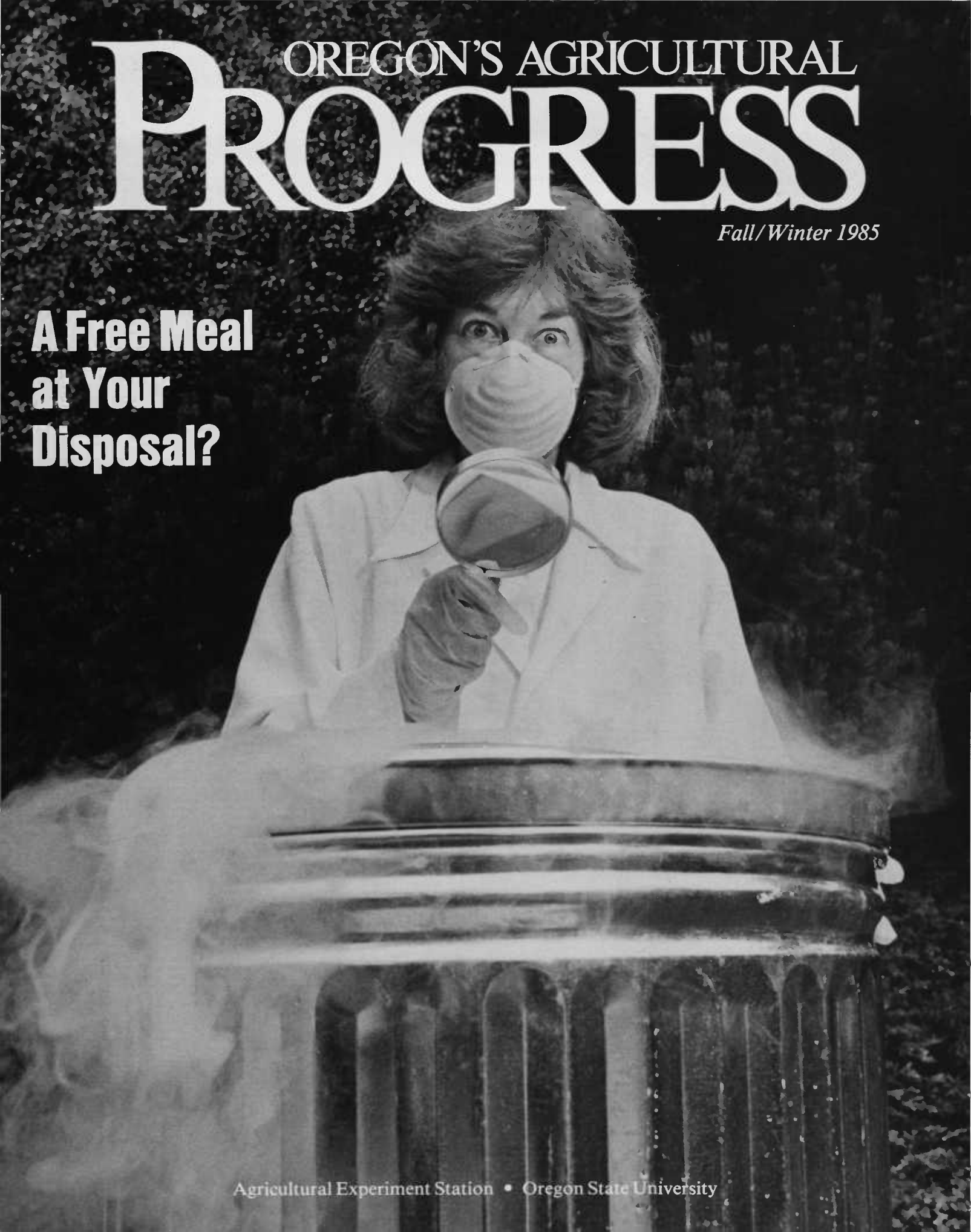
OREGON'S AGRICULTURAL

PROGRESS

Fall/Winter 1985

A Free Meal at Your Disposal?



Agricultural Experiment Station • Oregon State University

THE EDITOR'S NOTE

One of the things I like best about working on this magazine doesn't involve typing at a computer terminal. It's tagging along with researchers, gathering material for stories.

I've had a chance to spy on wild mustangs in the Owyhee Brakes, stalk weeds in Columbia Basin wheat fields, spotlight white-tailed deer along the Umpqua River, track bobcat in the Cascades, help start a grass fire in the Malheur National Wildlife Refuge, marvel at bald eagles soaring over Upper Klamath Lake, pose as an Arab sheik in a Willamette Valley grass seed field (don't ask why), stuff myself with experimental nectarines in a Hood River orchard, and spend a nervous night near Mount St. Helens, thanks to a dead helicopter battery.

I could go on (as I do sometimes, associates claim). But the point is, I get to travel around Oregon and peek into lots of curious little worlds. I'm usually amazed and delighted by the plants, animals and terrain. But the people—researchers and local residents—fascinate me most.

It happened again a few weeks ago. I was with an Eastern Oregon ranching family during their fall round-up. Day after day as they chased cattle through the forests, up and down mountains, I saw a way of life much more important to that family than the money they'd get when they sold their product.

Everyone—father, mother, grade-school-age kids, grandparents, even neighbors—pitched in to ride the range, feed those who did, or truck cattle. The goal was to get the animals to lower ground while they were still fat.

Never mind the foul weather, long hours and hard work. There were moments of pure joy, and a sense of camaraderie, that took things far from what many of us think of as the world of business. And that's despite the fact that the family knew it was walking a tightrope over the depressed cattle prices that are terrifying many Oregon ranchers.

Word came yesterday that it snowed when they took their cattle to market. Just four buyers showed up. Prices were down anyway. To get to the point, there won't be a round-up next year.

And that brings me to an article in this issue you may want to look over. It's about the search for alternative crops, an attempt to come up with options for Oregon farmers and ranchers. The research is necessary because of the fluctuating prices and shifting markets that helped drive the family out of business ... and forever make farming and ranching a form of high-stakes gambling.

— Andy Duncan

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Cover: An OSU study shows Oregonians are confused about how to judge food safety. See page 12. (Model: Sandy Ridlington; photo by Dave King)

Free

That's right. There is no charge for Oregon's Agricultural Progress. It is a report to taxpayers who help fund Oregon Agricultural Experiment Station research. For a subscription, write: Editor, Oregon's Agricultural Progress, Agricultural Communications, AdS 416, OSU, Corvallis OR 97331.

UPDATE

FRESHER COTTAGE CHEESE

OSU scientists and a private researcher in the Portland area have developed a product that extends the shelf life of dairy products such as cottage cheese and yogurt.

The product, called Microgard, is a formulation of naturally occurring microbes. A patent is pending and sales are expanding rapidly for Wesman Foods, a young Beaverton firm built around the product.

Microgard is being used in cottage cheese made from coast to coast, according to George Weber, a microbiologist for Wesman Foods who developed the product along with Experiment Station microbiologist William Sandine and OSU pharmacy professor James Ayres.

Microbes in products like cottage cheese and yogurt multiply and cause them to spoil. Sandine and Ayres found dairy microorganisms that inhibit growth of the nondesirable bacteria, and those are in Microgard.

The product, made by culturing selected organisms in skim milk, is thought to increase the shelf life of cottage cheese by up to a week.

Chemical preservatives also are available to control certain types of bacteria and mold, according to Ayres. But a need was seen for a natural product, he said.

The production of cottage cheese is a major industry. In 1984, more than 70 million pounds were consumed in Oregon and southwest Washington. Losses from limited shelf life often reach 5 percent, it is estimated.

It appears that the technology that produced Microgard can be applied to other dairy products, including sour cream, buttermilk and refrigerated salad dressings, according to the researchers.

Through the university patent, OSU and the researchers will receive royalties on the sale of Microgard.

Microbiologist Bill Sandine

REJOICE, RATS!

The rainbow trout is making a splash again.

In the last two decades, OSU scientists have pioneered use of the fish as a test animal for studying human and animal health problems. Now the federal government has given the effort an extra boost.

The National Institute of Environmental Health Sciences has awarded OSU $1.8 million to set up a campus center to be called the OSU Marine Freshwater Biomedical Sciences Specialty Center of Research.

Primary aim of the center, according to George Bailey, a biochemist in OSU's food science department who will be director, will be to continue to develop the rainbow trout as a model for research.

The work was started in the 1960s by retired OSU food scientist Russell Sinnhuber, explained Bailey. OSU researchers have shown that rainbow trout are sensitive to many of the same toxic and cancer-causing substances as mice and rats and they're much cheaper to work with.

"Also," said Bailey, "it's not sufficient to work with just rats and mice. You need to use other creatures to find out if toxic and cancer-causing mechanisms are constant. If they work in a range of creatures, that's powerful evidence that they work in humans, too."

In recent years, a major focus of the rainbow trout research has been on how substances in foods cause, or inhibit, cancer (see "Vegetables Versus Cancer," pages 8-11, Winter 1984 issue of *Oregon's Agricultural Progress*).

As part of that effort, Bailey and colleagues have used genetic techniques to develop strains of trout especially sensitive or resistant to cancer-causing substances. Also, the researchers have

DAVE KING

These albino trout are helping OSU food scientists study the cancer process.

incorporated into their research a strain of albino trout, acquired in Utah, that makes it easier to spot genetic changes triggered by cancer-causing substances.

Bailey hopes to use the trout to study genetic mechanisms in oncogenes, the genes theorized to turn cancer development on and off.

Principal researchers in the new center, besides Bailey, will be animal pathologist Jerry Hendricks, food scientist Daniel Selivonchick, agricultural chemist Donald Buhler and pharmacologist Larry Curtis of OSU's fisheries and wildlife department. Joe Nixon, a nutritional biochemist who died unexpectedly in October, was a key member of the research team and was to have been the center's associate director of administration.

The center's administrative headquarters will be with the Department of Food Science and Technology on the OSU campus. The scientists will continue to do much of their research where the trout are — at the OSU Food Toxicology and Nutrition Laboratory on Highway 34 just east of Corvallis.

ENGINEERED VACCINE TEST PLANNED FOR NEW ZEALAND

OSU researchers appear to be approaching the so-called "cutting edge" of biotechnology in agriculture— they're planning one of the world's first field tests of a genetically engineered vaccine.

The experimentation, to be done with sheep and cattle in New Zealand, will start in January.

Such testing has been blocked in the United States by a federal court injunction filed by a public interest group opposed to releasing genetically altered organisms into the environment.

A key goal of the testing will be to prove that genetically engineered vaccines made with the vaccinia virus, a harmless relative of the virus that causes smallpox, can be used safely in the field, according to Edward Wedman, a former dean of the OSU College of Veterinary Medicine who will do the testing in cooperation with New Zealand researchers.

"We're quite confident that these products will not cause problems and demonstrating that, in and of itself, will be of major importance," said Wedman.

In the initial phase of the New Zealand research, scientists will test the safety and effectiveness of a genetically engineered vaccine made with the vaccinia virus and genetic material from a relatively harmless disease organism called Sindbis.

If vaccinated test animals show no ill effects and become resistant to the skin sores the Sindbis virus can cause, the researchers will be in a position to test other vaccines when they are available. The organisms that cause ovine foot rot, bovine diarrhea and liver fluke disease are being studied by OSU veterinary researchers Alvin Smith, Eugene Berry and Gary Zimmerman.

Once enough information about the makeup of those viruses is available, it will be possible to insert genetic material from them into vaccinia to make experimental vaccines for the disease they cause, according to Dennis Hruby, an Experiment Station microbiologist who will do the genetic engineering work.

Hruby made the vaccine for Sindbis, and he and a private firm have tested it with swine under controlled, nonfield conditions and found it effective and safe, Hruby said.

The vaccinia virus is the key to the research. In the past, the virus has been used extensively for immunization against smallpox, a disease now eradicated throughout the world. Because of its large size and particular genetic makeup, vaccinia is uniquely suited for genetic engineering. It can serve as a vector, or cell carrier, for antigens that trigger the production of antibodies that fight various diseases.

OSU researcher Dennis Hruby eyes the virus he's using to make animal vaccines.

DAVE KING

Vaccinia is the largest and most complex of viruses. With it as a vector, it may be possible to develop a single vaccine that will immunize an animal or human against several diseases.

Although field testing of genetically engineered vaccines is illegal in the United States, at least for the time being, the government and scientific community in New Zealand have been receptive to the idea, according to Wedman.

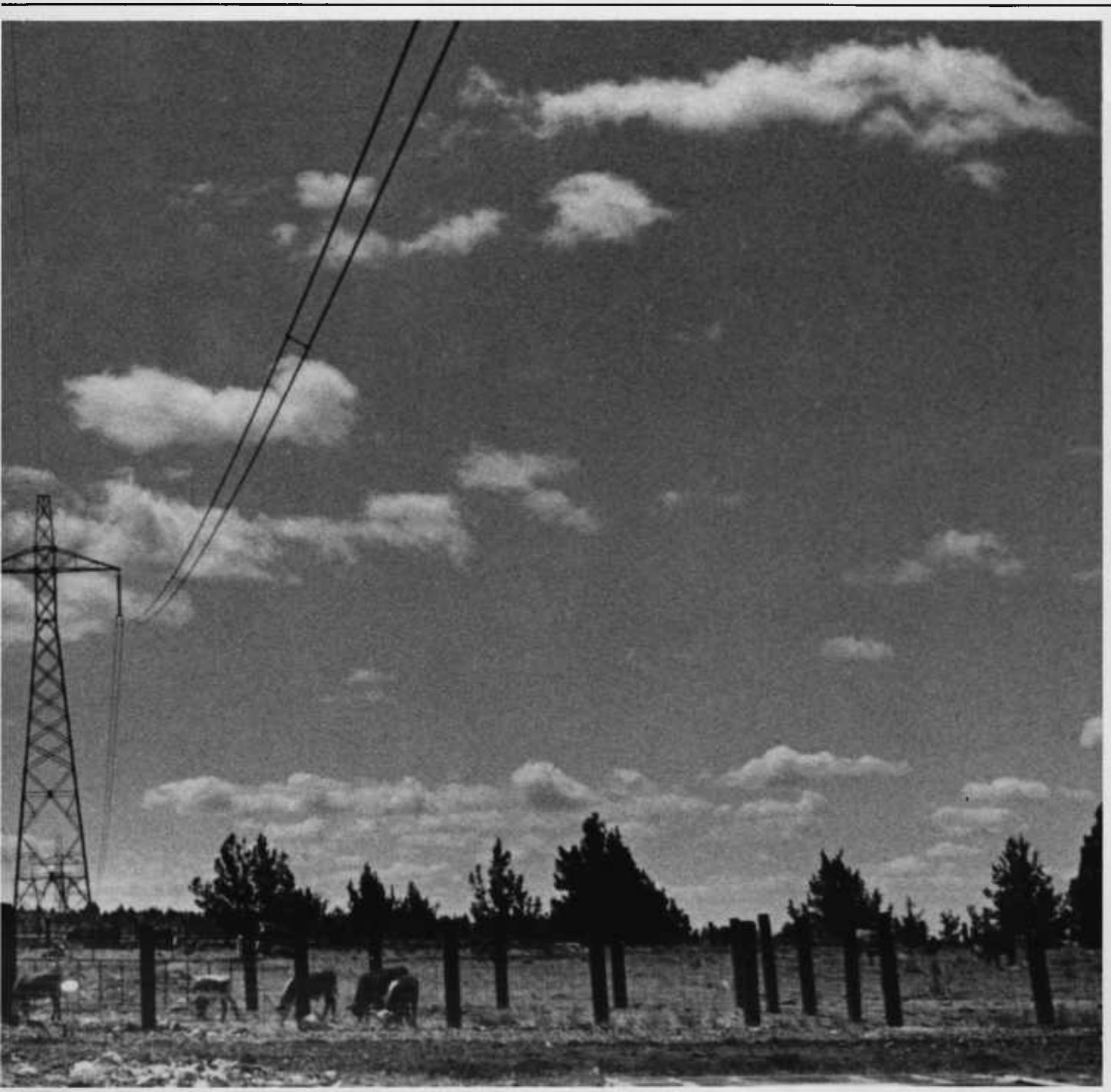
In New Zealand, where sheep outnumber people 20 to one, sheep diseases are not taken lightly. The New Zealanders are particularly interested in cooperating on a field test of a vaccine for ovine (sheep) foot rot.

RESEARCH LIST

Each year, the Agricultural Experiment Station publishes a list of research papers and booklets done by Station scientists during the previous year. Free copies of the list for 1984 are available from the Department of Agricultural Communications, AdS 416, OSU, Corvallis, OR 97331.

THE POWER OF GE

BY RICHARD FLOYD



Photos by Dave King

IZZLY MOUNTAIN

Charged-up OSU researchers are studying plants and animals that live under high-voltage lines carrying electricity from Oregon to California

It's a great job.

Bob Raleigh is the first to admit it.

The start of the OSU animal scientist's current assignment was to look over 320 acres of rangeland next to Grizzly Mountain, which is 12 miles southeast of Madras in central Oregon, then carve out a three-year project with Bonneville Power Administration. The result is attracting attention across the nation.

"We became involved because BPA wanted to find out if high-powered, direct current lines would affect livestock or plants," said Raleigh, known for his cowboy directness and ability to get things done.

"After a lot of talk, we decided the only way to find out was a scientific experiment, using cows and plants."

BPA began thinking about the project in 1982, when the agency needed an environmental analysis before upgrading the voltage of its intertie line, which runs to California, from 400 kilovolts to 500, said Jack Lee, BPA's major liaison person on the Grizzly Mountain project.

"Because the intertie crosses range and agricultural lands, we thought it would be an appropriate kind of study," said Lee. "And, after we developed an overall plan for the study, we went out to find other sponsors."

Utilities in Texas were particularly interested because environmental problems had developed over a proposed power line, a dispute which involved a licensing procedure for a 400-kilovolt direct current line. In effect, a hearing examiner ruled that possible health effects of such a line had not been adequately discussed.

Other sponsors who have joined OSU and BPA in the agricultural study are Central and Southwest Services, Inc., Dallas; Empire State Electric Energy Research Corp, New York; Houston Lighting and Power Co.; Los Angeles Department of Water and Power; Pacific Gas and Electric Co., San Francisco; Salt River Project, Phoenix, Arizona; Southern California Edison Co., Rosemead, California, and Western Area Power Administration, Golden, Colorado.

In more ways than one, the BPA site is a natural.

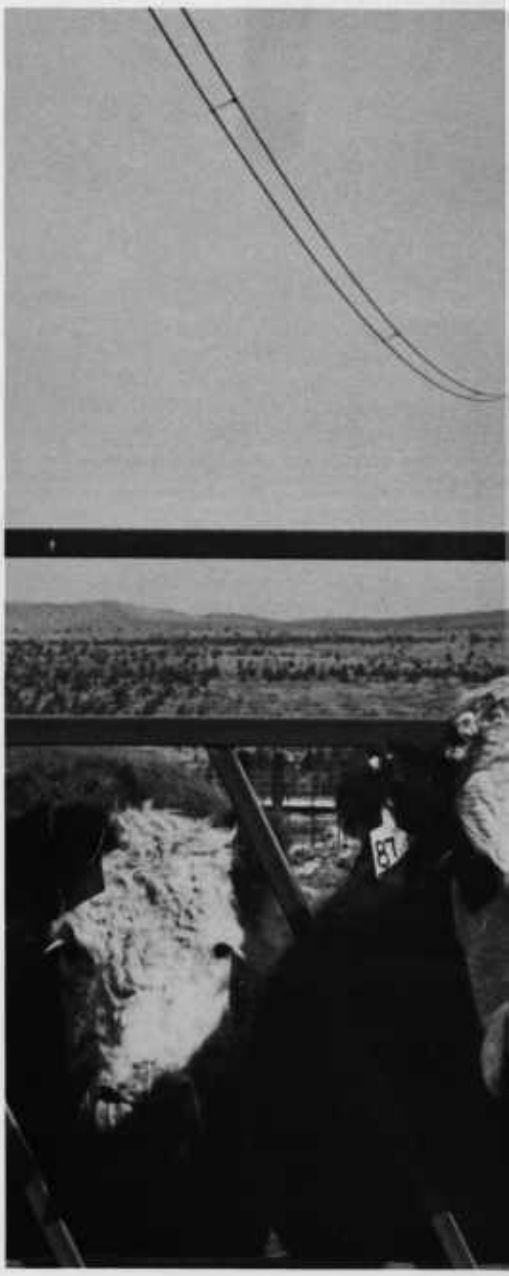
The 500,000-volt lines, the most powerful commercial lines in the country, hang over the land. The four lines, two negative and two positive, are supported by 125-foot towers that

Left behind were . . .

rusted farming equipment

and something of more

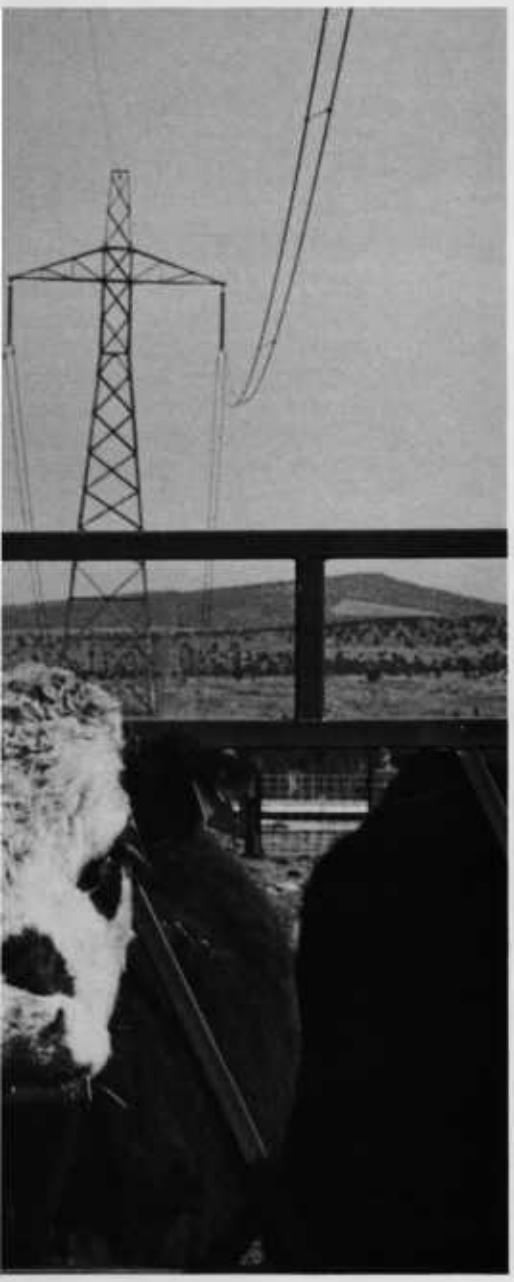
value.



march across the mountain desert. Carrying surplus hydroelectric power from Celilo near The Dalles to Sylmar in southern California, the system, the first commercial high voltage DC lines built in the United States and energized in 1970, helps feed hungry Los Angeles machines, equipment and homes.

The site is part of the Crooked River National Grassland, which is administered by the Ochoco National Forest. BPA picked the site for its flatness. It's about two miles of brush away from BPA's Grizzly Mountain substation and has been home to several sophisticated BPA measuring devices since December 1984.

Top left: Grizzly Mountain project director Bob Raleigh. Lower left: Technician Shaun Yeske examines alfalfa plot. Below: These cattle live directly under BPA power line.



Years ago, the juniper-dotted, rock-studded area was tilled in a futile effort to tame it. Left behind were parts of rusted farming equipment and something of more value, a well.

"We signed contracts with BPA at the end of January this year," said Raleigh, who was superintendent of OSU's Eastern Oregon Agricultural Center at Burns from 1969 until last year. "The study is the first known agricultural study under DC power lines, but several studies with AC (alternating current) lines showed no effect on livestock or crops."

Right after the contract signing, Raleigh went to work.

While he was winding up negotiations on several fronts and hiring, some by phone, a solid team of six enthused scientists and technicians, he found the well was inadequate for the $1.43 million project. After negotiating another contract, Raleigh had a new well dug, a 50-gallons-per-minute producer. The U.S. Forest Service took care of building a road from the substation to the project site under another contract.

"We picked up three used house trailers, one from a local used car dealer and two from a surplus equipment agency in Washington, and got them to the site," said Raleigh. He is head of the whole project for OSU and also directs the animal study.

Crews started right away to build cattle holding and working areas including four corrals, alleys and other facilities needed to hold 100 cows and their calves. They will live there below and near the four powerful lines, and be observed almost continually, for the rest of the three-year grant.

A copy of this facility, including cattle from the same Burns ranch, was duplicated on a controlled site approximately 2,000 feet from the power lines.

Each fall, all calves will be sold; each year, the cows will be bred by six resident Shorthorn bulls, all half brothers.

Plots between the 350-by-400-foot corrals are planted in two crops: winter wheat and alfalfa.

"Crop production and growth characteristics, especially any leaf damage or other abnormalities, will be monitored during the season at various distances away from the power lines," said Fred Crowe. A plant pathologist and superintendent of OSU's Central Oregon Agricultural Experiment Station at Redmond, he is responsible for the plant study of the project.

"Presumably, plants and animals will encounter fewer electrical effects with increasing distance from the lines," he says.

The project will give the scientists nearly three years of data on effects, if any, on cattle production and reproduction, and two full years on plant production.

"The study is the first known agricultural study under DC power lines."

Alan Burns of Portland, BPA's engineer for the project, is responsible for electrical measurements at the site.

"This part of the program is separate and is being done by BPA to characterize the electrical environment," he said. "Since the agricultural study was sponsored, we decided it would be a nice idea to tie the two together and we could get a lot of information, so we're working together."

He explained that the BPA wanted to get measurements of the electrical environment, particularly emissions given off by the lines and caused by coronas. A corona is a faint glow adjacent to the surface of an electrical conductor at high voltage.

"A corona is not anything unique or really that mysterious," said Burns. "It occurs with any type of high voltage equipment; when the voltage is high enough, air, an insulator, is broken down in the vicinity of the conductor. Our direct current transmission keeps the voltage high, unlike alternating current. When air is broken down, it ionizes and produces charged particles which can migrate a considerable distance from the line."

Plants are different they don't move much

The Bonneville Power Administration plant study at Grizzly Mountain, Fred Crowe, a plant pathologist, points out, is a bit of a contrast to the animal study.

"Plants don't behave like animals—they can't move around. We're using a distance parameter away from the center point of the lines as a variable study," he said. "In other words, will plants perform differently as they experience these peak and low areas of ionic electrical concentration?"

The planting plots are 24 feet wide and 400 feet long, the length matching the corral lengths. Each plot has a strip of alfalfa and strip of wheat, half and half, or 12-foot strips paired together. The whole crop study is duplicated in the control corral area.

"We had originally hoped to have the plots planted last spring but the rockiness of the soil and our difficulty getting the underground system in place delayed us at least a couple of months, so we converted to summer alfalfa planting and fall planting of winter wheat," said Crowe.

The irrigation system was a big problem, he said.

"We spent great effort and still are trying to set up a watering system that was compatible with the study," said Crowe. "We didn't want to go with an overhead system because there is a lot of wind at the site. To reduce that, we've gone with an underground system, one that we are not familiar with but feel is going to do a good job."

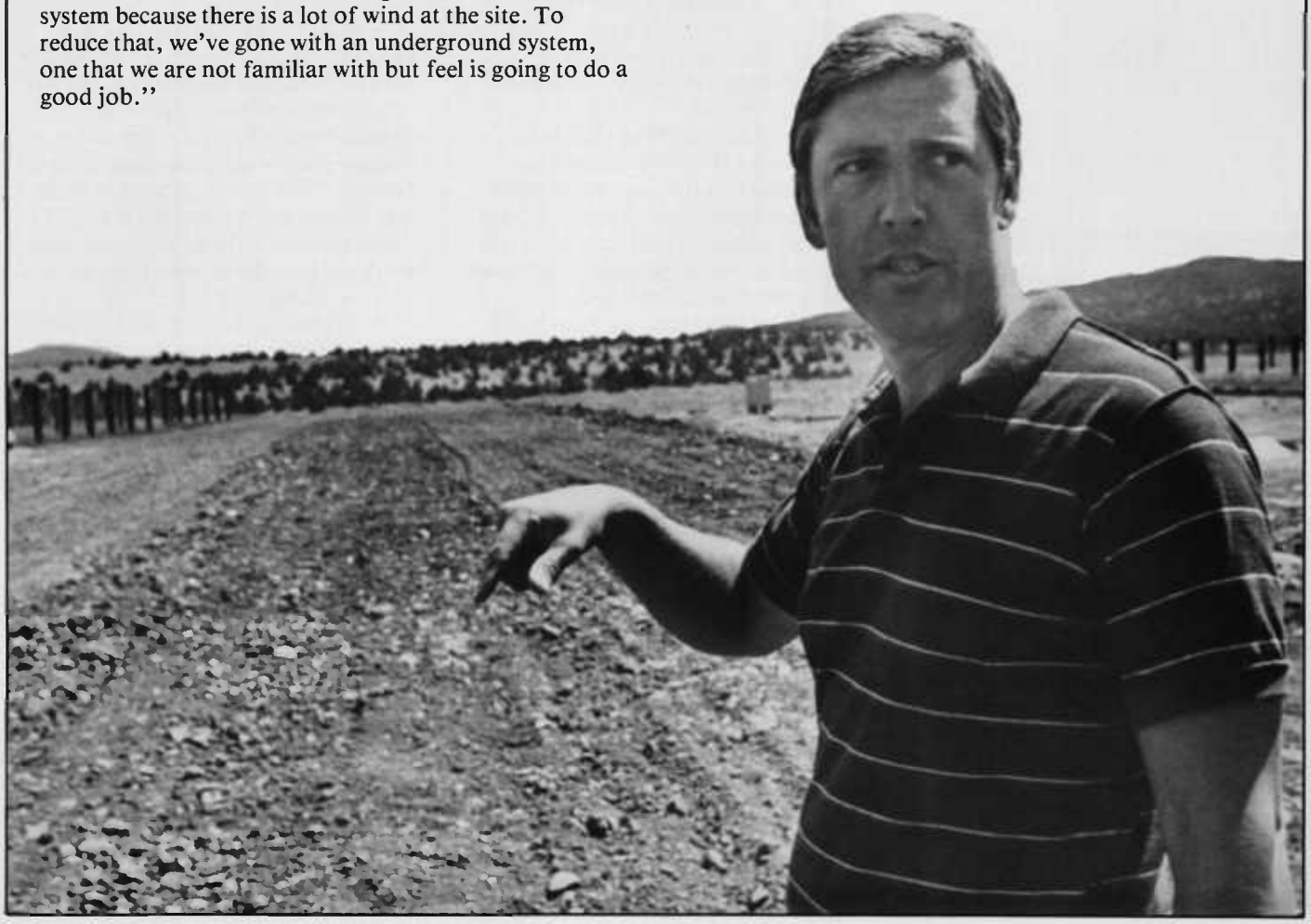
The winter wheat will be harvested each year. Once established, the perennial alfalfa will be cut regularly. The two crops were picked because they are commonly grown along much of the length of the BPA power lines and because of their plant structure.

"Some of the previous studies, under very high power conditions in the laboratory, suggest that the corona, emitted by the power lines, tends to develop on certain shapes of leaves. For example, sharp pointed leaves," said Crowe. "When plant damage has been observed under highly artificial conditions, it is usually at the tip of a leaf blade of a grassy kind of plant, whereas round-bladed grass, like alfalfa, takes a lot higher level to generate any kind of effect."

The concept of the perennial and annual nature of crops also came into play, he said.

"Perhaps some effects could build up over a couple of seasons, although we don't anticipate that. Alfalfa will give us the ability, maybe, to look at that kind of thing."

Plant pathologist Fred Crowe



A corona can have several by-products, including noise, light, ions that travel away from the lines. It also can create radio or television interference, depending on signal strengths, said Burns. On a dark night, light emissions from the powerful DC lines are visible as a dull glow.

"We're measuring at 500 and 1,000 feet on both sides of the lines and directly under them," said Burns. "From other tests, we know that some emissions can travel up to a mile from the lines."

There are three basic measurements at the Grizzly Mountain site. One device measures the number of charged aerosols or small ions in the air. Also measured is the electric field strength. Another device, a flat plate, measures how much current is impinged on it.

"The measurements we're trying to make with that plate are one billionth of an amp, or a nanoamp," said Burns. "The electronics are very sophisticated. We have cable systems that feed all the way back to a small trailer about 2,000 feet away that houses more electronics and a computer system to gather all the data."

Digging postholes in range country is a far cry from riding herd on a computer. But Raleigh's crew took care of building corrals by creating 2,100 holes and inserting black, eight-foot creosoted railroad ties every eight feet. The ties are linked with 6- by 8-inch bull panel wire fencing made of one-quarter-inch galvanized steel.

The duplication of the corrals was carried right down to two blue watering stations in the middle of the corrals, strategically placed under the power lines in one set of corrals. The control corrals, of course, are not near a power source.

Getting other supplies and equipment on site took a lot of time, too.

Hay for 200-plus head of livestock was purchased on bid, which meant that rigid rules had to be followed. Also bid bought was the equipment, including three new tractors, two feeder wagons, a hay chopper, scales, a squeeze chute for treatments, and other cattle-handling equipment. A rock harvester, to get rocks out of the way of the new plantings, was borrowed from a local rancher.

In addition to feed, the animals got color-coded ear tags large enough so they could be identified quickly for countless measurements.

"A corona is not anything unique or really that mysterious."

By the end of April, Martin Schott was hired as site manager. A rancher, environmentalist and range scientist, he brought many skills to the job, acquired while growing up on an Oregon ranch, running a riding stable, being a bartender and doing lots of other jobs. With him is his wife, Sallie, who rides almost daily, accompanied by the family's two black Labradors. She not only agreed to live in one of the site trailers but also agreed to be tour guide for official visitors.

Schott, sitting across from Raleigh in the battered trailer which has felt too many occupants and too many moves, said, "We're recording the estrus (in heat) of the number of cows during the breeding period, and every 28 days we weigh every single animal on the site."

Veterinarians routinely test the semen of bulls just before breeding, midway, and after breeding.

Schott and his team are also interested in animal behavior. Twice a week, a half hour after feeding, they record where the animals are standing along the feed bunk to see if there are any changes in how the animals cluster.

Once a month, for a 24-hour period, the OSU team checks behavior in the corrals every 15 minutes, recording the number of cows that are nursing, whether the animal is walking, standing, bedding, eating, or drinking. Other cattle measurements will help determine conception rate, calving interval, calving ease, percentage calves born, percent calves weaned and weaning weight.

"The animals were blood tested and checked for disease and parasites and proved to be normal with respect to blood values and free of parasites. They will get the same screening at the end of the study," said Schott. Only he and the technicians are allowed to feed the cattle, so they will stay calm.

Recent visitors found people bustling through established routines. The cattle were at home, accustomed to being moved from one corral to the next on schedule, and used to the men who fed them twice a day. Raleigh, bent over a cup of coffee, was content.

"No harmful effects from the lines are expected, based on operating experience with direct current lines and results of biological research with direct current fields and air ions," he said. "This project is needed because research directly applicable to such power lines is limited."

Job under way. Everything under control. Everybody working. That's the credo of a happy cowman. That's Bob Raleigh.

Technician Lee Reynolds, right, stacks hay that will go into a mechanical shredder. Technician Bill Brackett, left, delivers shredded hay to the hungry cattle.

THIS STUDY IS GARBAGE

The challenge was to pore over food Oregonians threw away and find out if some was still good

BY DAVE KING

I cracked open the refrigerator and there it was: green macaroni and cheese. It hadn't been that long since I put it there. Last Tuesday, or was it a week ago Tuesday? By the time I finished debating with myself, the green tint seemed more intense. I chucked it, quick.

Has this type of scene played in your kitchen recently? Chances are it has. Oregon families discard an average of $2.94 worth of food each week.

Photos by Dave King

That's about half a pound, or 6 percent of the food purchased in the average home per week, OSU researchers have found. But the quantity and value of the discarded food weren't the major interest of the food scientists, Margy Woodburn and Shirley VanDeRiet, and their research team. They wanted to know why people throw food away.

"What we found was a lot of confusion."

Why do we? With green macaroni and cheese, it's pretty obvious. But apparently other situations can, and do, cause confusion.

Woodburn and VanDeRiet coaxed the people in a sampling of 243 households from Oregon's Willamette Valley to record what foods they discarded over a seven-day period and explain why they decided to throw the food away. The researchers also had some people save food they planned to discard so they could study it.

"What we found was a lot of confusion and great deal of variation," said Woodburn, smiling wryly.

The researchers grouped answers to the question, "Why was this food discarded?," into eight categories. They ranged from the Quality category, which included burned food and fruits and vegetables that were overripe, to the Microbial category, which included moldy, off-odor, obviously spoiled food, to a Leftovers category (some people said "We simply don't eat leftovers in our house").

They analyzed discarded food from 50 of the households to find out if people's reasons for throwing food away were valid—for example, to find out if food thrown away because it looked spoiled really was spoiled. According to Woodburn, confusion about food safety and quality dating of food packages was obvious.

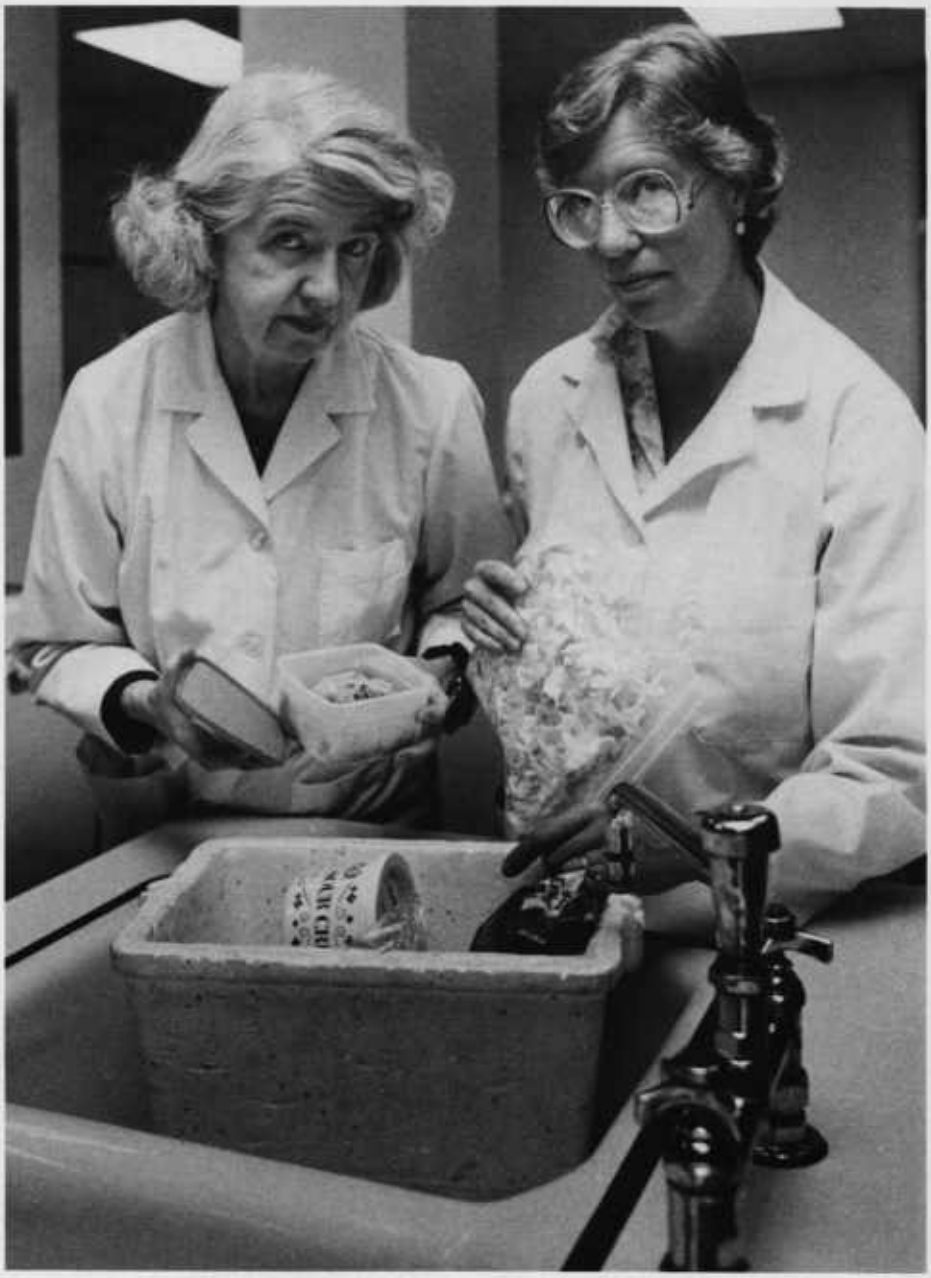
"For 62 percent of the foods we analyzed, householders did not make correct safety assessments," she said. "But only 9 percent of the time the householder thought the food was safe when in fact it could have caused illness if it had been eaten."

Many people, the researchers found, threw away food that was still safe because the quality date on the food had passed. According to Woodburn, a package date apparently seems so authoritative to consumers that it often overrules their own assessment of the food's condition and leads to a premature trip to the garbage can.

"This is a difficult problem for consumers," she said. "Inability to evaluate the safety and quality of food is apparent. It's the combination of the date marked on the package, and whether or not the food item has been properly refrigerated or stored at a safe temperature, that are most important."

To illustrate, Woodburn points out that 17 of 246 food items collected from the 50 households were found to be contaminated by *Staphylococcus aureas,* a harmful bacterium, at levels that could have caused anyone who ate the food to get sick. But, of the 17 contaminated foods, the consumers identified only one box of alfalfa sprouts as unsafe.

"Throughout the study, we found food discarded because of 'time' was usually still good," said Woodburn. "People need to consider the impor-



Foods and nutrition researchers Margy Woodburn, left, and Shirley VanDeRiet begin an examination of foods an Oregon family threw away.

tance of temperature history and the package date when making the combined decisions about quality and safety."

The researchers found another harmful bacterium, *Clostridium perfringens,* at high levels in 11 of the foods the 50 families threw away. Woodburn's research team thinks the most likely reason for growth of this bacteria was because the foods were left out at warm temperatures too long. Thorough heating of the foods would have killed all the bacteria, but that probably wouldn't have happened in many cases, says Woodburn.

"Forty-five percent of the food most likely would have been eaten without reheating," she said. "These were things like pasta salad, sandwich fillings and luncheon meat. And even if they were heated, our previous research indicates that few people heat leftovers to 165 degrees Fahrenheit, which is barely ample for killing the bacteria."

Of the 17 contaminated foods, consumers identified only one box.

Who gave garbage?

Thirty-one percent of the people studied have always lived in Oregon.

The majority of the others came here from other western states (42 percent).

In 93 percent of the households, the person who does the shopping also is the primary one responsible for discarding food.

In 44 percent of the households, people changed their menus in relation to the pay-period cycle. Of those 44 percent, 4 percent threw less food away during the end of the pay period, 74 percent ate less expensive food, and 13 percent had less to eat.

Sixty-two percent of those surveyed have microwave ovens. Of those, 91 percent said the microwave helps them use leftovers they would have discarded in the past.

VanDeRiet puts bits of dicarded food in dishes containing various growth mediums so she can trigger the growth of—and identify—bacteria in the foods.

Some interesting patterns show up when you shuffle through the reasons people discarded food.

The reason cited most often for discarding fruits and vegetables was poor quality. But the definition of poor quality certainly was an individual matter. Woodburn tells of avocados discarded because they were overripe. But the research panel considered them just right to eat. She also tells of dark-fleshed muskmelons discarded because they were "rotten" or "spoiled." Actually, she says, the flesh inside was firm and unblemished.

We need to stress . . . keeping refrigerator temperatures below 45 degrees.

Studying meats, fish and poultry, the researchers found that the value of an item had a definite effect on what was and was not thrown away. When asked "What would you do with one leftover lobster tail?" only 4 percent said they would throw it away. But, asked the same question about a serving of beef pot pie, 39 percent said they would toss it out.

How consumers judge the safety of refrigerated food was another topic examined. About 70 percent of the

Test your knowledge

How much do you know about judging the safety of stored food? Let's find out.

As part of the recent OSU study of discarded food, some people were shown three samples of iceberg lettuce: top quality lettuce, some with very slight rust on the base of an outer leaf, and some with rust on the cut edges and outer leaves. They were told that the top quality sample had been stored in a refrigerator the shortest amount of time and the rustiest sample the longest. Then researchers asked them "Which is the oldest lettuce you would serve on a sandwich?"

Which would you serve?

In the experiment, 40 percent of the people picked the unrusted lettuce. But 67 percent said they thought the oldest sample was perfectly safe to eat. That is true.

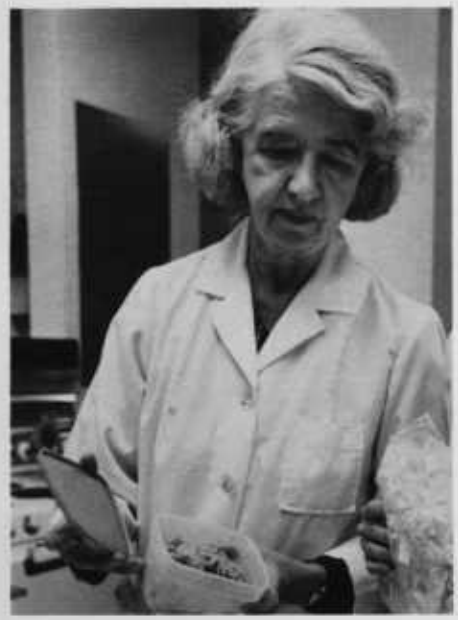
The researchers showed people a freshly thawed roasted turkey slice in a plastic container, told them the turkey had been stored in a refrigerator for four days, and asked if they would become ill if they ate it.

How would you come up with an answer, and what would your answer be?

Thirty-one percent made the decision without looking at the turkey. Nineteen percent looked it over, 46 percent lifted the turkey to their nose to smell it, and 2 percent touched the meat.

Their answers? Twenty-three percent felt the turkey would make them sick. Actually, if refrigerated properly, it would be safe, says OSU nutrition researcher Margy Woodburn.

The refrigerators of 21 percent of the people in the study weren't cold enough to keep food safe, says Woodburn, shown below.



people in the study suggested looking at the food, more than 85 percent said they would smell it, about 25 percent said they would taste it, and nearly 90 percent said the length of time in the refrigerator would be the important factor.

According to the research team, as long as a refrigerator is operating correctly at 45 degrees Fahrenheit, or lower, the length of a food item's stay in the refrigerator has little to do with its safety. But Woodburn and VanDeRiet note that when they tested the refrigerators of people taking part in the study 21 percent of them were not cold enough.

The researchers identified food preparers under 35 years of age, and those with low incomes, as important target groups for educational efforts.

"Younger householders, especially, need alternative criteria for evaluating leftover and unopened food, instead of relying simply on the package date or the expected shelf life," Woodburn said. "Consumers should be given clear, simple rules regarding the time and temperature relationships for safety of refrigerated foods. And we need to stress the importance of keeping refrigerator temperatures below 45 degrees Fahrenheit."

Many nutrition researchers think a lot of Americans throw food away unnecessarily because they have unreasonably high standards of quality. But in reviewing the results of this project, it becomes clear that confusion about how to store food, and how to judge the safety of it, are part of the reason we throw away as much as we do.

"The easy part's done," Woodburn said one day recently while shuffling through paperwork from the completed study. "Now we have to go out and start doing something about what we found."

"You know," she added, "we found the average dollar value of food discarded is $150 a year. People in economically stressed households could use that money to upgrade their nutritional status."

Temperature Zones

(in degrees Fahrenheit)

240	Canning temperature for low-acid vegetable, meat and poultry in pressure canner.
212	Canning temperature for fruits, tomatoes and pickles in water-bath canner.
185	Cooking temperatures destroy most bacteria. Time required to kill bacteria is less as temperature increases.
165	Warming temperatures prevent growth, but allow survival of some bacteria. However, quality and unstable vitamins are lost quickly.
140	Some bacterial growth may occur. Many bacteria survive.
125	DANGER ZONE: Temperatures in this zone allow rapid growth of bacteria and production of poisons by some bacteria. Don't hold food in this temperature zone for more than 2 to 3 hours. Quality may not change before food held at these temperatures becomes unsafe to eat.
60	Some growth of food poisoning bacteria may occur. Five hours is maximum safe holding time.
40	Cold temperatures permit slow growth of some bacteria that cause spoilage. Trim moldy area from foods. Discard smoked seafood after three weeks.
32	Freezing temperatures stop growth of bacteria but may allow some bacteria to survive. Do not store food above 10 degrees F. for more than a few weeks. Quality and unstable vitamins are lost in food stored above 0 degrees F.

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

Of Fababeans & Cuphea Genes

Hard times are boosting interest in the high-risk search for new and alternative crops that fit Oregon's varied conditions and shifting markets

BY BOB ROST

Last year the neighbors of Lou Hessi, who farms in Washington County near Portland, probably thought it was a little unusual when they saw him hand-weeding a one-acre patch of lupine, a flowering plant that produces edible seeds.

Hessi's major products are pigs, wheat, corn and oats. Why would he go to all that trouble, especially for a crop most people haven't even heard of?

"He just wanted to give his lupine a chance to mature," says Russ Karow, an agronomist with OSU's Extension Service. "I've encountered many growers willing to make a few sacrifices to experiment with a crop. Proper evaluation is nearly impossible unless the crop is allowed to mature free of weeds. Solutions to the weed control problems can come later."

More than 150 crops are produced in the state each year, which should tell you that Oregon farmers aren't strangers to the risks, costs and plain old hard work of experimenting with alternative crops.

In Hessi's case, he's evaluating the possibility of using a meal made from lupine seeds as a protein supplement in his hog feed. That could save him money.

Experimenting with alternative crops can be risky business for farmers, especially if they plant large acreages, but it is tricky business for the Agricultural Experiment Station scientists and Extension Service specialists and county agents who work with many of those farmers.

"We don't want to raise false hopes, but we also don't want to squelch interest in the crops either," says Karow. "Funds for most alternative crops are short. Much of the work is done with improvised resources—no funding per se. Even so, many growers are willing to give of their time and effort to piece it together."

To researchers and Extension personnel, there are important differences between what they call alternative crops and what they refer to as new crops.

A new crop is one that previously grew in the wild, one researchers are trying to domesticate. An alternative

BOB ROST

crop usually has been grown with commercial success some other place, explains Gary Jolliff, an agronomist with OSU's Agricultural Experiment Station. Obviously, developing new crops usually takes longer and costs more—with more chance of failure.

"With most alternative crops, looking at growth constraints is the number one priority. We want to know how to make the plant grow well in our climate," adds Karow. "With new crops, domestication and plant breeding research are the first concerns."

Rapeseed, a distant relative of the turnip, is an example of an alternative crop being studied in Oregon. The rapeseed plant, which reaches 3 to 5 feet in height and produces bright yellow flowers, yields from its seeds an oil that is edible or has value as a lubricant, depending on the variety. It already is being grown in the Willamette Valley, and Karow thinks there is sufficient demand to warrant higher production.

"At the moment, there is a tremendous world market for rapeseed oil," he says. "Canada is a volume producer of edible rapeseed oil (called Canola oil), but there is demand for more than Canada can presently produce."

State of Oregon trade teams sent to the Orient found interest high in Japan in rapeseed grown in the Willamette Valley, Karow says. No funding has been earmarked for applied research on rapeseed at OSU, but some plant variety research needs to be done to identify rapeseed geared to Oregon's climate, says the agronomist.

The lupine mentioned earlier and fababeans are two other alternative crops under consideration. Their seeds are sources of protein.

"No variety work has been done at OSU on either of these crops," says Karow. "What we've done is find a grower interested in putting in a test plot of one of these crops on his farm. I get the seed and give it to the grower, or identify seed sources for the grower. He plants the seed, and we just wait to see if it grows."

Last year, Oregon growers planted about 200 acres of fababeans. The beans, which when green resemble lima beans, are being evaluated as a feed for turkeys and swine.

Lupine is a year behind fababeans in development, says Karow. Washington researchers have done a lot of work with lupine, and OSU researchers and Extension Service specialists are using that information to speed work here.

OSU researcher Daryl Erhensing checks an experimental plot of pyrethrum. Ground blooms are sold as a flea powder for pets. An extract goes into insect sprays.

More than 150 crops are produced in the state each year.

The soybean is another alternative crop under consideration as a protein source. There are perhaps more than enough soybean-producing areas in the Midwest and South (the crop's current value reflects that). But Oregon farmers and ranchers import soybean meal, which they feed to livestock. Producing soybeans within the state would cut transportation costs, lower production costs and perhaps offer consumers less expensive meat and dairy products.

Soybean research at OSU has been aimed at determining what limits seed yield. One major limiting factor for growing soybeans in the Willamette Valley is low night temperatures that restrict growth.

According to Jolliff, funding for soybean research at OSU has been very low. As a result, researchers have been slowed in their work. But it is continuing. Researchers seem to agree that it is feasible that high-yielding soybean varieties could be developed if adequate long-term research funding and staffing were available.

Compared to most other alternative crops under study here, pyrethrum, a white, daisylike plant that belongs to the chrysanthemum family, may be in a good situation. Buyers can't seem to get enough of it, contends Daryl Erhensing, a researcher in OSU's crop science department.

Dried, ground pyrethrum blooms are sold as a flea powder for pets. The purified extract is the active ingredient in household insect sprays and sprays used to control pests around food processing equipment. Pyrethrum is practical for such uses because it is

almost harmless to warm-blooded animals. Until the arrival of DDT during World War II, it was one of only a few insecticides available.

"Pyrethrum has been grown in several parts of the world over the years," says Erhensing. "In the 1930s, the USDA put out test plots in 38 states, and two of the best locations for pyrethrum turned out to be near Albany and Hermiston."

The United States is the world's number one user of pyrethrum. Work on adapting the plant for cultivation in this country started because foreign suppliers such as Kenya, Ecuador, Tanzania and Rwanda have been inconsistent in price and supply. Erhensing hopes Oregon can contribute to a steady domestic supply.

The soybean is another alternative crop under consideration.

"We have excellent cooperators (growers) here who are willing to take risks, and sufficient private funding to see this development project through," he says. "Right now we're in a crash program to get pyrethrum into commercial production."

"Seed production, clonal development and plant propagation work are under way," he adds. "We want to generate the complete package of

DAVE KING

BOB ROST

Top: Learning to harvest the seeds of new crops, like the pyrethrum seeds here, is challenging. Bottom: Crop scientist Gary Jolliff with experimental soybeans growing at OSU's Hyslop Farm.

This one paid off

Amid plenty of prospective alternative and new crops that haven't yet made it into commercial production, and some downright failures, there are examples of recent successes in Oregon. One is garlic grown to be sold to commercial garlic growers as planting stock.

Farmers first planted it in Oregon in 1968. Up to that time, all the garlic planting stock produced in the West came from California or Nevada.

The California-based garlic industry liked the idea of getting planting stock from Oregon because it fit their planting schedules and garlic grown here was more vigorous and productive than planting stock grown in California.

The Willamette Valley's mild, Mediterranean-like climate is ideal for garlic production. Experiment Station scientists and Extension specialists and agents worked with farmers, and with California garlic industry organizations and companies, to get production started in the Willamette Valley. Now the crop has spilled over into Jefferson County in Central Oregon, an area especially suited for garlic production.

In 1984, Oregon farmers planted 1,900 acres of garlic for planting stock. The gross return was about $3.4 million.

Looking back into Oregon's agricultural history, a classic example of major economic impact from an alternative crop is the introduction of the grass seed industry in the Willamette Valley in the early 1960s.

information and recommendations needed to grow pyrethrum successfully."

At the opposite end of the spectrum from an alternative crop like pyrethrum is the new crop Cuphea. The low-growing, weedlike plant is in the earliest stages of research, and years of breeding work will be needed before commercial plantings can be considered.

Interest in Cuphea stems from the lauric acid oil the plant's seeds contain. The soap and detergent industries want this oil. The detergent industry would like to use Cuphea oil in place of coconut oil and palm kernel oil it now uses. Coconut oil must be imported. As with foreign sources of pyrethrum, maintaining a stable supply at a stable price has been a problem.

"We know little of the basic biology of Cuphea," says Steve Knapp, an OSU crop science researcher. "There are many questions to answer, including how to solve seed-shattering problems."

There are more than 200 species of the plant. "To begin our research, we had to decide right away which species to concentrate on and then study each intensively," Knapp says.

"This is high-risk research," he stresses. "We don't know that this crop can be easily managed. It's unrealistic to think that we will have Cuphea ready for commercial production in 10 years."

Meadowfoam, named for the way a field of it looks at the flowering stage, may be the most well-known new crop under study in Oregon, or at least the Willamette Valley. Research with it started—at OSU—in the early 1960s.

A low-growing plant like Cuphea, meadowfoam is planted in winter and produces a dense canopy of white flowers in June, a few weeks before harvest. Its seeds contain a high-quality oil that has many potential applications in cosmetics, lubricants and waxes.

Experiment Station researchers developed a meadowfoam variety called "Mermaid" for exclusive use by the Willamette Valley Meadowfoam Growers Association. They released the variety to growers in 1984.

Willamette Valley farmers have planted meadowfoam since 1980. The first commercial sale of meadowfoam oil was in June 1985 to a Japanese processing firm. That oil will be used in the manufacture of cosmetics.


DAVE KING

John Yungen, superintendent of the Medford branch experiment station, eyes Zinnias he's growing as a potential seed crop.

Making meadowfoam a profitable crop still appears to be an uphill battle, but Mike Stoltz, an Extension Service agent in Lane County, says the effort could pay off.

"There seems to be a lot of interest in meadowfoam oil now. This last crop of meadowfoam had the highest yields we've seen yet. Botrytis blight (a disease) wasn't much of a problem and we seem to be getting a handle on the pollination and fertility requirements of meadowfoam," says Stoltz.

"What's needed now are more sales," he adds. "The Japanese seem to be a little hesitant to buy in greater volume, possibly because they aren't sure we will be able to offer a consistent supply. Only time will solve that problem."

Meadowfoam oil might break into the industrial lubricants market, but only if growers are able to reduce the price enough to compete with industrial lubricants derived from petroleum, according to Stoltz.

"Dropping the price would mean getting the yields up, and right now that seems possible," he says.

These are some of the crops Oregon farmers and OSU researchers and Extension agents are experimenting with. New ones appear, and disappear, regularly. The search for alternative and new crops takes on added importance in hard economic times like those of recent years. Despite that, many of those familiar with the process emphasize— and re-emphasize—that it is a high-risk undertaking.

"The Japanese seem to be a little hesitant to buy in greater volume."

"It's not like working with a new wheat variety with a good chance of early success because you have the growing, processing, delivery and marketing systems established. This is all new. It's a different ball game. Everything must be coordinated," says Bob Witters, acting director of the Agricultural Experiment Station.

"But, in fact," adds Witters, "it's very important and we realize it. We're investing a lot of money in new and alternative crops research. Take a look around the state and you'll see that."

Bob Rost is a writer in OSU's Agricultural Communications Department.

LINDA McCORMICK

DAVE KING

Left: Meadowfoam has been a topic of alternative crop research at OSU since the early 1960s. Above: As part of flower seed research at Medford, OSU scientists are studying this ornamental flower, Echinacea.

Who speaks out for new crops?

Year after year across the United States, especially in states like Oregon where the growing conditions are diverse, farmers and researchers experiment with new crops, hoping they'll pay off. And some do. But what are the odds, really?

"In most cases, it's like going into Las Vegas with a nickel, hoping to hit the jackpot," claims one OSU scientist, referring to the limited resources usually available to develop new crops.

The status of research with new crops is discussed at length in a report issued last year by a task force set up by the U.S. Council for Agricultural Science and Technology, a national association of food and agricultural societies. Serving on the task force was OSU agronomist Gary Jolliff.

The report points out that most of the limited resources available for crop research and development are invested in established crops. It argues that research with new crops faces two formidable hurdles:

First, new crops don't have a constituency to promote them in legislative circles until they're approaching commercialization. Second, supporting new crops research is unattractive politically because the probability of a handsome payoff on any given new-crop project is low, or can't be expected to occur within the immediate future.

To give a chance to potential new crops that seem promising, research and development need to be sustained for many years, says the report. Mentioning a few examples like sunflowers, avocados and soybeans, it speculates that in the future, as in the past, the value returned to the American public by the few successes will more than make up for failures.

The report discusses a number of specific benefits that come from developing new crops. They include reducing the economic vulnerability of American farmers; combating problems like air pollution, soil erosion and rapid proliferation of crop pests facing farmers and consumers; reducing unwieldy surpluses of some crops; improving the country's balance of payments, and providing a stable supply of crops strategically important to the nation.

Options for improving new crop development presented in the report are 1) increasing federal support for existing research around the country, 2) expanding U.S. Department of Agriculture research, 3) setting up a national new crops coordinating council as a joint government-industry entity to assist researchers in finding funding and entrepreneurs in finding potential enterprises, and 4) establishing a national new crops institute that would do research, train technicians and assist entrepreneurs with new-crop enterprises.

Any of the options would help "reduce fluctuations in funding from year to year and would provide relatively stable long-term support," says the report.

Or, it says, the country could do nothing new.

"Pursuing this option," the task force concluded, "would perpetuate the current situation in which development of most new crops is a slow process because of the absence of a commitment to sustained effort and the inability to bring together the various disciplines needed to carry out all aspects of the work."

Copies of the report are available for $2.50 each from the Council for Agricultural Science and Technology headquarters, 250 Memorial Union, Ames, IA 50011.

Brazil's lesson still with him

Clint Shock may have a green thumb, but he's used it for a lot more than growing tomatoes.

The superintendent of OSU's Malheur Agricultural Experiment Station at Ontario once hitchhiked 750 miles from a small settlement in the jungles of Brazil into the city of Sao Paulo.

Heck, that was nothing. He made the return trip—still hitchhiking—carrying 10,000 harvest sacks.

That was in 1968. Shock and his wife, Candace, had gone to Brazil through a missionary program sponsored by the United Methodist Church. They became involved with a poor people's cooperative made up of about 400 Brazilian families that had carved 80-acre farms out of the jungle.

"The trouble was, those people were paying some local moneylenders about 10 percent over inflation a month to get the materials they needed to farm. The whole area worked for a dozen men," says Shock, recalling the hopelessness of the situation.

Because the Brazilian government had not issued the families clear titles to their farms, they couldn't get credit from banks. As in the coal company towns that once existed in America, the families continually "owed their souls to the company store"—in this case the moneylenders, who took crops in payment and sold them for a handsome profit.

The United Church of Canada and insecticide and chemical companies loaned 52 of the poor families enough money to plant a peanut crop without the lenders' help. The Shocks and others hoped the families could prove they were good credit risks. Things went well until rainy weather during harvest caused them to run out of the bags they were going to use to market the crop.

Shock's highway odyssey began.

"The first night I spent in a park under a bench. It was raining," he remembers.

The next day he got to Sao Paulo but no one would sell bags on credit, so he went to a city nearby. Exhausted, he promptly fell asleep in the office of a factory owner who had taken pity on him and given him coffee and a sweet roll.

The owner thought the episode was funny and eventually sold Shock the bags he needed on credit. The factory owner also found Shock a 200-mile ride with a truckdriver. A trucker he met at a gas station took him another 150 miles toward the settlement. Then, left on the open road, he thumbed it the rest of the way in vehicles big enough to carry his load.

The people sold their own peanuts, and the moneylenders and Brazilian government got the message. The government gave the families clear titles to the land so they could get credit through banks. Today, the former jungle area "looks like Iowa" when you fly over it, says Shock.

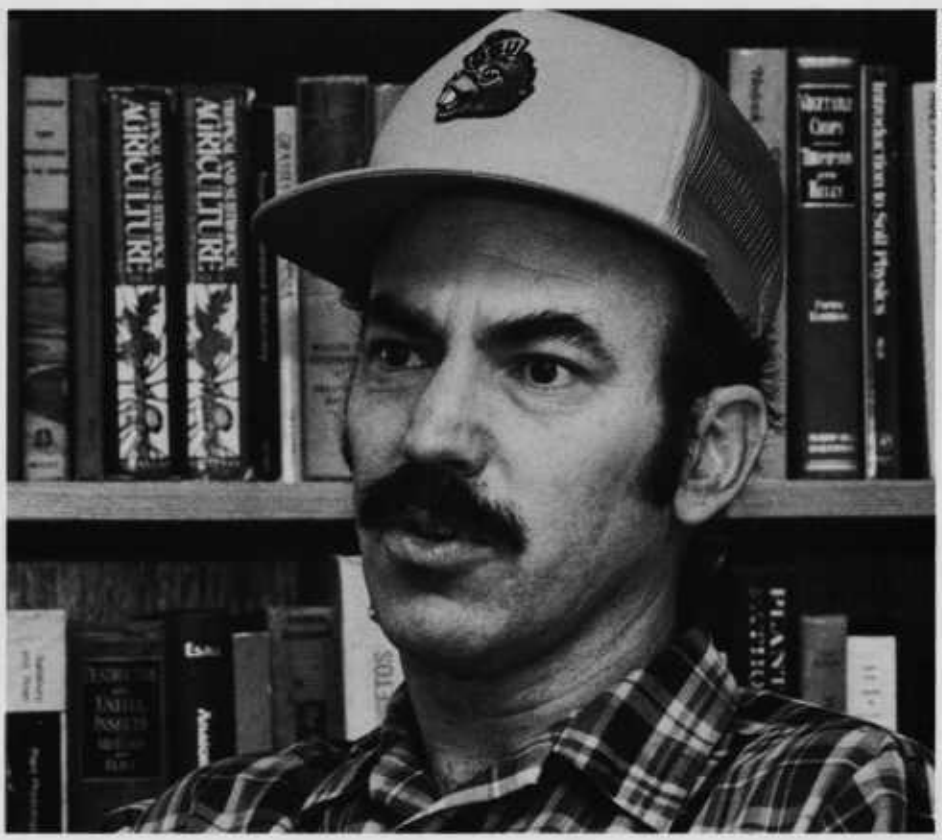
He and his wife spent 10 years in all in Brazil, where he also worked as leader of erosion control, revegetation and crop research projects for an international institute. The experience in that country may have taught him as much as his Ph.D. training in agronomy at the University of California at Davis, he says.

"The Brazilians, though they have their problems, are very kind and nonviolent, and through them we learned to look for the good things in people and not be so concerned with defects and inadequacies."

He and his wife learned to ignore minor hardships, too.

"Before Brazil," says Shock, who grew up in Southern California and came to OSU last year from a research job with Louisiana State University, "I never would have thought I could stand harsh winters like we have in Ontario. But my wife and kids and I love it here. We have a wide range of crops that grow well, and the people are really warm and friendly."

— A.D.



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Clint Shock

A New Crop?

(See page 18.)

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