistry of hops is something people have been working on for 50 years. But we still don't know all we need to," said Al Haunold, a U.S. Department of Agriculture hop breeder stationed at OSU.

Haunold, who is attempting to develop a hop variety for the Northwest with noble aroma, is keenly interested in Deinzer's and Lam's study. He is trying to develop a variety with sufficient amounts of humulene and other oil components to produce the desired aroma.

U.S. brewers buy hops with noble aroma from Europe, where prices are high and the supply is unstable because of disease problems.

A IS FOR ADULTERATION

By Andy Duncan

'Fe, fi, fo, fum
I smell the blood of an English man,
Be he alive or be he dead
I'll grind his bones to make my bread'

—Author unknown

The last two lines surprised you, right?

Most people have that reaction. They remember chanting the first two lines as chipmunk-cheeked kids, maybe while playing hide-and-seek. But they never stopped to think about what came next.

Ron Wrolstad, a researcher in OSU's food science and technology department, likes the rhyme. He sometimes recites it as a humorous, if ghoulish, way of introducing people to the history of food adulteration—the practice of adding impurities to food so it can be sold, or traded, more profitably.

That's a history Wrolstad and his graduate students and research assistants are helping shape, most recently with some sophisticated sleuthing into "the case of the bogus cranberry juice cocktail." In that project, they even joined forces with a New York City detective agency.

We'll get to their research. But first, let's go back to the verse about bone-laced bread.

The incident that inspired the nursery rhyme's author is a pretty good indication of just how wild the food adulteration racket has been through the ages. It occurred in 18th-century England during the Industrial Revolution.

The mess started in London in 1757, to be exact. In a publication called "Poison Detected," a person identified by the editor only as "My Friend, the Physician" (catchy nom de plume, huh?) claimed the bakers of London were putting lime, chalk and alum into their loaves. Then "The Physician" let loose his big gripe.

"It is averred by very credible authority," he wrote, "that sacks of old bones are not infrequently used by some of the bakers ... thus the charnel houses of the dead are raked to add filthiness to the food of the living."

Well. Charnel houses, in case you don't know, are where they deposited human bodies. At the very least, The Physician was getting a little carried away, believes Wrolstad. (Because of his teaching and research, the OSU scientist has become something of an expert on the history of adulteration; a publisher recently asked him to write a book on the subject).

"There may have been a miller in London who had wet grain and added a little bone meal as a grinding agent," he says, "and a little lime may have been added to flour as a bleaching agent. But try making bread using bone meal and alum. You can't do it."

But that's not the point. Some crazy things definitely have happened.

"There are plenty of horror stories," says Wrolstad. "Dried, ground, baked horse liver in coffee, floor sweepings in tea, sulfuric acid in vinegar, ground leaves and twigs in black pepper, water in milk, wine and just about every other beverage."

And those are just additional examples from the Industrial Revolution era in England. Wrolstad tells fascinating tales about earlier tricks in other parts of the world. Most Americans know about the scandals in the U.S. meat processing and packing industries in the early part of this century (hot dog, anyone?). They led to the establishment of the Food and Drug Administration.

Then there's Connecticut. It's the Nutmeg State, Wrolstad points out. That's because cheaters used to carve certain wood so that it looked like the spice. There was a scandal, but the name stuck.

Basically, the adulteration business has boomed whenever people stopped growing their own food or getting it from neighbors—wherever more complex food distribution systems developed.

Charnel houses . . . are where they deposited human bodies.

"I've heard some good lectures on food law," says Wrolstad. "It hasn't changed since Roman times: Thou shalt sell wholesome food that is what it's said to be."

What has changed is the ability to detect impurities—adulterants—slipped into food.

For example, the hydrometer, developed in the 1700s, measured the density of wine, milk, liquors and other drinks. That made it harder for the unscrupulous to water them down.

"One of the major stimulants for the establishment of agricultural experiment stations in Europe and the USA was the need for knowledge on the composition of foods," says Wrolstad.

"But," he adds, "history has shown time and time again that when new analytical procedures stop certain practices of adulteration, more sophisticated types of adulteration are adopted."

You can imagine how spooky the one-up stuff between adulterators and analyzers has gotten in this age of microwave popcorn and space flights to Neptune. And that is where the research of Wrolstad and his associates comes back into the story.

"Our interest, traditionally, has been in the composition of fruits and how that affects their quality—marketing factors like color, flavor, longevity, etc.," he explains. "We've developed some pretty sophisticated methods of analyzing composition. With cranberries, we and Ocean Spray (a private company) are probably the world leaders. We do some sophisticated work with apples, too."

That's how his group got involved with adulteration.

"The people who produce and sell juices need rapid methods of screening their composition to detect adulterants, and we're working on that," he explains. "They also need better ways of precisely identifying adulterants, techniques that will stick in court. The defense attorney (for a firm accused of using adulterants) will say fruit was grown on a certain mountaintop in Tennessee and it's just different because of that."

Now, OSU has a major effort in the adulteration area that goes hand in hand with the fruit quality work. Current researchers, besides Wrolstad, include graduate students Victor Hong, Leticia Pilando and George Spanos and research assistant Bob Durst.

There are several good examples of what the OSU group has accomplished. Wrolstad lightheartedly calls one "the case of the sorbitol-laced blackberry wine."

"Because of its (the imported concentrate's) low price and quality, Pacific Northwest producers of blackberry concentrate suspected that the imported blackberry concentrate was adulterated," he says. "We initiated a compositional study on authentic blackberries."

Analyzing the sugars, acids and so on, the OSU researchers developed a

"profile" Wrolstad compares to "the skyline of Chicago. It was recognizable." They compared that profile to one they developed of the imported concentrate's components.

The verdict? You already know, of course: The imported concentrate was adulterated.

Blackberries don't contain sorbitol, but the imported concentrate did. The researchers found that the profile for the concentrate's sugars and acids fit that of plums, which contain sorbitol. They deduced that the producer was substituting plums, which are cheaper, for blackberries. With wineries buying the cheaper, adulterated foreign concentrate, Northwest growers couldn't sell as many berries.

Wrolstad's group also contributed to what he refers to, jokingly again, as "the case of the heavy-weight carbon."

In that one, by identifying the type of carbon in a substance, food scientists were able to detect the adulteration of honey, maple syrup and fruit juices with cane sugar and high fructose corn syrup.

"Criminals"—Wrolstad's term—in the apple industry struck back.

This is where they worked ... with "private eyes."

"They were successful in circumventing the isotopic carbon assay (scientific terminology for the detection technique) by using invert beet sugar, synthetic malic acid, caramel coloring and high-quality apple essence," he explains.

But then the good sleuths found a way to detect synthetic malic acid, putting them ahead again.

In 1982, an organization called the Processed Apple Institute succeeded in litigation against a company that was making adulterated apple juice and claiming it was 100 percent apple juice. Recently, in a move that clearly excites Wrolstad, the FDA initiated legal action again a large firm that was buying the adulterated apple juice and using it in a beverage for babies.

The OSU researchers' most recent effort was "the case of the immigrant acids and alien anthocyanins in bogus cranberry juice." This is where they worked, albeit indirectly, with "private eyes."

"What happened was that a firm came to us for help because they were certain that some of its competitors couldn't produce cranberry juice cocktail, with the de facto industry standard for the drink of 25 percent cranberry juice, at their selling price and make a profit," says Wrolstad. "The firm knew its competitors' products did not look, smell and taste like 25 percent cranberry juice cocktail."

It was a small, family company from New Jersey, Minot Food Packers, Inc., that asked for help. The company is what is known in the juice industry as a "private label packer," one that processes a product and packs it under a client's label.

"They were in a situtation," says Wrolstad, "where they either had to start adulterating, too, or lose the business. They absolutely refused to cheat. I have a lot of respect for them."

The firm hired a detective agency in New York to provide "blind samples" of the product to Wrolstad so results of the testing would be on more solid legal ground. "The detectives would purchase the samples in supermarkets back East and send them to me by UPS. I only talked to them on the phone," Wrolstad recalls.

The OSU researchers found that 17 of 31 samples they analyzed were adulterated. Chemical profiles suggested the adulterants were malic and/or citric acid and grape skin extract (probably used as a colorant).

"Some samples had as little as 3 percent cranberry juice and many had 15 percent," Wrolstad says. "We

Food scientist Ron Wrolstad, left, and graduate students Victor Hong, center, and Leticia Pilando remove pulp from a cranberry crusher.

calculate that the advantage to the criminals could be as much as $2 a case (12 quart bottles) if you used 10 percent cranberry juice instead of 25 percent. I feel there are three groups being ripped off: Consumers, cranberry growers and legitimate processors."

A frustration for Wrolstad is that the FDA rarely takes action in such cases, including this one.

"They either had to start adulterating, too, or lose the business."

Most adulteration problems, he explains, aren't a public health hazard. The adulterators are committing "economic fraud"—misrepresenting the contents of their product. "Economic fraud has a very low priority for the FDA because there is no public health hazard," he says.

Then what good is the research?

"In publishing our findings, as we have, it's now known that this type adulteration can be detected. This serves as a deterrent to the adulterator. Economically, I think what's happened is that the people purchasing cranberry juice concentrate now want to make darn sure the stuff they buy is authentic. That affects the demand for, and the price of, cranberry juice concentrate and cranberries."

Wrolstad points out that several large companies that make cranberry juice concentrate, and use it in a cocktail drink they make and market themselves, are "caught between a rock and a hard place."

"They're not the ones doing the adulterating," he says. "They wouldn't risk their good names. It's the firms that sell to others. But the big companies are afraid of prosecutions. They're afraid the consumer will hold them guilty by association.

"Some firms would prefer to have the problem referred to as mislabeling rather than adulteration," he adds. "My response is that, according to U.S. food law, it is adulteration when an undeclared, cheaper ingredient substitutes for an economically valuable component. It doesn't have to be

Pure cranberry juice like this is extremely sour. The cranberry beverages sold in supermarkets usually contain about 25 percent cranberry juice.

The OSU adulteration research team (left to right): Leticia Pilando, Bob Durst, Ron Wrolstad, Victor Hong and George Spanos.

hazardous to be an adulterant."

The problem is getting worse, he fears.

"The FDA is understaffed and, really, these firms that cheat are at minimal risk and the economic incentives for them are high. I think the problem of economic fraud has accelerated over the last 10 to 20 years. I really think the FDA should build some cases and make some examples."

Wrolstad can tick off several tactics for catching cheaters the OSU research team has developed. Using a process called high-pressure liquid chromatography to detect certain adulterants is one example.

Northwest growers couldn't sell as many berries.

"But any single analytical technique can be circumvented," he points out. "What we're advocating now is the use of a matrix of methods. Multiple pieces of evidence."

That might solve the problem permanently?

"I wouldn't bet on it," says Wrolstad. "What's happening today is no different than what has happened historically in food adulteration. If there's any opportunity whatsoever to make a profit by cheating, some people are going to find it, particularly when there's a minimal risk of being caught and punished by the FDA."

THE SPLINTER OF OUR DISCONTENT

By Dave King

Local crime rates don't match unhappy Oregonians' views on police protection

He is tall and lanky and his friends call him Pete. He and his family have lived in rural Clackamas County all their lives. He married Sally just out of college, but he's known her almost as long as he can remember. They live a calm, but social, life in the country, even though their nearest neighbor is almost half a mile away.

Sonia, on the other hand, has never lived anywhere but in cities. Right now, she lives in Eugene. And it's the smallest city she's ever lived in. As a single parent, she and her six-year-old son, Aaron, live a quiet, relatively static life. Everything has its place and is in it, when possible. She doesn't know too many of the folks who live around her. But that's all right. Who wants to share the burdens of other people's lives when you've got your own?

Different? Sure, almost as different as can be. But there's one thing these hypothetical families would share, if they were real. Both would be dissatisfied with police protection from crime—despite big differences in their local crime rates.

Joe Stevens, an agricultural and resource economist at Oregon State University, has just published the results of a two-part study concerning crime prevention in four Oregon counties (Lane, Clackamas, Deschutes and Jackson) and in the United States overall.

In the study, Stevens identified some things Oregonians do to make themselves feel safe. Those actions include buying items for protection like weapons, lights, and alarms; asking neighbors to watch their houses while they're out; and contributing money to political causes related to safety. Also, Stevens attempted to measure our willingness to pay additional taxes for crime prevention.

Results from the sample of 403 heads of households showed that more than 75 percent had purchased safety-related items, at an average cost of about $49 a year. Twenty-two percent of the respondents had relied on neighbors to watch their houses. Only about 5 percent of the people in the study had been sufficiently dissatisfied to resort to political action. And, interestingly, 69 percent said they would be willing to pay additional taxes, averaging about $50 a year, if the household burglary rate could be reduced by one third.

Breaking the respondents down into city, small town and rural residents, Stevens found that city residents like Sonia were more willing to pay higher taxes than the others.

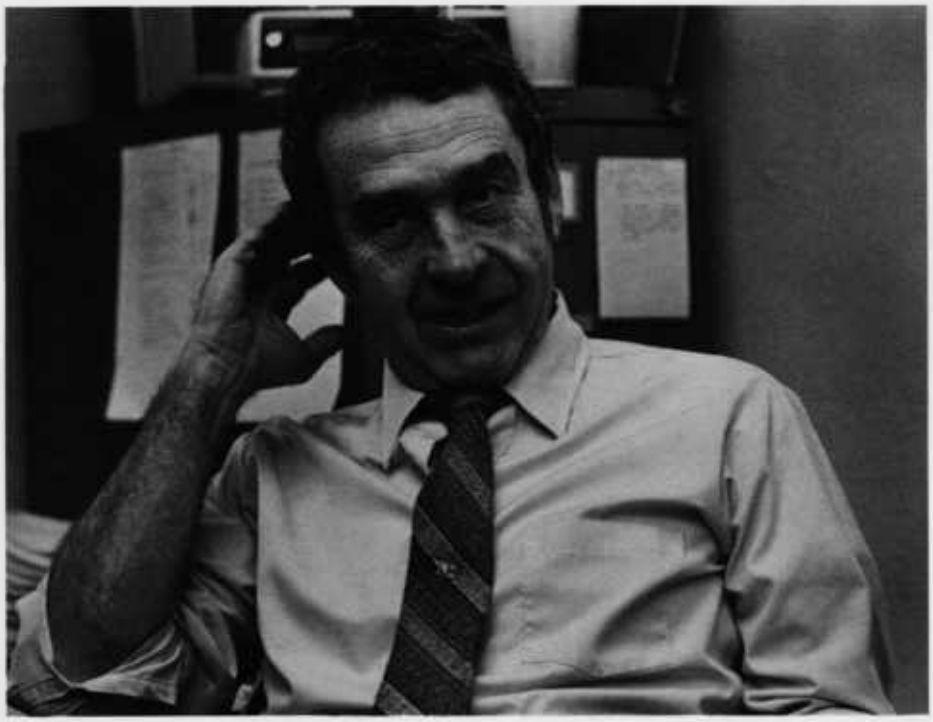
"People in city households indicate a willingness to pay an additional $28 a year in taxes to reduce crime compared to residents of small towns or rural areas," Stevens says.

The most satisfied people are those who live in small towns like Junction City or Canby.

One of his objectives was to find out why people become satisfied or dissatisfied with police protection. For instance, in the case of Sonia and Pete and their families, their dissatifaction is not in line with crime rates. Oregonians like Sonia living in cities face a crime rate twice that of rural Oregon residents like Pete and his family.

But looking through the survey results it is not entirely clear why rural residents are as dissatisfied with police protection as are city residents, even though rural crime rates are lower. Lower population density, less frequent police patrols and longer police response times in rural areas all may be important factors.

That some types of people are more dissatisfied with police protection than others, regardless of the crime rate, is the key finding of the research, according to Stevens. The most dissatisfied people are those who live in rural



The people most satisfied with crime prevention are in small towns, says OSU researcher Joe Stevens.

areas and those who live alone or have been victimized during the previous year (no matter where they live), he points out.

"From this," he says, "we came to the conclusion that satisfaction with police protection depends not just on crime rates, but on personal characteristics of the people, particularly where they live and whether they have been a previous crime victim."

Almost 24 percent had bought rifles or shotguns.

The key to a person's level of satisfaction may be a perceived ability to do something about your situation: Pete can do something about his dissatisfaction, but Sonia doesn't know if she can.

"Apparently," says Stevens, "rural residents, although relatively dissatisfied, are able to significantly increase their overall satisfaction by taking personal action like making substantial market expenditures in items such as lights and alarms, etc."

Stevens discovered that the most satisfied people are those who live in small towns like Junction City or Canby. They have a relatively low crime rate—although not quite as low as the rural areas—and the highest satisfaction with their police protection.

"An important point about this, from the standpoint of those who are trying to make public policy decisions concerning crime, is that the greatest unmet need is in the cities," says Stevens. "People who live in rural areas are more likely to take action, like installing lights or security alarms or owning weapons. And, people in smaller towns are able to take social action, like asking a neighbor to watch their house. But people living in cities are less able to satisfy their needs this way."

A good question at this point is: Why don't the city residents also use the marketplace to help raise their level of satisfaction with personal safety? The answer is they do, but not to the degree that rural residents do. Rural residents spend more than city residents protecting themselves and their property—about $22 a year per rural household compared to about $12 a year per city household, according to the study.

"City residents do buy items for their protection," says Stevens. "But apparently, the purchases are just not as effective in raising their level of satisfaction."

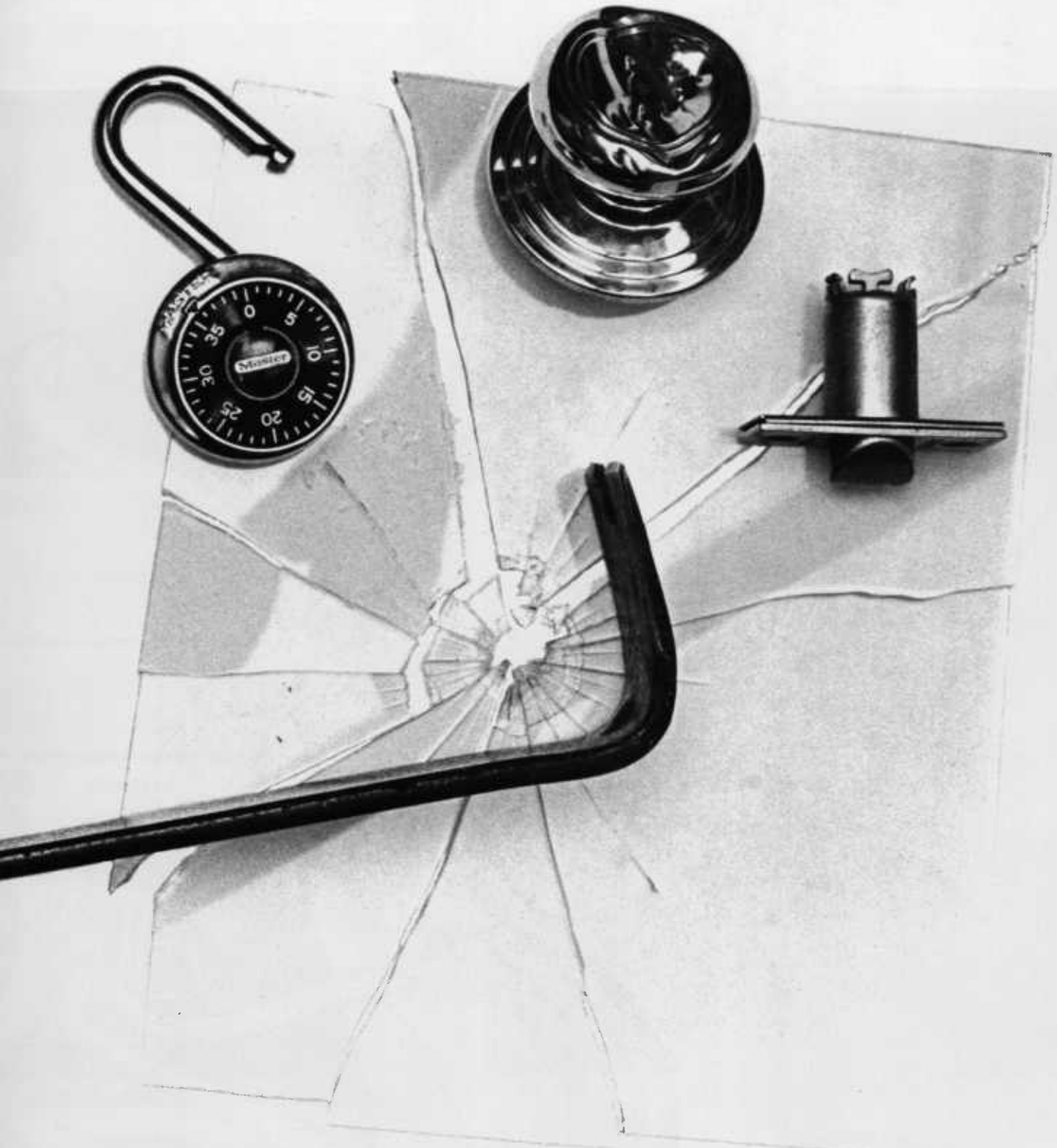
People purchase a wide variety of items for their protection, he discovered. According to Stevens, the most expensive purchases were for security guards. About 2 percent of the respondents spend an average of $111 on guards.

More than 40 percent of those surveyed had purchased yard lights, at an average yearly cost of more than $11. More than 36 percent bought deadbolt locks, at an average annual cost of nearly $5. Watchdogs came next, with almost 32 percent spending an average of more than $60 a year on their protective pets. Almost 24 percent had bought rifles or shotguns and spend an average of $3.50 a year on them. Handguns cost 22 percent of those surveyed about $4 a year.

Two types of crime were used in the study: crime against persons (murder, rape, robbery and manslaughter) and crimes against property (burglary, larceny and auto theft).

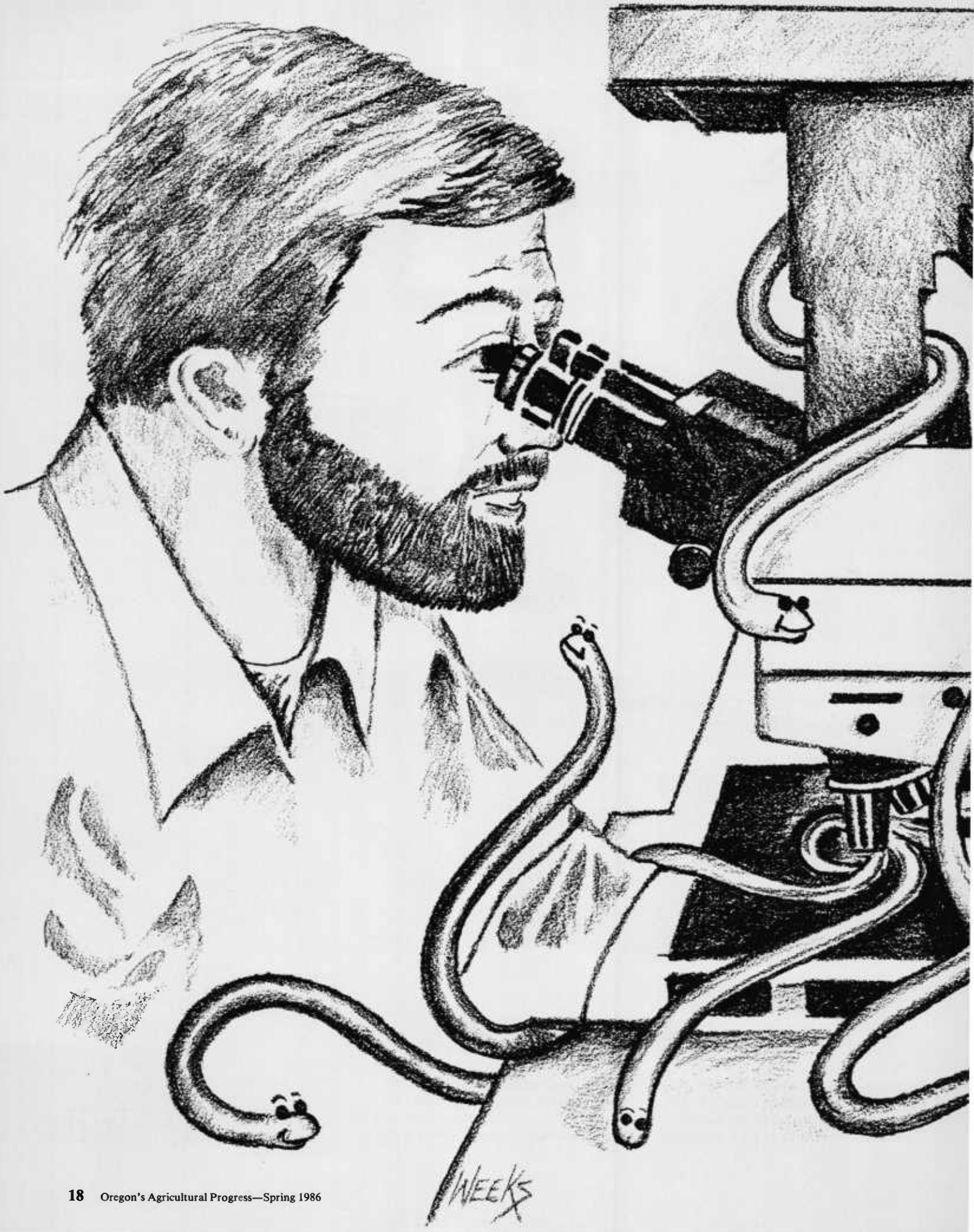
According to Stevens, results from his study should interest people making public policy decisions, especially in times of shrinking resources. He says asking a question concerning "willingness to pay" may help provide decision-makers with information many have not had in the past. But Stevens is quick to point out that this is an emotional issue.

Stevens identified some things Oregonians do to make themselves feel safe.



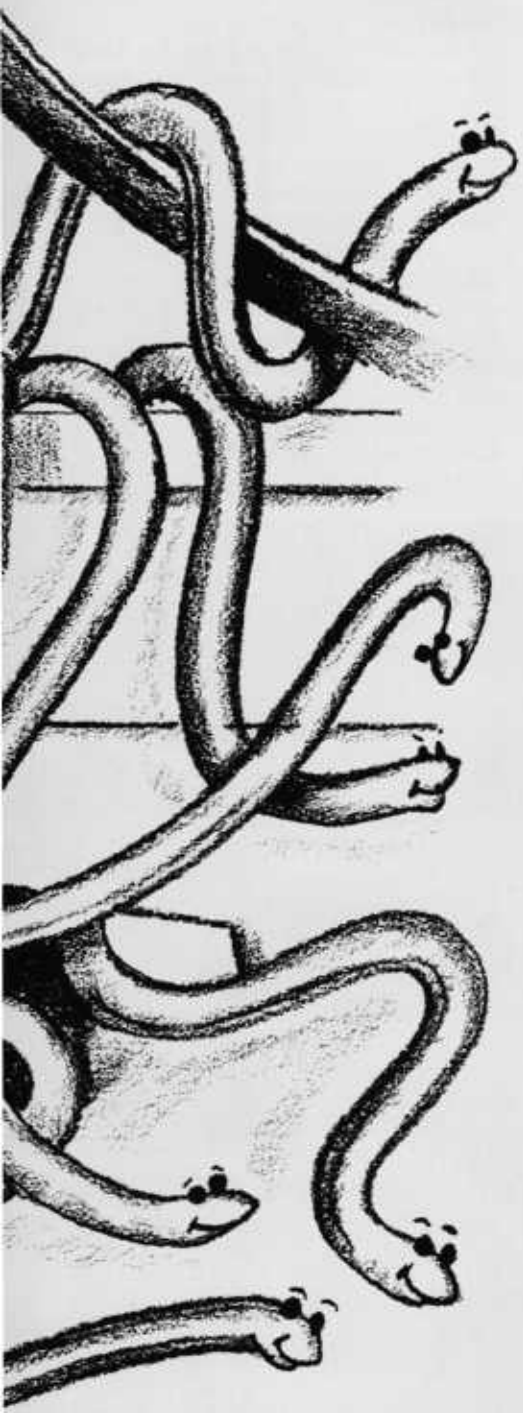
"Many times, in cases of crime, personal hazards may be dimly perceived. You just don't think it will happen to you. We see many more inconsistencies between what people say they will do and what they actually do. We used the question about 'willingness to pay' to get a little closer to what people would actually do, but these results always need to be viewed with personal knowlege of one's specific city, town or rural area."

Dave King is a radio-televison producer and writer in OSU's Agricultural Communications Department.


WEEKS

THAT MOMENT IN THE LAB

A tiny invader may stir up a big sheep industry ruckus



The crisp, clear morning of February 25, 1985, deceived Eric Hoberg. It started normally, except for the oddity of sunshine in winter in the Willamette Valley. After breakfast, he walked the four blocks to his OSU office. He had a cup of coffee, like he usually does, then went to his lab and started doing what people in his field spend a lot of time doing—looking through a microscope.

But about 11 a.m. Hoberg focused on the magnified image of something he'd never seen. It was less than an inch long and, to the naked eye, resembled a strand of hair coiled in several places like a watchspring. Within hours, he and OSU veterinarian Gary Zimmerman had sent the specimen, by express mail, to a government facility in Beltsville, Maryland, just outside Washington, D.C.

Today, the researchers realize that moment in the lab could be significant for years to come to the sheep industry in Oregon and other parts of the country.

Hoberg is a research associate in OSU's Veterinary Diagnostic Laboratory. He specializes in studying the evolution and geographic distribution of parasites. That February morning he was involved in the routine chore of identifying roundworms taken from the intestines of a lamb. The lamb was part of the control group (the animals not treated) in a test Zimmerman was doing with an anti-parasite drug.

"Based on my preliminary observations, I decided I was looking at *Nematodirus battus,* a type of parasite that hadn't been reported in the United States before," says Hoberg. "I thought it was kind of interesting. But I didn't really think that it would prove to be significant. New recordings of parasites in North America aren't uncommon."

Zimmerman is a parasite specialist, too. He was familiar with *N. battus,* as scientists refer to the organism on Hoberg's microscope slide. He knew it was the only nematode, or wormlike, parasite of sheep the U.S. Department of Agriculture listed as an agent of foreign animal disease. That refers to a disease-causing organism not thought to be in the United States. Obviously, the government is pretty aggressive about trying to keep such an organism off U.S. soil.

That is justified, in the case of *N. battus.*

Until the incident at OSU, the parasite's known range was the British Isles and areas in Europe including Norway, The Netherlands, France, Italy and Yugoslavia. In Britain, it is considered to be the most pathogenic (deadly) parasite of lambs. It's not uncommon for the disease the parasite causes, called nematodiriasis, to sweep through 90 percent of the lambs in a flock of sheep, killing up to 30 percent of them.

Hoberg and Zimmerman sent the specimen on the slide, and some others like it, to the U.S. Department of Agriculture's Animal Parasitology Institute in Beltsville, Maryland.

They requested that scientists there examine the parasites and, if they agreed with Hoberg's finding, put them in the National Museum in Washington's collection of parasitic worms. They also asked the Beltsville scientists to notify USDA's Animal and Plant Health Inspection Service (nicknamed APHIS), which is responsible for protecting the country from foreign animal diseases.

Researchers have found 11 more infected flocks and pastures in the Willamette Valley.

"Beltsville called us the next morning to confirm Eric's diagnosis," says Zimmerman. "I had a talk with a scientist back there who's the top government nematode specialist in North America. He never gets excited, and he was excited."

That was the thrill of scientific discovery. The practical importance of the finding for sheep producers was hazy, and it still is, according to Hoberg and Zimmerman. The main reason is that no one has figured out how and when *N. battus* got into the country—so no one knows the extent of the problems it will cause here.

A little background on that:

After Hoberg's laboratory discovery, he and Zimmerman inspected samples from the intestines of other lambs on the two adjacent Willamette Valley farms where Zimmerman purchased animals for the drug test. They found *N. battus.*

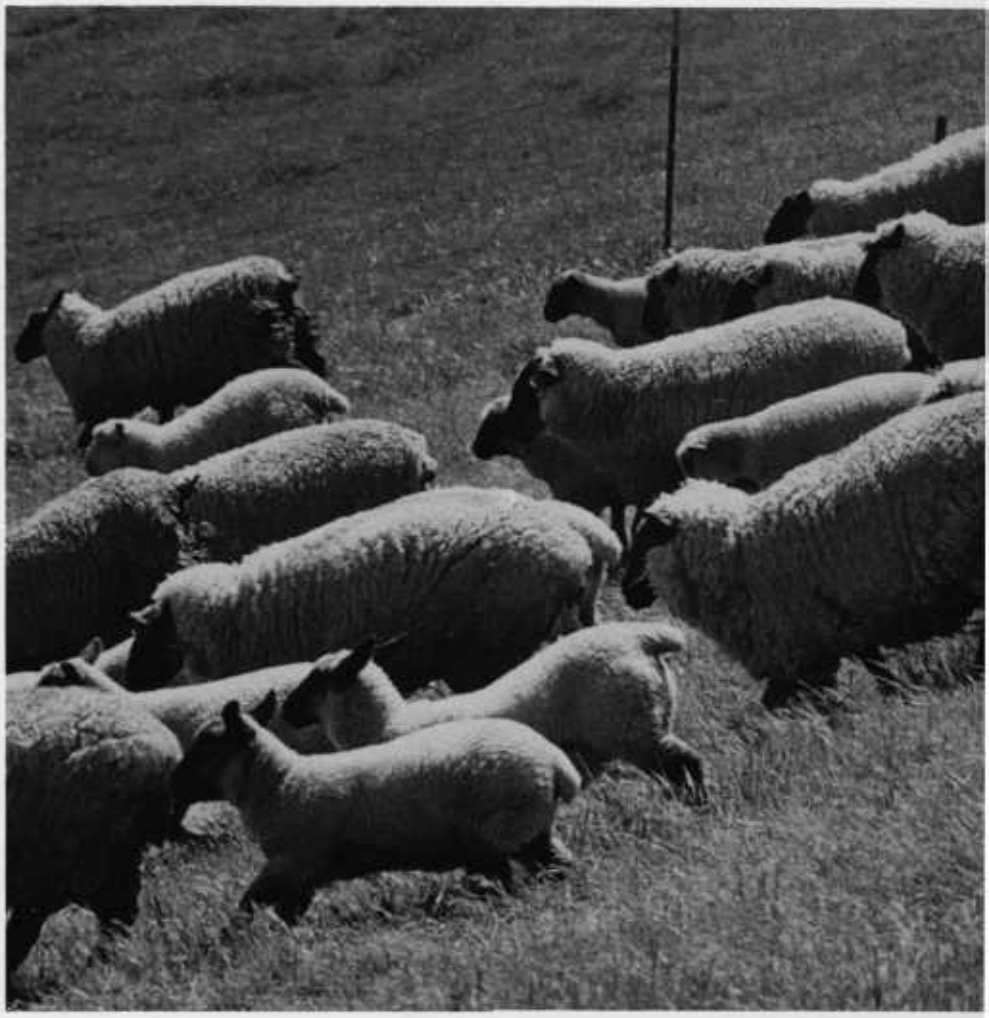
Since then, the OSU scientists and USDA and Oregon Department of Agriculture researchers have found 11 more infected flocks and pastures in the Willamette Valley, from near Portland to the Eugene area. They've also found two infected flocks near the Oregon coast.

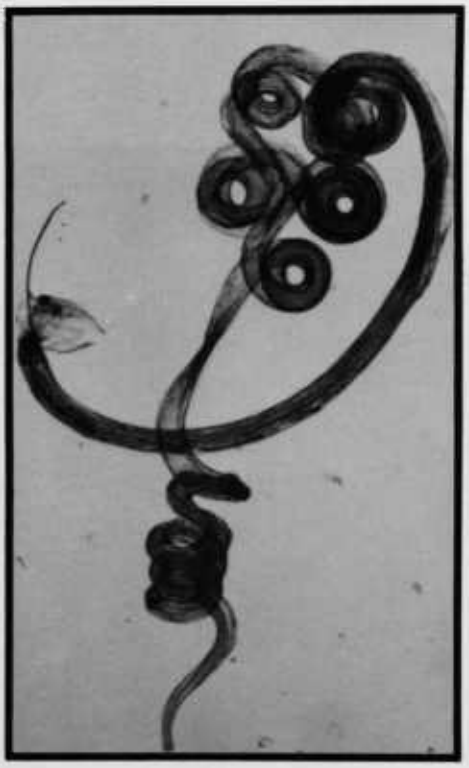
To keep several viral diseases out, the government does not allow the importing of sheep directly into this country from Britain or the other countries where *N. battus* has been detected. The reason is that none of the countries have programs to certify that their exported sheep are free of the diseases. But sheep from those countries are imported to countries such as New Zealand and Canada that have certification programs. U.S. producers bring the offspring of those sheep, which are not screened for worm parasites, into this country.

So far, researchers haven't linked any of the *N. battus* infections in Oregon directly to imported sheep, although Canadian sheep have been introduced into flocks in Oregon known to be infected. That leaves things still open, according to Zimmerman and Hoberg: *N. battus,* which to the untrained eye resembles common U.S. nematodes, could have been here for years, surviving undetected in parts of the country similar to Britain and the areas in Europe where it's been found. Or it could have come in recently in the offspring of sheep from infected countries or in sheep imported illegally.

Researchers have found no solid evidence of disease caused by *N. battus*—just the presence of the parasite. But there's the potential for trouble, even if it's been here for years without causing problems. "It was in Norway 10 years before it started causing problems, so it's just too soon to draw conclusions," says Zimmerman.

Interest in the parasite is growing. Several research groups are trying to learn more about where it is in the United States and how it behaves here. They include Zimmerman, Hoberg, their assistants and OSU graduate student Lora Richard in OSU's College of Veterinary Medicine; Oregon Department of Agriculture veterinarians; researchers with the National Nematode Services Laboratory in Ames, Iowa, a part of APHIS; and scientists with the Biosystematic Parasitology





"It was in Norway 10 years before it started causing problems."

Laboratory in Beltsville, Maryland, a part of USDA's Agricultural Research Service.

Mike Daly, a veterinary researcher with the Oregon Department of Agriculture, is cooperating with Zimmerman and Hoberg on research. And Ramsey Burdett, the agriculture department's state veterinarian, says he has requested that APHIS intensify its search for *N. battus* in Oregon and surrounding states and set up a requirement that Canadian sheep coming to this country be screened for *N. battus*.

APHIS researchers are spot-checking samples from the intestines of sheep slaughtered in western Oregon and fecal samples from western Oregon sheep. They're also checking sheep slaughtered in states such as Missouri that have imported breeding stock from Oregon in recent years.

"We're giving reports back to the sheep owners and veterinarians as a service to them," says William Prichard, the veterinarian in charge of APHIS's Oregon Veterinary Services division in Salem. "But no policy has been developed yet on how it should be handled overall. We're trying to determine how big a problem this could be."

Zimmerman and Hoberg see the need for that, too.

"We haven't had the funds ourselves, but our original recommendation was for an immediate surveillance program that would include intensely surveying the sheep population adjacent to areas in Oregon where *N. battus* has been found and then working out from there," says Zimmerman.

The OSU researchers are involved in several types of *N. battus* research. They're testing drugs that could be useful, comparing worms found in Oregon to the ones that cause problems in Great Britain, and studying the life cycle of *N. battus* in western Oregon.

Understanding the life cycle here is particularly important in assessing potential disease problems, say Zimmerman and Hoberg.

In Britain, females of *N. battus* lay eggs in the spring that become spread over pastures as sheep defecate. Larvae develop rapidly in the eggs, but don't hatch until the following spring, apparently because they first must undergo a period of cold sensitization. As temperatures increase in the spring, the larvae hatch, or bloom, and are ingested by grazing sheep. The larvae can cause nematodiriasis by penetrating the lining of the animals' intestines. Eventually, the larvae mature into adult worms, produce eggs and the cycle is repeated.

Symptoms of the disease include severe diarrhea, rapid weight loss and extreme dehydration. In the worst cases, animals die two or three days after the onset of diarrhea. The disease seems to be restricted to suckling lambs. But older lambs and adult sheep can harbor the parasite and transmit it from one area to another.

The key to disease with *N. battus* is the size of the larval hatch, Zimmerman points out. If most of the larvae in a pasture hatch before lambs are grazing heavily, the lambs won't ingest enough to bring on the disease. If the larvae hatch later in the season, the lambs may be too old to suffer many ill effects. Severe outbreaks of the disease usually occur only in years when the weather, the lambing cycle, the number of *N. battus* eggs in pastures and other factors come together in a certain way.

Researchers don't know yet if weather conditions, and other factors, in Oregon and other states will allow *N. battus* to cause disease problems. Climatic conditions in the Willamette Valley are similar, but not identical, to those of the British Isles.

APHIS's Prichard has his opinion:

"It's likely that it's been here for several years. We really have done very little sampling in other states. It could take several years for the parasite load to build up so that we get some (lamb) losses. We think maybe in a flock or two we've seen some clinical signs of it (the disease caused by *N. battus*). But we haven't confirmed that yet."

Top: A microscopic view of Nematodirus battus. Left: The parasite causes disease in suckling lambs.

Because the potential for trouble is unclear, it's important that U.S. veterinarians and sheep producers be alert to large losses of young lambs and notify state or federal agriculture officials, says Zimmerman.

"There's nothing that would immediately make a person wonder if its nematodiriasis," he says. Diarrhea caused by *N. battus* would be similar to coccidial scours, a common sheep problem in Oregon caused by microscopic parasites called protozoa. One characteristic of nematodiriasis is that it moves rapidly through a flock. Usually, nearly all the lambs show clinical signs of the disease within 6 to 10 days of its first appearance.

"Producers don't always realize their losses."

Diagnosing the disease with complete accuracy involves extensive laboratory tests. Producers with lambs that die after suffering severe diarrhea and weight loss could contribute to the research effort by bringing the carcasses to OSU's Veterinary Diagnostic Laboratory for analysis as soon as possible after death, or contacting APHIS, says Zimmerman.

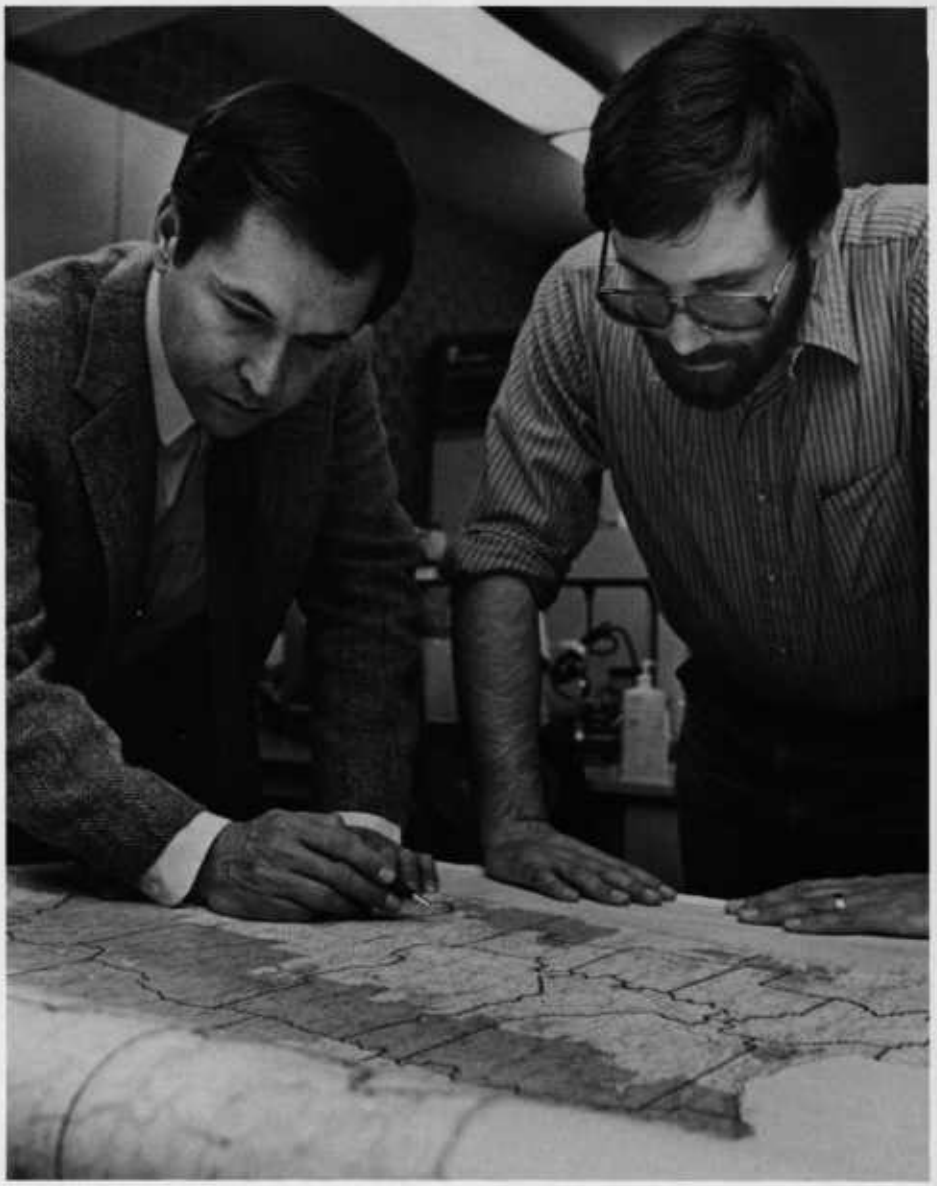
Controlling the parasite is difficult. Drugs have been used in Western Europe with varying success. Rotating pastures between sheep and cattle and leaving pastures vacant for a period, or tilling and reseeding them, are other tactics. But cattle have proved to be hosts for *N. battus* and, because the larvae can live for long periods of time, leaving a pasture vacant or tilling and reseeding it may not be as useful as previously thought.

So far, not too many sheep producers are losing sleep over the parasite, according to Zimmerman.

"Where *N. battus* has been found, the producers are concerned," he says. "But most people have to see a disease to be concerned. Sheep people and some veterinarians are saying, 'What's the problem. We don't see it.'"

But that's a typical attitude toward parasites, he adds.

"Parasites act differently than other disease organisms. They don't spread quickly like bacteria and viruses. It can take years. Producers don't always realize their losses because the damage is done slowly and they don't recognize the problem."



Veterinary researchers Gary Zimmerman, left, and Eric Hoberg

Better safe than sorry is Zimmerman's and Hoberg's attitude toward potential problems with *N. battus*.

Oregon sheep producers have more than 500,000 animals with a production value of more than $12 million a year and a replacement value of about $26 million. The OSU researchers have been busy in the last year telling the sheep industry and fellow researchers and veterinarians around the country about *N. battus*.

"This could be like the old thing of the guy falling out the window of a skyscraper," says Zimmerman. "At the 75th floor he thinks, no problem. Same thing at the 25th floor. *N. battus* could be building up out there in our pastures. Eventually, it could have a high economic impact."

Then again, its life cycle in this country may prevent disease, he adds.

"It's still entirely possible this parasite may not cause problems because environmental conditions don't allow high enough levels at the right time of the year (lambing time). We just don't know."

—Andy Duncan

CISCA'S TOO BUSY FOR SHOP TALK

Twenty years ago, if you had told Machteld, who lived in a suburb of the city of Utrecht in The Netherlands, she'd marry a guy from Southeast Asia, become a college professor, and live in a place called Oregon in the United States of America, she might have grinned politely. She also would have questioned your sanity.

No telling what reaction you'd have gotten from Dave, who lived in the bustling metropolis of Taipei in the Republic of China (Taiwan), if you had filled him in on his future with a girl from Holland. He did not develop his friendly, aggressive personality the day before yesterday.

But fate doesn't care about maps, so meet the Moks of OSU's horticulture department—partners in research and in life.

Today their daughter, Cisca, is probably one of the few 12-year-olds in Corvallis who sits around the dinner table listening to mom and dad discuss "protoplast fusion" and "interspecies crosses." She should be glad they do it in English and not their native languages, Dutch and Mandarin Chinese.

"Actually, she really doesn't hear many business conversations," says Dave Mok when asked about the perils Cisca faces being the daughter of Ph.D's who do research in such a rarified field as plant genetics. "We talk about science, but usually after she goes to bed."

Also, he adds, Cisca is too busy with her studies and a time-consuming hobby, tennis (she's the top-seeded player in her age group on the Northwest juniors circuit), to pay much attention to his and Machteld's shop talk.

As for the meals on the Moks' dinner table, they're usually not what you'd call full course, agree Dave and Machteld, who share cooking duties. "We eat out a lot," they add.

"We got into this lifestyle so early in life ... I guess we don't know any other way," says Dave. "It's kind of intriguing when I stop to think about it. If Machteld is away for three weeks at a scientific meeting in Europe, Cisca and I just carry on. But if another wife in the neighborhood is sick for two or three days, we'll all chip in to feed the poor guy."

To Dave, "getting into this lifestyle early" means about 15 years ago at the University of Wisconsin in Madison. He and Machteld were doctoral students. They met, romantically speaking, in a parking lot.

"We knew each other," he says, "but her lab was in the basement and mine was on the third floor. The first two years, we never said more than hello to each other." A chance parking lot meeting led to a dinner date —and marriage, Francisca and a move to Corvallis after they finished their degrees in 1975.

Actually, Dave went to Corvallis first.

"We had talked it over. We could either get postdoctoral positions together in someone else's lab, or we could go wherever one of us got a regular teaching and research position," says Machteld. "But when we finished the postdoctoral research positions, we'd be right back in the same situation. Dave was almost a year ahead of me. He finished his degree first. So when he got the offer (for a regular position) at OSU we decided he should take it."

Cisca (left), Machteld and David Mok

Dave went ahead to Oregon. Machteld and Cisca stayed in Wisconsin a few months while Machteld completed her doctorate. But not having a job in Corvallis didn't slow the soft-spoken, but determined, Machteld when she did arrive.

"I started doing research and publishing and after about a year Dave and I started writing research proposals together," she says.

Some were funded. Today, besides working on research projects with Dave, she has her own projects and teaches part-time in the horticulture department.

Problems? Not from the Moks' perspective. How about from the point of view of the university, which has a number of husband-wife combinations (including another one in OSU's horticulture department, although those spouses work in different departmental areas)?

"I can only discuss our situation," says C. J. "Bud" Weiser, head of the horticulture department. "We realized it could be a sticky situation having a wife and husband doing research together. You could imagine all kinds of chances for friction if they voted as a block on issues, if one served on a committee evaluating the other's research, and so on.

"But it's worked beautifully because of the individuals," adds Weiser. "They have different personalities and divergent opinions on some things, and they express them."

— Mark Bakken

Mark Bakken is an OSU senior majoring in technical journalism.

Our Split View of Police Protection. (See page 14.)

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