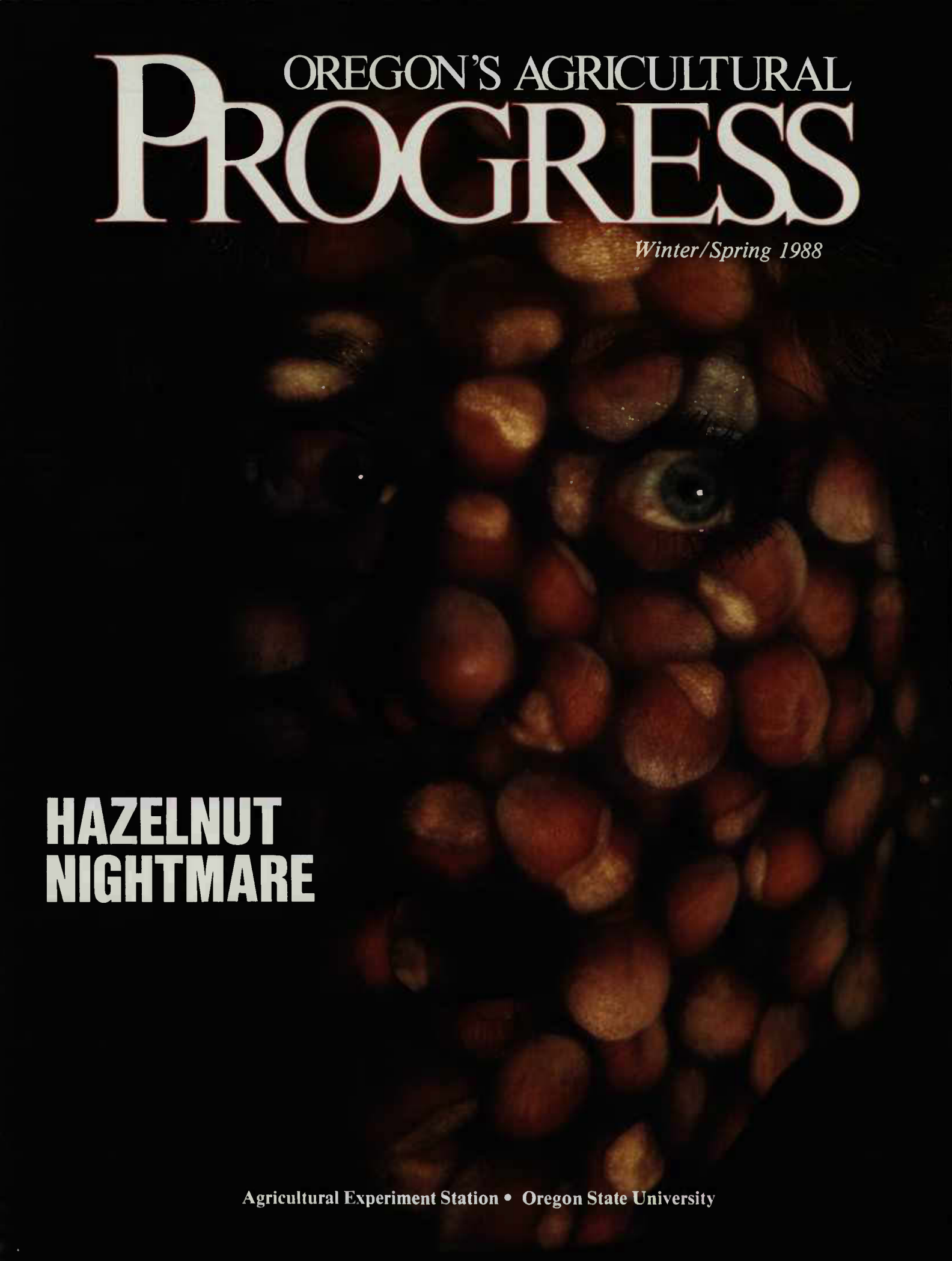
OREGON'S AGRICULTURAL

PROGRESS

Winter/Spring 1988



HAZELNUT NIGHTMARE

Agricultural Experiment Station • Oregon State University

THE EDITOR'S NOTE

Spring, that magic time of renewal when my thoughts turn to...slug patrol.

Years ago, when we moved to Oregon, I decided I wasn't going to do anything when the slimy creatures came out of various nooks and crannies after dark to dine in our garden. We're on this planet together. Live and let live and all that, I figured.

What gluttons *they* turned out to be.

I really didn't want to hurt them. But I felt I had to do something. We wanted a few nice tomatoes. I tried burying cans full of beer. Someone said the beer would attract the slugs and their snail relatives and they'd fall in and drown, victims of their own ravenous desires. A few did drown, smaller ones that could get through the cans' three-inch tops. Overall, the beer traps were about as effective as the Maginot Line in World War II.

Escalation. I put a ring of a powder that looked like sawdust, and was supposed to kill slugs, around our tiny garden. It was a better defense, but a lot of them slipped through. They still seemed to be ruining the garden. And the thought of that powder seeping through the soil into our tomatoes tortured me, though I didn't know for sure if that was possible.

Something finally snapped. I grabbed a trusty old Little League bat and, night after night, just before I went to bed, took a solemn walk to the garden. It was slug versus Louisville slugger. I took to patrolling other parts of the backyard, too.

I don't know much about their lifecycles or reproduction. But I do know that for the rest of that summer, and the next year, and for several years thereafter, I had to contend with guilt, but very few slugs.

What's the point?

Nothing other than that scientists who study insects, entomologists, are crawling all over this issue. Reading the stories about how some of them are battling bugs and worms they consider pests started me thinking about my moment of truth with the slugs.

Journalism student Cindy Holland's feature article is about an approach a bit more sophisticated than swinging a baseball bat—using computers to control the corn earworm. In the "Update" section, entomologist Bill Stephen explains how bees in California threaten Oregon's alfalfa seed industry.

Portland writer Louise Mastrantonio describes research intended to help filbert growers with a disease that is killing trees. A fungus, not an insect, causes filbert blight. But it *sounds* like something an entomologist would work on.

Dave Stauth of the OSU's Department of Information tells us about two insects humans have promoted to hero status—a worm and a beetle that feed on the poisonous weed tansy ragwort and may be eating themselves out of a job.

There's also an article about an economic study of Oregon's controversial fur trapping industry. Keeping down the numbers of wild animals that can cause damage in agriculture, forestry and other areas is an important function of the fur trapping industry, two researchers assert. But others, who oppose fur trapping, don't see it that way. They say trapping animals so you can sell their pelts should be viewed separately from trapping to control damage.

How do we make the right choices in this world of fierce competition for resources, and a delicate natural balance? Each new generation of slugs starts me wondering about ut that.

Andy Duncan

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Cover: Eastern filbert blight is a nightmare for Oregon growers, who produce 98 percent of U.S. hazelnuts. See story, page 6. (Photo by Dave King.)

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BEE TO SNATCH ALFALFA CROP?

Don't look now, but invaders could snatch the Northwest's $100-million-a-year alfalfa seed industry.

The threat comes from an aggressive new bee species found in Northern California.

If the bee crosses the mountains into Eastern Oregon, Washington and Idaho, it will compete with the leaf cutter bee that pollinates alfalfa, says Bill Stephen, OSU entomologist. The California bees, indifferent to pollinating alfalfa, quickly would displace leaf cutter bees and leave the alfalfa industry without an effective source of pollinators, according to Stephen.

Alfalfa seed growers already are troubled by a fungal disease called chalk brood that has been killing leaf cutter bees in recent years. OSU scientists are racing the clock to solve both the invader bee and chalk brood problems before they cripple the industry.

"If some of those new bees reach Oregon, the alfalfa seed industry would be left high and dry," said Stephen, who is leading the research effort. "But it's inevitable that some of the new species will eventually cross the mountains, even though the Sierra Nevadas, Siskiyous and Cascade Range form a pretty good barrier. If we're going to solve this problem, speed is of the essence."

An educational effort among beekeepers, alfalfa seed growers, Extension agents and the public is going to help to deal with the problem, and quarantines are being considered, Stephen says.

One incident was narrowly averted last year when a Canadian beekeeper planned to import some of the new species from Northern California to Idaho, not realizing they could cause trouble for farmers. The Idaho and Nevada Seed Commissions paid the man for his financial losses on the bees, arranging for them to be kept in California for research purposes.

The leaf cutter bee

Trouble with the chalk brood disease started about 10 years ago. Bee larvae that eat spores of the fungus die, and bee populations can drop by 40-80 percent.

"The problem with the fungus became so severe that the federal government is now funding specific research on it, about $100,000 a year since 1980," Stephen says. "We now know a lot more about how it works than we did, but I'm not sure we're a lot closer to a solution for alfalfa growers."

Stephen was studying the disease in Northern California in 1985 when he discovered the new, aggressive bee species. The species, *Megachile apicalis,* is a close relative of the leaf cutter bee, *Megachile rotundata.* Its ancestors probably were imported from Europe in a small colony but then changed, becoming far more aggressive, says Stephen. It literally drives the leaf cutter bee out of choice nesting sites, he says.

OSU researchers believe an unusual genetic process called a "founder event" helped create the new species. That is when a small group of bees interbreed, causing new genetic recombinations.

Now OSU researchers are trying to use these novel genetic recombinations in a crash bee breeding research program. The goal is to develop a new bee that has the desired characteristics, including being aggressive enough to compete with the California bee, being an alfalfa pollinator, and resisting disease better.

One reason the alfalfa seed industry boomed in the Pacific Northwest in the 1960s was Stephen's discovery of the pollinating abilities of the leaf cutter bee. Many other bee species, such as honey bees, do not prefer to pollinate alfalfa. He discovered leaf cutter bees while working in an alfalfa field in Idaho's Snake River Valley in 1959.

SNAG THAT TUNE

If Oregon wants the hills to come alive with the sound of songbirds, it needs more snags.

Harvest practices that leave a modest number of dead, broken or dying trees in the forest could have a dramatic impact on the population of wild birds, according to an OSU study.

The study suggests that leaving existing snags during the clearcut process can increase bird diversity and density by about 30 percent and help some birds that are considered rare.

The cost of this approach would not be very high, the scientists say, and is small compared to recent attempts to create snags by blowing the tops off second-growth trees.

Graduate student Barry Schreiber and Dave de Calesta, Extension specialist and reseacher in the Departments of Fisheries and Wildlife and Forest Science, did the research in the Siuslaw National Forest in the Oregon Coast Range. The researchers hope the study's implication will be considered in forest management on both public and private land.

"The type of birds that nest in cavities of dead or dying trees must have a certain type of habitat," de Calesta said. "The best way to accommodate their needs is by leaving a few snags when older timber is clearcut, usually in old-growth or burned-over areas. Now, the younger, second growth forests have almost no snags."

If this is done, said de Calesta, a good variety of wild birds can flourish. They

include the northern flicker, violet-green swallow, tree swallow, hairy woodpecker, house wren and western bluebird. The latter two are considered rare in the Coast Range.

In the past, a perception has been that snags posed a danger to forestry workers, de Calesta said. But evidence suggests most injuries are caused by trying to remove them, he said. Tall snags might pose a problem for helicopters used to dispense herbicides, he said, "but the study showed that snags as short as 20 feet are adequate for bird nesting."

A growing appreciation for the value of snags has led some forest managers in second-growth forests to blow the tops off trees with dynamite. This process can cost up to $160-$200 a tree, de Calesta said.

The research indicates that leaving 6-8 snags of the adequate height and diameter per acre in older forests would have the desired benefits for bird populations. The extra birds might help reduce problems with insect infestations, the researchers noted.

THEIR VIEW IS IMPORTANT

We all know them, people only able to see things one way—theirs.

Usually they're unpopular, because the ability to take another person's point of view, what social scientists call "perspective taking," figures a great deal in popularity.

Recent OSU research reflects the critical role this ability plays in the lives of children and adults, and how children learn the skill from their parents.

"People are socially better adjusted because of the ability to take the perspective of others," says David Andrews, head of the human development and family studies department of the OSU College of Home Economics. Good perspective takers are better able to interact with others, he explains.

In learning to take another person's point of view, children do as their parents do, not as they say, the OSU studies showed.

"It's partially the parents' own ability to be good perspective takers that guides development of the skill in children," says Andrews. "We typically assume adults are all equally good in this aspect but we have found some very successful adults who are not good perspective takers, and it's affecting their relationships."

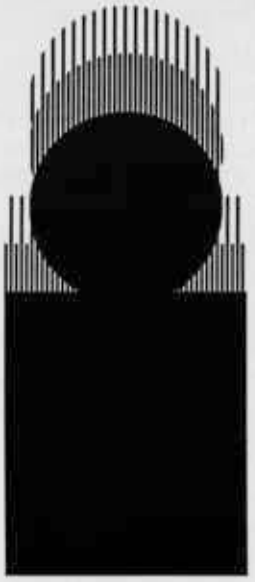
Andrews and associates Ed Long and Cindee Bailey assessed perspective taking with several studies of parents and their children, focusing on pictures, puppies and other aspects of their environment.

Andrews and Long studied perspective taking within the marriage relationship. Using married parents of OSU students, they found partners were more satisfied with their relationship, and less likely to have thought about ending the marriage, if they had partners who were good perspective takers.

The match between the partners' abilities may be crucial, the researchers found.

"If both partners aren't good perspective takers, the expectation isn't there and it doesn't make a big difference. If one person is good at it and the other isn't, however, it affects the satisfaction of the good perspective taker in the relationship," says Andrews. Also, if one partner perceives the other to have perception-taking skills and feels those aren't being used, it can hurt the relationship, he adds.

Poor perspective takers "need to expose their children to a wider circle of people to see other role models" to help foster better social adjustment, Andrews says.



NEW PEPPERS

"Marbles" and "Riot," new pepper varieties released by the Agricultural Experiment Station, are supposed to look good. But "Riot" also will warm up your mouth if you chomp into it, says OSU vegetable breeder Jim Baggett.

The dwarf ornamental varieties are the kind of peppers used primarily to spruce up the appearance of home gardens, and in homes as dried decorations. But both are edible. "Marbles" is not pungent, while "Riot" can be used as a hot flavoring pepper. It tastes somewhat like a cayenne or small chili pepper, according to Baggett.

The breeding work on the varieties took him about 10 years, said Baggett, who continually has experimental breeding lines of vegetables in various stages of development.

"We're getting requests for seed from seed companies and commercial bedding plant growers," he said, "and we have samples of seed available to home gardeners for trial upon request."

Marbles bears abundant small cherry-shaped fruit on a plant about 6-8 inches tall and 12-16 inches wide. The fruits of Riot are long and conical. The plant is 6-8 inches tall and 10-12 inches wide.

The fruits of both ornamental peppers begin to develop red color in late August in western Oregon. From that time, they show a mixture of ivory and purple, with intensifying shades of orange to bright red. Both provide a display of color until the first frost arrives.

Tree breeding research may help growers deal with a ghastly foe

HAZELNUT HORROR

BY J. LOUISE MASTRANTONIO

Shawn Mehlenbacher examines the dead branches of a hazelnut tree. To him, the sunken area and small bumps erupting at random along the twig mean just one thing: eastern filbert blight.

It's a fungal disease that threatens to destroy Oregon's booming hazelnut business—a $45 million industry that produces more than 98 percent of the hazelnuts grown in the United States.

Mehlenbacher is a plant breeder in OSU's horticulture department. He came to Oregon in the fall of 1986 from New Jersey, where he had worked with fruit trees. "A week after I got here, filbert blight was found in an orchard near Damascus," he recalls. "All hell broke loose."

It was the first time the blight had been found in Oregon. Until then, it had been known on the West Coast only in a few orchards in southwest Washington. Last year, three more infection centers were found in Oregon and orchardists are concerned that the fungus, which spreads by wind and splashing rain, may have a firm foothold in the Willamette Valley, where rich soil and mild weather make for perfect growing conditions.

"Everyone who works on this problem recognizes that it's here to stay," Mehlenbacher says. "Like it or not, we're going to have to learn to live with this disease."

Although many fungal diseases are easy to control, the filbert blight is not. Like chestnut blight and Dutch elm disease, eastern filbert blight is systemic. Spores of the fungus enter the tree, most likely through diseased buds, and spread to the trunk, eventually killing the tree.

Once an infection has been detected in an orchard, it's a continual battle for growers. Treatment includes application of fungicides, pruning out infected branches, and, finally, dehorning—a drastic pruning that takes all but five or six feet of the trunk and eliminates nut production for several years. But these are stopgap measures, not cures. The long-term solution lies in genetics.

"The world's entire production is based on selections out of the wild."

That's where Mehlenbacher comes in. The potential for solving the blight problem and for improving the quality of the hazelnut crop is almost unlimited, he believes, because so little breeding work has been done. OSU's program is small but still the largest such effort in the world.

"We're fifty years behind other agricultural crops," Mehlenbacher says. "The world's entire production is based on selections out of the wild." To emphasize the point, he goes down a list of the major hazelnut growers, offering terse commentary:

—Turkey produces 65 percent of the world's hazelnuts with two varieties, Tombul (round) and Sivri (long). "All selections out of the wild," he says.

—Italy, 23 percent. Tondo (meaning round) Gentile delle Langhe, Tonda Romana, and Tonda di Giffoni. "All selections out of the wild."

—Spain, 5 percent. "Almost all of the acreage is devoted to Negret. Again, selections out of the wild."

—United States, 3 percent. "Major cultivar Barcelona, out of Barcelona, Spain. Again, just selections out of the wild as far as we know."

Several varieties are grown in Oregon, with Barcelona being the principal one. It usually is interplanted with Daviana (every third tree in every third row) as a pollinizer. Barcelona is susceptible to eastern filbert blight, but not as susceptible as Daviana or Ennis, another variety that has been planted heavily in recent years.

OSU's breeding program started in the late 1960s under the direction of horticulturist Maxine Thompson, now retired. The goal was to improve the quality of Oregon's hazelnut crop for the kernel market. Most of the world's supply is used in candy, cookies and other prepared foods. "What sells best for that market is nice, white, round kernels," Mehlenbacher says, pointing to some Turkish hazelnuts that look more like macadamia nuts.

The dark brown, large, round nuts of Barcelona are attractive and market well in the shell. But there are a lot of problems with Barcelona for the kernel

Right: A hazelnut tree in an experimental OSU orchard has bags over its branches to keep it from pollinating nearby trees.

AL HOLLISTER

JEFF STONE

CRAIG RIGGERT

Left: The telltale bumps, or pustules, on a tree infected with eastern filbert blight. Right: Plant pathologist Jeff Stone collects twigs from an infected orchard east of Portland.

HAZELNUT HISTORY

Since about 1981, Oregon growers have been using the name hazelnut for a small round nut produced in great quantities in the state. But before that they called them filberts.

"Filbert is a British term," says Maxine Thompson, retired OSU horticulturist, who started the hazelnut tree breeding program at OSU in the late 1960s.

Thompson says that, as she's heard it explained, Oregon growers in the later part of the 19th century thought using the term filbert for their product would make it sound more cultured and distinguish it from wild hazelnuts.

In 1981, the marketing unit that represents the industry decided using the name hazelnut for their product would make things easier because the nuts are called hazelnuts in other states and countries.

Eastern filbert blight has been a problem in the eastern United States for many years. The disease afflicts native hazelnut trees there. But those wild trees are somewhat tolerant of, if not resistant to, the fungus.

But in the 1920s and 1930s, people tried to start a hazelnut industry in New York by bringing in cultivated European trees. Filbert blight destroyed the trees.

For decades, there was a quarantine on bringing eastern hazelnut trees to the western United States. The aim was to keep the blight east of the Rockies. But in the early 1970s, OSU horticulturist Harry Lagerstedt, now retired, discovered eastern filbert blight in southwestern Washington.

Lagerstedt and Ron Cameron, an OSU professor of botany and plant pathology also retired now, began looking for other infected areas and studying the disease.

"Oregon hazelnut growers recognized the problem. Hazelnut orchards in southwestern Washington were devastated quickly. But when it jumped the Columbia River and showed up in Oregon in 1986 they really started to get worried," says Jeff Stone, an OSU plant pathologist and fungus expert who is studying filbert blight.

Stone has overcome earlier problems researchers had in getting the fungus to grow in the laboratory and has several goals.

"One is to find out why it didn't grow in culture easily. Maybe that will tell us something about what kind of things we can throw at it," he says.

He also is developing methods of inoculating young filbert trees with laboratory cultures and is studying the fungus's lifecycle to try and learn more about how it infects hazelnut trees.

The Oregon Department of Agriculture is leading efforts to survey the state to identify areas of infection and to contain the disease by telling growers how to use pruning and copper sprays to control it, Stone says. Others, such as Craig Riggert, an agent in the OSU Extension Service's Washington County office, also are transmitting research findings to hazelnut growers and are collecting field information about the disease that is helpful to OSU researchers.

"The long-term solution is definitely going to have to be resistant trees," says Stone. "There is the possibility of short-term control with sprays. But the possibility of eradication is nil. It doesn't attack native Northwest hazelnut trees. But there are too many escaped European trees that can be reservoirs or hiding places for it. It's in the Northwest forever."

market, Mehlenbacher says. He mentions thick shells that are hard to crack, a fibrous kernel, and a high proportion of blanks and moldy kernels.

Mehlenbacher, whose work is partially funded by the Oregon Filbert Commission, plans to change that. His goal is to develop varieties that:

—Resist eastern filbert blight, a high priority now that the disease has been found in Oregon.

—Are high-yielding, bear young, and drop their nuts before the fall rain starts.

—Resist big bug mite, an insect that causes "blasted" buds, reduces yield, and may provide an entryway for spores of the filbert blight.

—Have nuts with thin shells and a high percentage of kernels.

—Have short husks so nuts fall to the ground and can be harvested by machine.

—Have few defects such as mold, empty shells and twin kernels.

"It's like a magnet for the blight."

Any one of these qualities may be achieved rather easily, according to Mehlenbacher, but getting all of them is more difficult. Fortunately, the work of crossing varieties, growing the hybrids and selecting the best for continued experimentation has been going on long enough that results are already beginning to come in. One hybrid, Montebello x Compton (also called OSU 43-58), is considerably better than Barcelona, says Mehlenbacher. He is distributing scionwood, the grafting material trees are reproduced from, to commercial nurseries. Growers should be able to buy young trees within three years, he says.

AL HOLLISTER

AL HOLLISTER

Top: Plant breeder Shawn Mehlenbacher between rows of experimental hazelnut trees. Above: Mehlenbacher evaluates nuts from the experimental trees.

The variety is the first released from the OSU breeding program. It should have better yields than Barcelona, thinner shells, and fewer defective kernels. Also, the fibrous inner husk comes off readily when the nut is roasted, a plus for the kernel market.

A high priority now is finding a replacement for the tree used for pollination, Daviana. "When an orchard comes down with blight," Mehlenbacher explains, "it's Daviana that shows it first. It's like a magnet for the blight." There are several candidates, all the result of crosses with a hazelnut variety called Gasaway.

"Gasaway is small, ugly, torpedo-shaped—all the things we don't want in a nut," says Mehlenbacher. "You can hold the entire yield of a large tree in your hands," a pitifully small amount compared to the 25 pounds growers usually get from a Barcelona tree.

Gasaway would hold little interest for breeders except for one thing, it's immunity to eastern filbert blight. That characteristic was noticed in an orchard of primarily Du Chilly, another filbert variety, in Washington state. The Du Chilly trees were dead but the Gasaways "were big, vigorous, green, and free of blight," Mehlenbacher says. He expects to have a pollinizer to replace Daviana in about three years.

Finding a replacement for Barcelona will be a tougher nut to crack. It may take 20 years to breed a tree that has all the desired crop characteristics and also is resistant to eastern filbert blight. Prime candidates for further breeding work are the Montebello x Compton variety OSU is releasing, and Gasaway. Other potential candidates are the wild East Coast hazelnut tree, *Corylus Americana,* and the wild West Coast hazelnut tree, *Corylus cornuta Californica.*

Breeding from either of the wild native varieties would be a slow process.

"When you start with a wild species, you're starting with junk," says Mehlenbacher. "It takes several generations to get all the desired traits." But he has plenty of patience to go with his optimism, and those seem to be traits inherent in a good plant breeder.

Louise Mastrantonio is a free-lance writer based in Portland, Oregon.

DAVE KING

BY CYNTHIA HOLLAND

GUESS WHO'S COMING TO DINNER?

OSU scientists plan to give farmers some expert help when an unwelcomed visitor returns

Really the worm is innocent, just doing what comes naturally. It hatches on the thin, silky strands at the top of an ear of corn waving in a field of green stalks. Hungry, it starts eating the silk and eventually reaches the husk, slips inside, and discovers the tasty kernels at the top of the cob.

Some time later, you pull over to a roadside stand to buy corn-on-the-cob for dinner. You pull the husk back for inspection and, yuck—an unexpected diner wriggling on a patch of bare cob. You check another ear. Same thing. Back to the car. No corn tonight. Familiar?

The corn earworm is only 1½ inches long, but it's caused big problems in the Oregon corn industry. Enough, in fact, so that OSU researchers are developing a computer tool to help growers control the pest, which can make corn unusable for canneries and unsavory to discerning consumers of fresh corn.

In the past, the Willamette Valley was considered to be tucked in a pocket where there were minimal corn pest infestations, according to Leonard Coop, a post-doctoral research associate in OSU's entomology department who is studying the corn earworm.

In 1985, the corn earworm caused serious problems for Willamette Valley canneries.

But in 1985 a corn earworm infestation in the Valley created severe problems for Oregon canneries, whose top corn products these days are the packages of frozen ears you see in grocery store freezer cases.

Now OSU researchers are programming the knowledge and intuition of an expert into a computer system to help farmers combat the damaging effects of this insect, explains a researcher working with Coop, OSU entomology professor Brian Croft.

"It always must have the human brain at the other end."

The "expert system" will combine information about a particular farmer's corn crop, and field location, and offer advice valuable in making decisions. These decisions may involve the use of fertilizers, pesticides, water or other ways of dealing with pests.

Computer expert systems do not make decisions for farmers. They are just another source farmers can use to help them make decisions.

"We call these expert systems decision makers, but they really aren't. They are decision assists," Croft points out. "It always must have the human brain at the other end to interpret them. The end decision is

always going to be made by the human brain."

Of course the tiny corn earworm doesn't much care about all those fine points of scientific interpretation. It doesn't care much for scientists either, apparently, having viciously attacked the hands of researchers who disturbed its activities. The worm has clamped hard onto fingernails. If it can get to a soft area of skin, it can draw blood, Coop says.

Corn earworms, which frequently show up in backyard gardens, are sometimes cannibalistic. In a small field, it's not uncommon to find three on a single ear of corn. Larger earworm larvae often turn against each other.

"Earworm moths fly hundreds if not thousands of miles."

The earworm is a sporadic and unpredictable insect. Although the pest seems to follow a cyclical pattern, researchers haven't found the set of conditions that may stimulate an outbreak.

Two to three generations of larvae hatch in one growing season. The first of these generations may have spent the winter as pupae in cocoons buried two to four inches in the soil. During this stage, the earworm has no appendages or mouth but does have the ability to spin silk.

Researchers believe very few corn earworms, if any, survive this stage in western Oregon. The state's cool, wet winters and heavy soil make it almost impossible for the worms to emerge from the ground in late spring. The survival rate may be as low as .001 percent, according to Coop.

Many of the earworms that cause damage in Oregon are thought to be immigrants.

"Earworm moths fly hundreds if not thousands of miles," Coop said, "Studying their migration is expensive and difficult."

In August, mature, nondescript, brown corn earworm moths lay their eggs on the silk of ears of corn. Within five to six days, larvae hatch and begin to feed on the soft silk, interrupting their feeding orgy several times to shed layers of skin.

Within one to two weeks, the worm tunnels down to the sweet kernels on the cob. If it eats 2½ inches down an ear, the ear may not be suitable for high-grade uses in canneries.

Canneries must chop damaged ends off the cobs to make them suitable for the frozen corn-on-the-cob market. The kernels on some of these ends may be processed as canned corn, but the canneries lose money when some of the damaged ears must be sold as silage at a much lower price .

It's hard to determine the exact losses the corn earworm causes because canneries classify the damage differently. Sometimes, a cannery may penalize the grower directly, or it may classify the damage with bird damages.

DAVE KING

Earworms frequently feed on the corn in backyard gardens.

Corn earworm damage decreased in the years following the peak infestation period in Oregon in 1985. Last year, the worm caused minimal damage.

"Though we are on a downward trend, it is still something we have to deal with," Coop cautions, however.

The computer approach to dealing with pests isn't new, just different, Croft notes. In the past, researchers used computer models to help answer farmer's questions. But these models weren't user-friendly, as computer people put it.

They flutter around the trap looking for a female.

"The problem with models is that they were too rigid and did not allow for some of those close-call decisions," Croft explains.

"The expert systems program provides a more user-friendly interface. Finally, we can pass on knowledge gained from research to the farmer," Coop adds.

The expert system computer program gives the user the logic the expert used to make a decision. The system is scientifically oriented, based on the best research available; however, in some cases, an expert's decisions are made intuitively, based on sound judgement and experience.

Croft compared this to the process a mechanic uses when diagnosing a problem with a car. The mechanic would go through a series of steps to discover why the car doesn't run. He uses his past experience with cars to recommend the procedure necessary to remedy the problem. The same process can be applied to agriculture.

"Ninety percent of the time an expert system brings in science to bear in solving the problem; ten percent is dealing with those decisions where there is no scientific information and no basis in science, so we must rely upon judgement," Croft said.

An expert system program can be played as a game to find a management strategy right for a particular set of field conditions.

Because no two corn fields are alike, the expert system combines computer models, data bases and the history of that particular crop to develop a procedure the farmer can use to solve problems.

One method of collecting valuable information for the expert system involves moth traps. The traps use a female sexual attractant called a pheromone to lure male corn earworm moths.

The trap is a double-cone shaped web that is designed to release the pheromone attractant from a small rubber capsule that hangs at the base of the trap. When male moths pick up the scent, they flutter around the trap searching for a female corn earworm

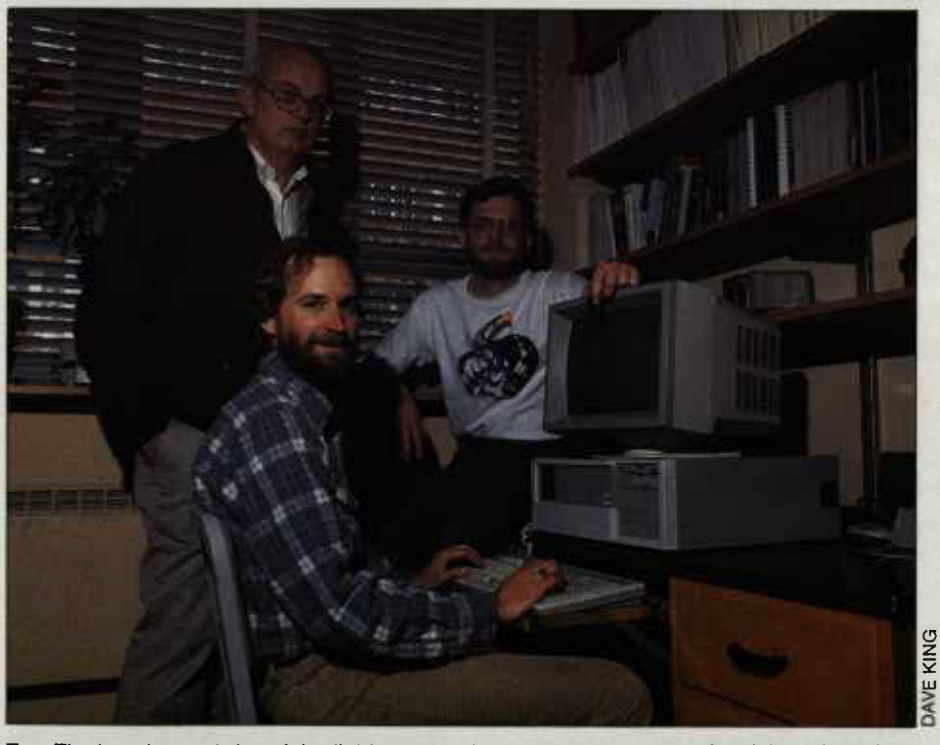
moth. The males fly up into the webbed cone's wide opening. Once trapped in the first cone, the male's behavior is to continue flying upward, eventually becoming trapped in the upper chamber of the second cone.

When field personnel check the trap, they are able to estimate infestation ratios in the area. The geographic location of the field, the planting date of the corn, and the size of the field are other variables the farmer supplies to the expert system.

The heart of the expert system is actually a pair of development models—one for the corn and the other for the earworm. The system combines the models to provide a "profile" of projected damage at harvest. The expert system provides various alternatives for dealing with the situation, including simply doing nothing if that is the most economical strategy.

Despite low populations of the worm in the Willamette Valley last year, Coop and other researchers plan to keep on studying life patterns of the pest to find a way to minimize future infestations.

DAVE KING



DAVE KING

Top: The location and size of the field and planting date are examples of variables that will go into the computer expert system for corn earworm control. Above: OSU entomology researchers Leonard Coop (seated), Brian Croft (standing, left), and Ray Drapek.

The program will be distributed to Extension offices.

"We can still study through the low years. They are still here and we can still collect data and run a successful program in spite of the fact of the reduced problems," Coop said. "The key to predicting the seriousness of the seasons is understanding the forces that affect immigration, like weather patterns."

Research suggests that corn earworms may follow certain weather fronts. But researchers don't have enough data to fully understand the reasons behind this.

By the end of this year, Croft said, a prototype of the corn earworm expert system will be available for further testing. But it will take awhile before it will be available for farmers' home use.

Initially, primary users of the expert system will be Extension Service specialists and agents, who work with farmers, he said. The program will be distributed to Extension offices so it can be tested this coming growing season. Extension personnel will be able to contribute to the research process by voicing likes and dislikes and suggesting revisions.

One concern Coop has is how growers will respond to the expert system. The corn earworm has not been a major factor the last two growing seasons.

"Are they going to say the problem went away, so we don't need to do any more research? We'll wait until it flairs up again, which may be next year or may be five more years?"

One thing he knows for sure, Coop says, is that "it will come back."

Cynthia Holland is an OSU journalism student.

Two economists contend that fur sales are a minor part of the trapping industry's impact

THE VALUE OF A CONTROVERSY

Before agriculture, before anyone had sunk a plow in Oregon soil, harvesting and selling pelts was an industry here. When the settlers started arriving in the 1830s, they trapped for pelts too, but also for another reason: to keep wild animals from attacking their livestock and crops.

Trapping is still valued highly by some. It is one of the ways some Oregon farmers and ranchers protect crops and livestock. Others, such as foresters planting trees, use trapping for similar reasons, and there is still a fur industry. But today many animal rights groups oppose trapping, or at least many uses of it. They see trapping wild animals for fur that will go into humans' coats and other goods as cruel and unjustifiable, particularly the use of powerful leg-hold traps that grip the creatures until they die or are killed or released. They also say there often are other ways of preventing wild creatures from causing damage.

They set out to examine the dollar value—not the morality.

Two researchers tip-toed into the economic corner of this swamp of controversy, the kind more than a few scientists might just as soon sidestep, recently when they set out to examine the dollar value—not the morality—of the fur trapping industry in Oregon.

"The fur trapping industry came to us. They wanted to pay for an economic study of trapping done by an independent source," says Carl O'Connor, OSU agricultural and resource economics professor. "I assume one reason they wanted to document the industry's value is the pressure being put on them by people who oppose trapping." O'Conner did the research with University of Arizona economist Russell Gum, who formerly worked at OSU.

His and Gum's finding?

The fur trapping industry has an economic impact of more than $16 million a year on the state, O'Connor and Gum estimate. In fur trapping, they included not only trapping done solely for fur sales but trapping done to control damages caused by wild animals (pelts from that usually are sold, too).

Income from pelts sales is a minor part of their $16 million estimate, explain O'Connor and Gum. The major items, they say, are values they estimated for increased damages and damage prevention costs they project would affect the agriculture, forestry and recreation (hunting) industries if there was a total ban on trapping.

O'Connor and Gum calculate that a complete ban on trapping would cost the agriculture industry about $3.5

Raccoons are among the fur-bearing animals of economic significance in Oregon. Some see the creatures as treasures, others as pests.

OREGON DEPARTMENT OF FISH AND WILDLIFE

million a year and the forestry industry more than $6 million a year, and that there would be a decrease in the value of recreational hunting opportunities in the state of about $7.3 million a year.

One of the economists readily acknowledges that some of the estimates in the study could as easily be labeled educated guesses as they could scientific projections.

"Obviously," says O'Connor, "many of these areas, such as the impact of trapping on recreation, are very, very difficult to capture."

The results of their study were published recently as Agricultural Experiment Station Special Report 812, "Economic Value of the Fur Trapping Industry in Oregon." Some highlights from the report:

Predators are the key to the estimated $7.3 million impact the study says a total ban on trapping would have on hunting. Coyotes, foxes and raccoons reduce the populations of game animals such as antelope, deer, waterfowl and upland game birds, and a trapping ban would magnify that, according to the study.

"The impact of these predators on game populations and the resultant impact of reduced game populations on numbers of hunters and the resultant recreational values is not well documented," states the report. "However, the fact that recreational hunting has economic value cannot be questioned."

Estimates in the study that link trapping to recreational hunting are based on the idea that hunters will spend more, and hunt more often, in areas with higher chances of success.

The value of livestock losses attributed to predators was more than $3 million.

"At the current time," says the report, "the state of the art in wildlife population modeling does not provide a clear indication of the magnitude of the link. Thus the relationship estimated was based on the professional judgment of wildlife and recreation managers."

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Three fur-bearing animals some consider to be pests: The beaver (left), the coyote (upper left), and the bobcat (upper right).

It is estimated, the report notes, that more than 350,000 Oregonians spend almost $150 million a year, or slightly less than $400 each, on hunting.

The mountain beaver is the key to the researcher's $6 million estimate of the impact a total trapping ban would have on the forestry industry. The stub-tailed rodent, which resembles an overgrown guinea pig and is only distantly related to dam-building beavers, damages Douglas-fir and other tree seedlings in Oregon coastal forests.

Standard forestry practice is to trap the rodents to reduce damages. Alternatives to that involve using poisons, or physical barriers such as tubing that protect the seedlings. Poisons recently registered for use in mountain beaver control have not yet proved to be effective, and the tubing costs between $100 and $250 per acre, compared to about $40 an acre for trapping. About 100,000 acres of forest land need protection, the report says.

Two kinds of trapping led to the $3.5 million estimate of the impact a total trapping ban would have on agriculture, says the report. One is trapping done specifically to reduce predator damage to livestock or furbearing animal damage to crops. The other is trapping done in agricultural areas for other reasons, such as pelt sales. That kind of trapping may help reduce excess populations of predators and other furbearing animals, the report says.

In 1985, the U.S. Fish and Wildlife Service's Animal Damage Control group reported that the value of livestock losses attributed to predators was more than $3 million, according to O'Connor and Gum. About 80 percent of the losses were lambs and calves.

Coyotes were thought to have caused 98.7 percent of the total agricultural losses. Examples of other problems include beavers damaging fruit trees and other trees, clogging irrigation systems and flooding croplands; nutria eating corn and wheat; muskrats and nutria weakening or destroying irrigation ditches and levees; and raccoons and nutria destroying sugar beet seed crops.

In addition, each year predators kill poultry, ducks, goats, pigs and other animals on small farms across the state and those losses usually aren't fully reported, the researchers say.

Clearly...for many Oregonians the main issue isn't money.

Another impact of the fur trapping industry is, of course, fur sales. Generally, the value of furs harvested each year in Oregon has been increasing since the early 1960s, when only $150,000 worth of pelts were harvested. The value in 1985 was $1.3 million for 77,000 pelts (figures used in the study).

The fur-bearing animals of most economic importance in the state are bobcat, raccoon, coyote, beaver, muskrat and nutria. The most significant trend in recent years, says the report, has been a decline in the economic importance of beaver pelts and an increase in the importance of bobcat pelts. In 1985, for example, trappers harvested bobcat pelts worth $622,000, compared to beaver pelts worth $137,800. Coyote ($199,800) and raccoon ($196,200) pelts also were worth more than beaver pelts.

Pelt prices vary widely. The general trend since the early 1960s has been an increase in prices to a 1980 peak. Then there was a decline and recent rebound. The decline in prices after 1980 led to a decline in the number of trappers.

In 1985, the state sold 3,716 furtaker licenses. Most of those individuals trap to supplement their income or for recreation, the researchers believe, although there are some full-time trappers.

After adding economic impacts, O'Connor and Gum did some subtracting. Banning trapping, they say, would save taxpayers a substantial part of the $1.3 million-a-year cost of government animal damage control programs, which also use tactics such as aerial gunning, poisoning and guard dog programs. The $1.3 million, a 1985 figure, includes funds from various federal agencies such as the U.S. Department of Agriculture's Animal and Plant Health Inspection Service and the U.S. Fish and Wildlife Service; state agencies such as the Oregon departments of Agriculture and Fish and Wildlife; private timber companies, and the governments of 25 participating Oregon counties.

The most-used method of trapping wild animals is leg-hold trapping. The 3,609 animals eliminated that way in 1985 accounted for 41.3 percent of the animals killed that year. Such damage control work employs the equivalent of about 38 full-time employees, the report says.

The researchers also developed estimates for what they think partial trapping bans would cost the state annually. They calculated that a 50 percent ban would cost about $8 million and a 10 percent reduction about $2 million.

Clearly, though, for many Oregonians the main issue isn't money. In 1980, a ballot measure asked Oregon voters if they wanted to eliminate the use of leg-hold traps, which some say subject animals to cruel, lingering deaths, and other trapping methods. The measure failed, but it generated considerable debate.

"We'd like to see commercial (fur) trapping eliminated. Our major objection is that it isn't selective. You don't know what you'll get," says Sara Vickerman, a Portland-based regional program director for the Defenders of Wildlife. "We see it as a last vestiage of market hunting. You can't shoot a deer and then sell the meat, or raid heron and egret nests for the feathers like they used to."

DAVE KING

Mink are trapped in Oregon. But the bulk of the furs sold come from animals raised commercially.

Ron Harder, state organizer for Fur Takers of America, has another viewpoint. He says fur trappers are harvesting a renewable resource and, while early trappers had no concept of wildlife management conservation, trappers today will not trap an area where wildlife populations appear to be suffering.

"My livelihood depends on a surplus," he says.

The Defenders of Wildlife's Vickerman looks at so-called damage control trapping differently than fur-trapping. With that, it's government support she objects to. "I have less of a problem with a rancher using a trap he bought to eliminate a predator," she says.

Vickerman says there are a range of alternatives to damage control trapping, such as using guard dogs extensively to protect livestock and drive predators like coyotes back to their natural diets of rabbits, mice and other rodents.

ANDY DUNCAN

ANDY DUNCAN

Top: The OSU researchers contend that predators reduce the population of game animals like deer, reducing the dollar impact of recreational hunting. Above: Agricultural economist Carl O'Connor.

"But the federal government spends an average of about $1 million a year in each western state for damage control programs that employ mostly trapping," she says, "and we have to scramble to get $100,000 for a guard dog program."

"We'd like to see government programs that favor non-lethal over lethal control methods," she says. "We'd like to see programs that say when you want to set a trap yourself, you pay. When you want to use a guard dog, the government pays."

"When lethal means are necessary," she adds, "we'd prefer that they emphasize selective techniques that kill the animal causing the damage and not techniques that reduce the general population."

"It isn't our position that there is one technique that will work in all situations," Vickerman emphasizes. "Most are site specific. We favor an integrated approach to pest damage that places a higher priority on techniques that prevent damage in the first place."

Dave de Calesta, a researcher and Extension specialist in OSU's fisheries and wildlife department who works in the controversial damage control area, also likes the integrated approach.

If non-lethal control methods aren't totally effective, then lethal methods may have to be used, says de Calesta. "Evaluate the situation. Look at the array of techniques available, their advantages, shortcomings and impacts on non-targeted animals," he says.

But money, not morality nor strategy, was the focus of O'Connor's and Gum's study. One thing is certain, they assert in their report: While there aren't "irrefutable scientific studies to document the exact magnitude" of trappings' impact on recreation, forestry and agriculture, "sound evidence exists which indicates that there is a relationship between trapping, agricultural damage, recreational hunting opportunities and forestry costs."

"Thus," they conclude, "while the exact magnitude of the economic impacts of trapping may be argued and is certainly worthy of further research, the basic policy conclusion is clear; trapping has benefits to economic interests in agriculture, recreation, and forestry which are of larger magnitude than the fur values."

—Cindy Holland and Andy Duncan

THE TANSY

BY DAVID STAUTH

On a small plot of land near Salem, a farmer is growing tansy ragwort. The man is growing this noxious weed on purpose. And he hasn't lost his mind. He's being paid to grow it by none other than the Oregon Department of Agriculture.

Not that long ago, there was no pressing need to cultivate tansy in Western Oregon. Billowing fields of it could be found waving in the wind on almost any roadside, and the poisonous weed was Public Enemy Number One for most livestock owners in the area. It threatened their forage crops, their livestock and their economic livelihood.

But times are changing in the tansy ragwort wars, and the strange-but-true situation near Salem is just one reflection of that. There is some evidence that the attack on the weed may have succeeded almost too well. With the latest techniques in "biological" weed control, the one-two punch of the cinnabar moth caterpillar and the ragwort flea beetle have eliminated more than 90 percent of the tansy in many areas.

Recent research suggests tansy can come back with a vengeance.

On one level, that's great. On another level, the bugs may be eating themselves into a near extinction, or such low populations that they may not be able to quickly control a resurgence of tansy ragwort from buried seed.

The tansy ragwort "nursery" near Salem is one symptom of the problem. In the past decade the level of tansy infestation in Western Oregon has steadily diminished. Because of that, the state's aggressive biological control program is now hard pressed to find enough flea beetles and in 1987 didn't have any cinnabar moths to distribute at all. The field of tansy near Salem is being used to nurture a good population of the beetles for spot inoculations in problem areas.

As battles continue against tansy, OSU scientists are trying to gain a larger perspective on the problem, and the entire field of biological weed control. They want to understand both this weed and the up-and-down life cycles of its natural enemies.

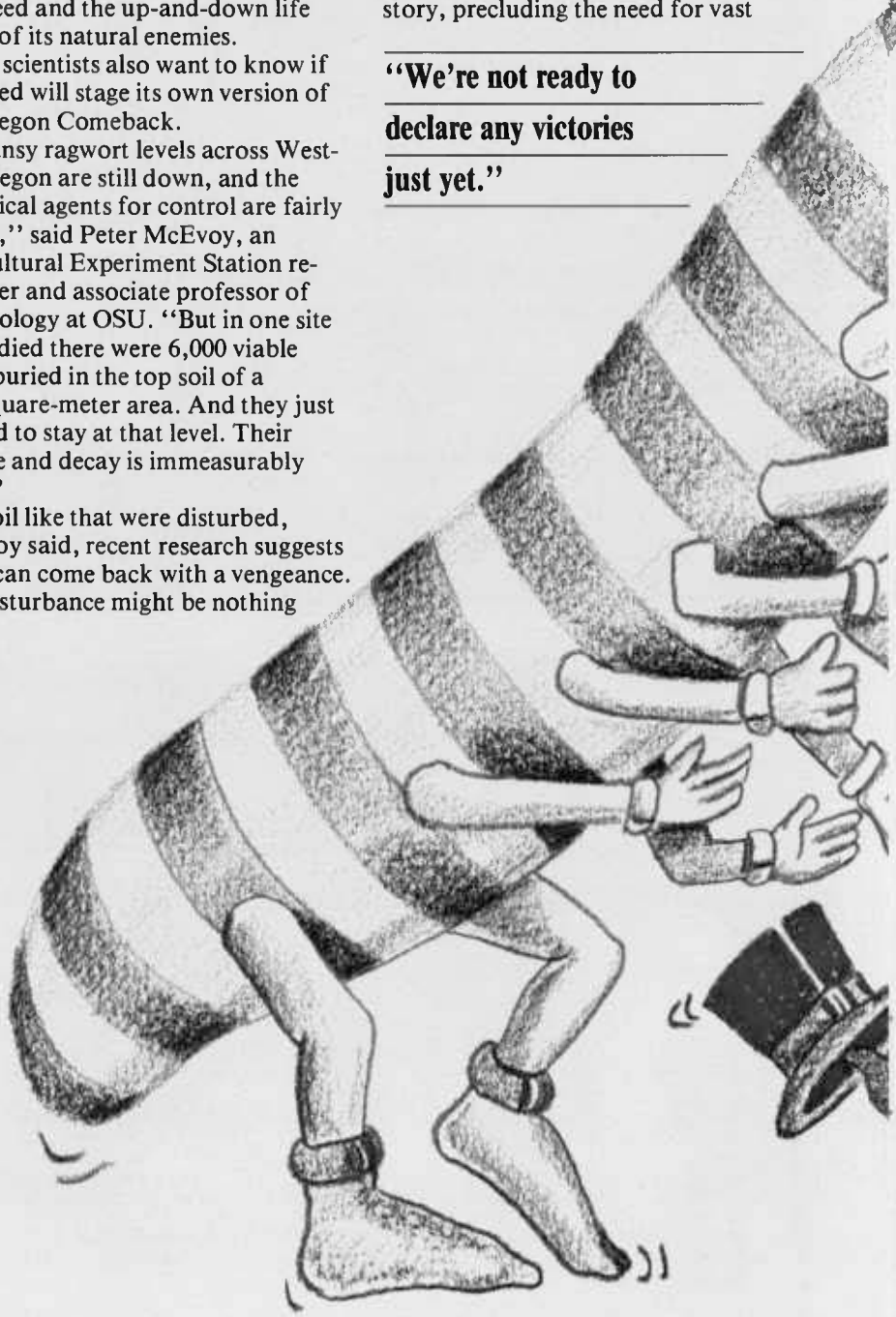
The scientists also want to know if the weed will stage its own version of the Oregon Comeback.

"Tansy ragwort levels across Western Oregon are still down, and the biological agents for control are fairly strong," said Peter McEvoy, an Agricultural Experiment Station researcher and associate professor of entomology at OSU. "But in one site we studied there were 6,000 viable seeds buried in the top soil of a one-square-meter area. And they just seemed to stay at that level. Their decline and decay is immeasurably slow."

If soil like that were disturbed, McEvoy said, recent research suggests tansy can come back with a vengeance. The disturbance might be nothing more elaborate than a cow's hoof print or a farmer's plow. And the big question is whether there will still be any cinnabar moths or ragwort flea beetles left to deal with it.

So far, the biological battle against tansy has been a sparkling success story, precluding the need for vast

"We're not ready to declare any victories just yet."



TWIST

A couple of insect heroes may be eating themselves to death

amounts of herbicide treatments. But the battle also goes to the heart of some important scientific questions in biological weed control. Can insects, like the those that eat tansy, push the infestation to a low, acceptable level, and keep it there? Or will they actually eliminate so much of the weed that the control insects starve to death and leave no defensive barrier to the weed once it returns from seed?

"We just don't have an answer to some of these questions yet," McEvoy said. "Even if we lose most of our biocontrol agents in some spots, it may be that insects from other nearby areas can move in and replenish the populations. On the other hand, we may have to continue some of our manual intervention indefinitely, and keep our eye open for problem spots."

At one coastal site near Lincoln City that OSU scientists have been monitoring for several years there have been some signs of a comeback. This past summer, flowering tansy plants were found in a field where the weed had been thought to be virtually eliminated. Cinnabar moth populations were down considerably, although the flea beetle was holding its own.

The battle against tansy is important. In the past, damage estimates that included contamination of seed crops, hay silage, lost forage and livestock deaths have ranged up to $20 million a year in Oregon. The toxic agents in the weed, pyrrolizidine alkaloids, can damage an animal's liver, eventually killing it.

Eric Coombs, a biological control entomologist with the Oregon Department of Agriculture, agrees with OSU's McEvoy that the verdict on the tansy battle is still out.

"About five or ten years ago, you could compare our tansy infestations to a raging forest fire," Coombs said. "Now it's more like a fire that's under control, with a few hot spots still left over. But most every area that had an infestation of tansy still has one, and the potential for its return is very

evident. We're not ready to declare any victories just yet."

According to Coombs, there has been about a 60-70 percent drop in the overall level of tansy infestations in Oregon compared to 10-15 years ago. Most sites that have been inoculated with control insects have more than a 90 percent drop. The state program to control the weed is the most intensive of any in the nation, he said, and has helped boost the credibility and value of biological weed control as a science.

"The flea beetle is the real workhorse and the moth just gets most of the credit."

"On the state level, we're primarily interested in just getting rid of this weed," Coombs said. "We look to OSU to help us scientifically understand what is working and why, and also to help us take what we learn with tansy and apply it to other weed problems."

The tiny ragwort flea beetle has been a big asset in recent years, Coombs said. It's almost invisible, unless you know what you're looking for, and gets far less attention and interest that its larger, more colorful partner, the cinnabar moth. But "at this point the flea beetle is the real workhorse and the moth just gets most of the credit," Coombs said.

The combination of the two control insects is surprisingly effective. The beetle attacks tansy leaves, stems and roots in the fall and winter. In a "second wave of attack," the cinnabar moth caterpillar strips the plant's flowers and leaves in the spring and summer. Each insect adds to the effectiveness of the other.

If killing the weeds one time were all it took, the problem might be easy. But McEvoy says tansy ragwort seed may live up to 16 years. A large, healthy plant can produce up to 100,000 seeds, which are then spread by wind, human and animal activities. They make great hitchhikers on anything from hay wagons to muddy vehicles or human boots.

Tansy ragwort is not a persistent problem in forests, the scientists say, but those areas can make convenient reservoirs for materials that can cause infestations at a later date.

The persistent nature of the weed was highlighted by a 10-year survey of a site in the Willamette Valley near Monroe. For several years in the late 1970s, tansy ragwort plant numbers were moderate. Then the soil was disturbed in 1979. The number of plants the next year jumped almost 800 percent. A few years later the problem was back under control.

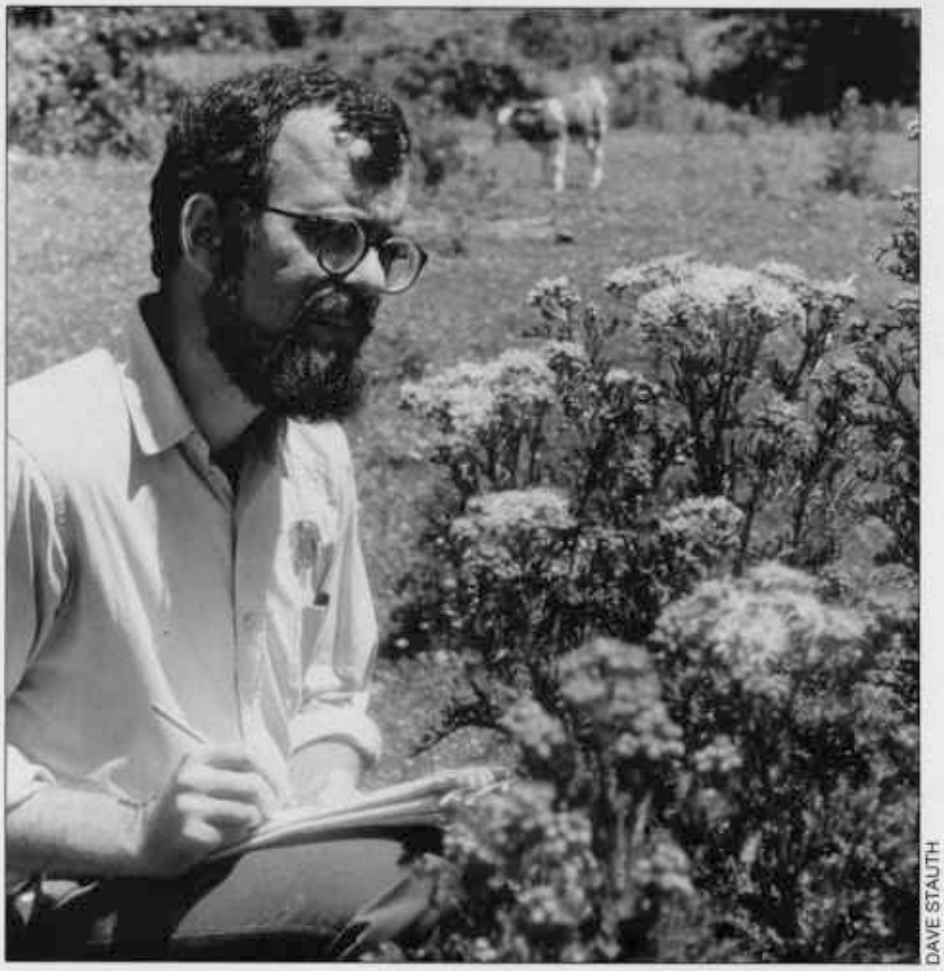
When the flea beetle becomes well established across Western Oregon, it may offer the best hope for keeping the weed at a consistent, low level of infestation, one that would pose a minimum economic threat. Scientists have found that when there is very little tansy on which to feed, the flea beetle has a better long term survival record than the cinnabar moth.

Efforts with other weed control problems are also receiving attention. The early success stories of biological weed control with tansy ragwort have spurred interest in the field.

OSU now has one of the most active programs of research in the nation on the theory and practice of biological weed control, funded by the Agricultural Experiment Station and the National Science Foundation. The Oregon Department of Agriculture has expanded its efforts and now has seven employees working extensively with biocontrol of weeds.

On a state level, more than 30 biological control agents are now being tried with more than 20 weed species. Some are working better than others. A variety of weed problems have been targeted, including diffuse and spotted knapweed, a competitive range plant; yellow starthistle, a toxic plant and vigorous forage competitor; and gorse, a spiny, robust plant that can form an impenetrable barrier, impossible to move through.

And of course the biological battle against tansy ragwort will continue. Even if they have to grow a few fields of it now and then.



DAVE STAUTH

OSU entomologist Peter McEvoy examines tansy ragwort growing near the Oregon Coast.

THE FUN STOPPED HIS THIRD NIGHT

What do you say to a person when he's waxing nostalgic and all of a sudden confesses he quit the most exciting job he ever had after three nights?

In this case: Why, Professor Nelson?

Gene Nelson already had explained that he had quite a few jobs before settling into his present one as the head of OSU's agricultural and resource economics department. Most were when he was in college and graduate school.

"The one that was the greatest adventure, the one I remember more than any of the others, is three nights driving a taxi. Picking up drunks, driving around Galesburg trying to find a ride," Nelson recalled, eyes twinkling at the memory.

To put this in perspective, you should know that in 1963 the Galesburg he mentioned had about 25,000 residents. To the residents of his nearby hometown of North Henderson, population 200, it was the big city "where you went to cruise down mainstreet."

The third day of all that fun in the cab, about the time dawn broke on the rolling, west-central Illinois farmland, Nelson finished a 6 p.m. to 6 a.m. shift, turned off the motor and walked away from his taxi for good.

"I wasn't making enough money," he said.

And earning enough money to pay for college was the point.

Nelson started while he was still in high school living on his folk's farm. His father helped him identify a new-at-the-time breed of hogs from Denmark called Landrace hogs. Their leaness meshed nicely with a trend toward leaner pork. He helped develop a market for the breed in the area by showing them in 4-H and Future Farmers of America livestock shows. The money he made when he sold off those hogs helped get him started in college.

"I decided I'd go just to see if I could make it, but I didn't have any big plans," he said, remembering that he wasn't a great student in high school and not many from his senior class of 30 even considered college.

The summer stint driving a cab was sandwiched among a string of jobs that supported his studies as he blossomed from tentative freshman at Western Illinois University to Ph.D. candidate in agricultural economics at Purdue University.

"I did everything from drawing signs to building hog houses to milking cows at the college dairy farm," said Nelson.

"The trick," he remembered about the dairy farm job, "was getting the cows milked and then getting back to the dorm in time for dinner . . . and not smelling too bad."

DAVE KING

Gene Nelson

A job with the FmHA (Farmers' Home Administration) almost kept him from where he is today.

"I was a student trainee for a couple of years and I really liked it. I'd probably still be working for the FmHA if it hadn't been for an agricultural economics professor named Dick Gibb (now the president of the University of Idaho). He encouraged me to go to graduate school," he said.

Nelson came to OSU as an agricultural economics professor and researcher in 1969, shortly after receiving his Ph.D. He moved "reluctantly" into the department head position in 1981, on an acting basis, when his predecessor took another job that was supposed to be temporary.

Nelson had enjoyed teaching, research and working with the Extension Service, but it turned out that being a department head was pretty interesting, especially in the middle of an agricultural recession.

"The temptation for an economist is to run out to the field with very little information and lots of sympathy," he said, explaining that making the right choices about how you can best serve the state during tough economic times, and not losing sight of long-term goals, can be an extremely challenging balancing act.

"I found working with faculty, getting small groups of people together to hatch ideas, rewarding," he said. When the former department head didn't come back, Nelson applied for and got the job.

He enjoys working with industry and government as his department's chief representative to the outside world. "But I'm a generalist in farm management and production economics. I'm careful to be honest and defer to other faculty members when people ask me questions about things outside my field," he said.

"My philosophy is that all the good ideas in the university come from the faculty level. My objective is to create an environment so those ideas can come forth and be implemented with a minimum of hassle."

—C.H. and A.D.

Look Who's Coming to Dinner

(See Page 10)

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