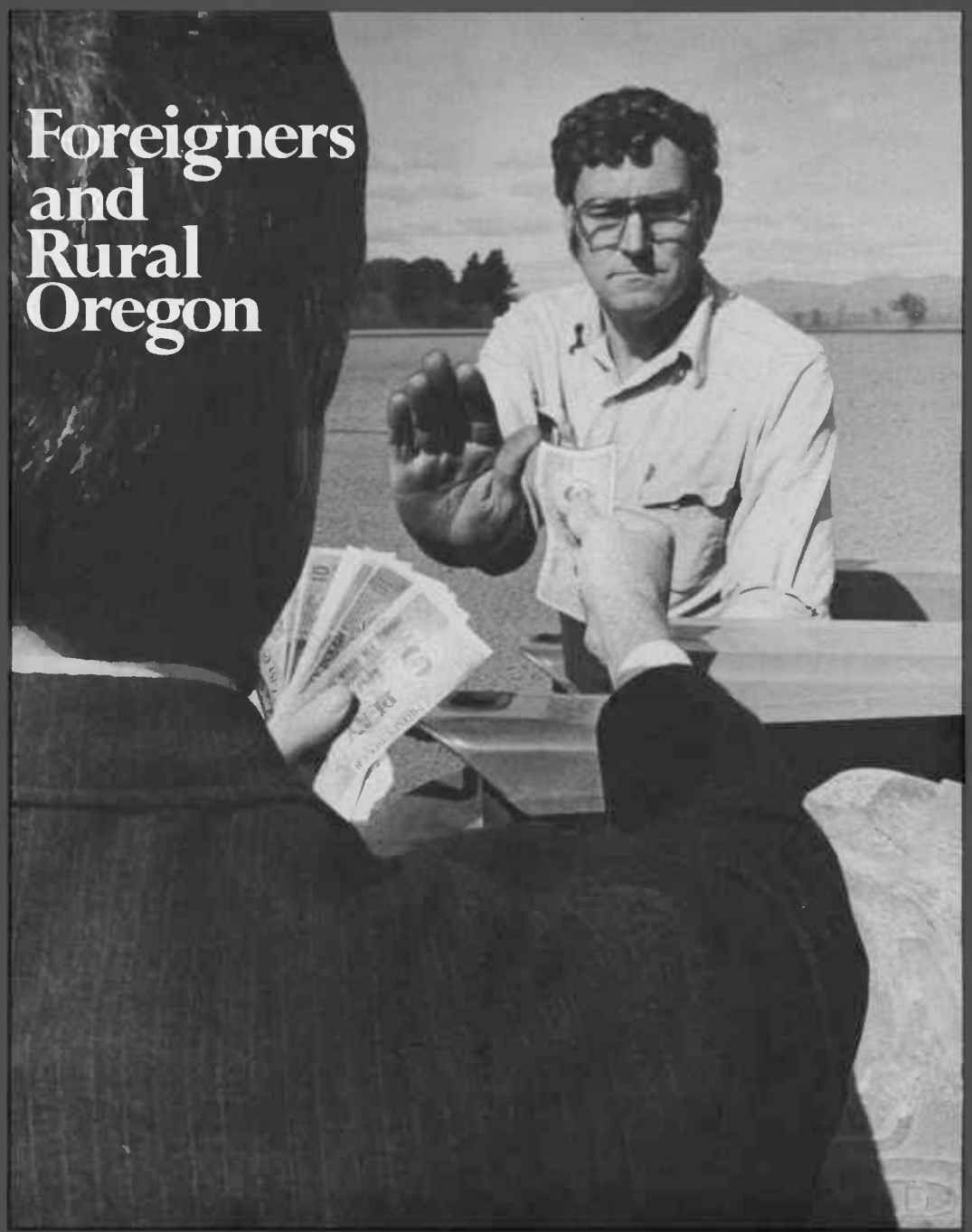
Oregon's Agricultural
Progress
Fall 1980

Acid Rain & Crops

Foreigners and Rural Oregon



Agricultural Experiment Station
Oregon State University

comment

Director John R. Davis

Hang in there: it builds character

During the early days of August, when the Oregon Legislature met in special session to consider budget reductions, many of us reminisced about similar times in previous years, or about situations in other states where budget problems reached crisis proportions.

In some states, we recalled, employees were not paid for a month or so; in others, scrip was issued and merchants agreed to accept that scrip so state employees could buy groceries and other necessities. People worked together with understanding and determination to succeed in spite of the problems.

The same spirit prevailed in Oregon this time, and I am extremely proud of the faculty and staff of the Agricultural Experiment Station for their attitude toward the state's budget problems. In one department, for example, a number of faculty volunteered to take a month leave without pay if salary savings would prevent termination of other employees' jobs. Others talked about a four-day work week—all to save jobs for technicians, secretaries and students.

Sharing the sacrifices

Fortunately, we will not need to resort to such financial extremes to save jobs. But the spirit and the willingness to share in the financial sacrifices were right up front and one can't help but feel great personal pleasure in being a part of this organization. I anticipate that these same faculty and staff members will devote extra time and effort this year to offset some of the budget shortages and to attempt to assure that our research is continued—or at least maintained—with high standards of quality.

When we recruit young scientists for the Agricultural Experiment Station, we usually search nationally to locate persons best qualified for the position. Often in the past we would facetiously point to the Three Sisters, and place a value on each one, as a means of competing with some of the higher salaries offered by other schools.

We would tell these prospective faculty members that if the state ever fell on hard times, and budgets were cut, at least they would be in an area with beautiful surroundings where the environment was conducive to productive thinking.

Little did we realize how true our suggestions were. And, now that we are put to the test, I can see that we understated our ability to respond to problems. We live in a beautiful state with a superior climate and marvelous scenery. But we also live in a state with beautiful people—people who will carry their share of the load when the going gets tough.

Oregonians are extremely independent in politics, in ethical beliefs and in many other ways. Just the same, when we have a common tragedy or the community at large is in trouble, Oregonians seem to be able to put aside their urge for independence and really pull together.

Of course, that's good, and it is typical of the American way of life. When we emerge from our financial crisis—when the lumber industry starts to pick up again, and when the economy of the state and the country starts to move in a positive direction—will these attitudes still prevail?

Will we be willing to recognize that, economically speaking, the other guy still has acute problems? Will we work together to solve them?

It seems to me troubles such as budget cuts in important public service areas may build character. We should take advantage of these tougher times and learn to work together more closely when times are good. This is when an organization such as a university can help people most, because knowledge also builds character and helps sustain that high character.

Tough times

These are tough times for the state, the University and the Agricultural Experiment Station. But the tough get going, and through all this adversity we surely will prove our character and our worth to all the people of the state. We expect your sympathy (keep those cards and letters coming). But, most of all, we expect you to recognize our values and our character. Together, with strengthened determination and a renewed economy, we can build a stronger university and an Agricultural Experiment Station capable of even more outstanding achievements.

Hang in there with us, and with all of agriculture.

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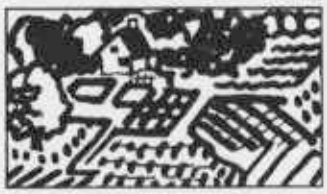
Richard Floyd, Editor
Experiment Station Communications

Dave King, Assistant Editor
Experiment Station Communications

Andy Duncan, Editor
Oregon's Agricultural Progress

Marilyn Holsinger, Designer
Oregon's Agricultural Progress

Cover: OSU researchers have characterized rural landowners. See page 12. (Photo: Dave King.)



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Microbiologist Bill Sandine, second from left, chats with research assistants in his laboratory. Facing Sandine are: Tom Dohman, far right; Yakubu Izaguabe, foreground; Thomas Kling. On Sandine's right is David Heatherbell, OSU food scientist.

Thanks to Bill Sandine

cheese makers

are losing their fear of viruses

Little Miss Muffet sat on a tuffet eating her curds and whey. Along came a virus . . . and it just about spoiled everything.

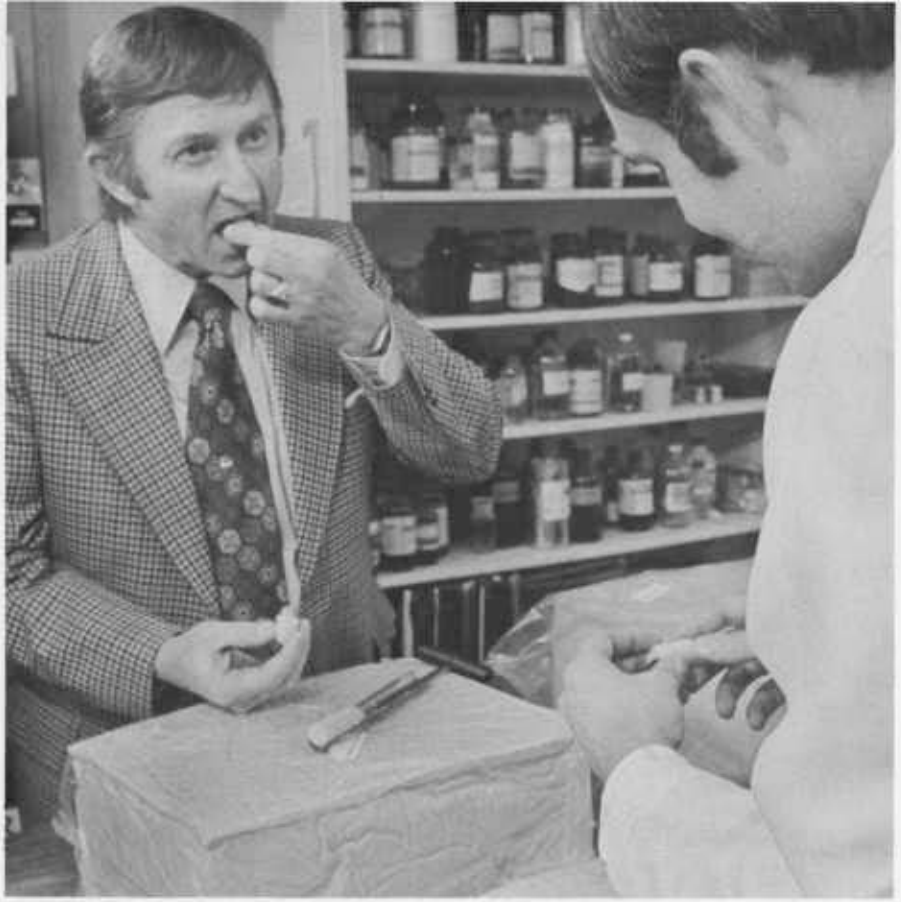
Well, that's sort of a silly way of introducing what OSU microbiologist Bill Sandine has been up against the last couple of years. But it steers you in the right direction.

The point of this story is that Sandine's work with curds and viruses apparently is going to pay off big for Oregon's—the entire nation's—cheesemakers (and those of us who love to eat cheese).

The somewhat modest researcher has delivered to the cheese industry a production technique, intended to thwart troublesome viruses, which by his own estimate will save "millions of dollars a year."

A brief description of how cheese is made helps explain what Sandine and his research assistants have accomplished in their OSU laboratory:

Cheesemakers depend on bacteria (colonies of "good" bacteria called starter cultures) to convert materials in



Sandine samples cheese with research assistant Randy Thunell. Cheese plants in Tillamook and Portland, plus two in Washington, already are using the technique the OSU scientist developed to prevent spoilage caused by viruses.

milk into the solid, cheeselike substance called curd. It is the first step in making each of the thousands of kinds of cheese. From that point, differences in how the curd is processed (fermented, baked, molded, salted, contaminated with other types of bacteria, as in odorous limburger cheese, etc.) determine the texture and flavor of the various cheeses many of us enjoy eating.

Sandine's work zeroed in on that initial step, when the starter culture converts milk sugar to lactic acid, which in turn causes the protein in milk to coagulate into curd (the remaining liquid is whey).

He knew certain viruses regularly invade starter cultures at cheese factories and hamper the bacteria in their attempts to convert milk sugar into lactic acid. The end product of the microscopic skirmishing frequently is a vat of partially-soured milk rather than curd suitable for cheesemaking, and such spoilage often costs average-sized factories more than $50,000 a year.

Let's try to cut the waste, Sandine and his associates decided.

Knowing the viruses could alter themselves—by mutation—and effectively attack any new bacteria strain they might develop, the researchers theorized they could foil the organisms by devising a way cheesemakers could keep a step ahead.

The plan worked.

The technique Sandine's research group developed—OSU has applied for a patent on it—involves showing cheese firms how to mix several "diverse types" of bacteria to create a starter culture.

When viruses attack one of the strains, Sandine explained, that strain of bacteria is pulled out of the culture and the cheesemakers employ the mutation process for a little razzle-dazzle of their own.

They examine the bacteria under siege and pick out cells successfully resisting the virus invaders (usually there are a few). Then those "super bacteria" are cultured and returned to the starter culture.

"Viruses keep showing up," said Sandine. "But now the cheesemakers stay a step ahead and avoid spoilage. The starter strains are so different that, if one is vulnerable to a virus, the others won't be. The starter culture never has to be changed."

That is important because in the past cheesemakers have had to change starter cultures every two or three vats (a costly annoyance). Many have designed and built multimillion-dollar facilities to protect their bacteria from viruses.

Sandine said cheese plants in Tillamook and Portland, and two in Washington state, are using the new culturing technique on an experimental basis.

"The firms report a night-and-day difference," he said. "They no longer live in fear of viruses."

The success hasn't daunted Sandine. He has joined forces with an OSU pharmacy professor, James Ayers, and some graduate students, to develop a new type of medium—growing environment—for starter culture bacteria, and he is eyeing the possibility of using "genetic engineering" to construct bacteria that produce lactic acid from milk sugar more effectively.

The bacteria medium already is being sold by a firm in the Midwest, and Sandine said sales to date suggest there is a U.S. market for millions of pounds a year—at about $1 a pound.

Royalties to OSU from sale of the patented medium may reach several hundred thousand dollars a year, according to Sandine and Ayers, who, as the inventors, also are receiving royalties.

Is Sandine's attention focused entirely on cheese? No, wine fanciers may be happy to know. He is optimistic about locating and culturing a type of bacteria that can help assure Oregon winemakers of a quality vintage year to year (for details, see Work in Progress, Page 14).

Eliminating tall ladders in cherry orchards is one of the goals of horticulturist Maxine Thompson, shown here inspecting mutant trees at OSU's Lewis-Brown Horticultural Farm near Corvallis.

Maxine's Cherry

Just about every time Maxine Thompson tucks a little bag under her arm, strolls out of her Cordley Hall laboratory and crosses OSU's shady lawns to a single-story brick building near the west edge of the campus, Agricultural Experiment Station cherry research plunges deeper into the atomic age.

That's because she drops off the bags, filled with cherry tree shoots used for grafting, called scions, at the OSU Radiation Center.

"We get a lot of weird cherry trees," says the horticulturist of the radiation experimentation she started several years ago. "Some are sterile. Some have speckled leaves. Some have different branching habits. We get a lot of junk, a lot of mistakes. But there's always the chance of a mutant carrying something good. That makes it worthwhile."

The purpose of the research, of course, is to produce more efficient trees and give a lift to Oregon's second largest fruit industry (trailing only the pear industry, the state's cherry industry in 1979 produced 38,000 tons of sweet cherries worth $20.7 million to farmers and 2,000 tons of tart cherries worth $1.8 million to farmers).

Specifically, Thompson hopes to help solve harvesting problems caused by the 20- to 25-foot-high cherry trees in many farmers' orchards.

"Compact, or dwarf, trees that produce just as many, or more, good cherries in less space would help growers get rid of long ladders and might have stiffer limbs better for mechanical harvesting," says the researcher, adding that similar research is being conducted in Italy and England.

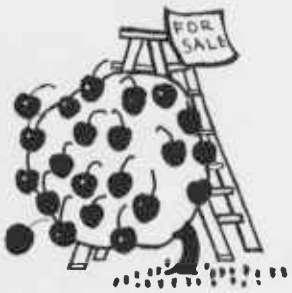
"And compact trees certainly would be popular for backyards, too," she added. "There usually isn't much room and people have to have at least two trees for cross-pollination."

Thompson's plan for producing a commercial quality compact cherry tree (several dwarf varieties exist but are not widely grown) centers on the radiation experiments, which may seem exotic but have been used in fruit research since the 1930s.

When she takes a bag of scions to the Radiation Center, the shoots are packed into a small container, which then is placed inside a six-foot-high lead cylinder and exposed to doses of gamma rays from a highly radioactive substance called Cobalt 60 (similar to the type of cobalt physicians use to kill cancerous cells).

In the cylinder, the fast-moving gamma rays blast through the scions, occasionally altering a scion cell's molecular structure. When the irradiation, which can take from a few minutes to several hours, is completed, Thompson takes the scions back to her lab and eventually to research plots to be grafted onto cherry rootstocks. The result may be the "weird" cherry trees she describes, or gamma radiation may have caused a beneficial mutation (genetic change)—and the growth of a compact tree.

"About one plant out of a thousand from the irradiated buds develops into a compact, mutant tree," says Thompson. "Then we have to repropagate it and grow several trees



to evaluate its fruit quality, how quickly it produces, how much it produces, its resistance to disease, and so on."

The advantage of using radiation to produce a new cherry tree variety, instead of cross-breeding two trees, is that, generally, a tree grown from an irradiated scion has only one or two traits different from the tree that produced the scion, the researcher says.

"If you start cross-breeding, many different characteristics show up," says Thompson, "and we don't want that because most of our cherry varieties

Trees

(the atomic dwarfs)

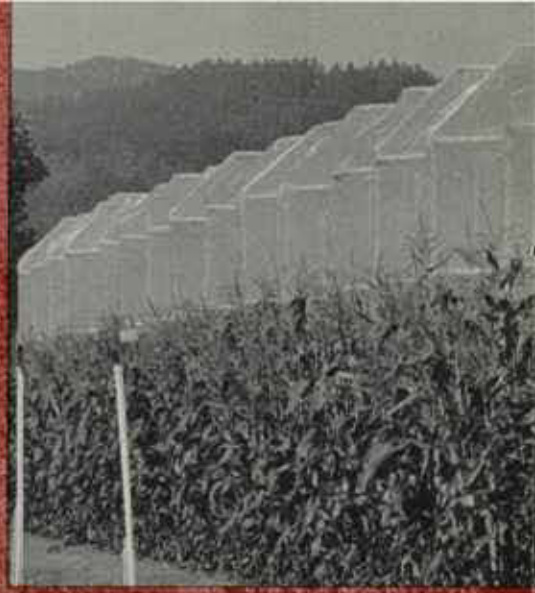
are well adapted. We just want a smaller, more efficient tree."

Even using radiation, developing new cherry tree varieties can be a painstakingly slow process, adds Thompson, who is experimenting not only with scions from Oregon trees but with scions from trees developed in other parts of the world.

"We do have one 'Royal Ann' compact mutant now that looks promising," she says. "It had many flowers the second year (a good sign). Now we want to propagate it on different rootstocks to see how it performs."

But it is still a little early to size up the mutant tree's commercial potential, says Thompson. That's why she plans to keep delivering little bags to a single-story brick building near the west edge of the OSU campus.

Several of Thompson's compact cherry trees, center, are "dwarfed" by conventional trees about the same age.



The goings on inside their plastic bubbles is taking OSU crop scientists into the center of the storm over

ACID RA

Imagine a fall rain shower laced with acid.

Imagine how such rains, which occur regularly in some parts of the country, might affect the fruits and vegetables that pour into your grocery store.

Now you have an idea of what researchers are trying to learn in a project (the largest of its kind in the country) underway at OSU's experimental Schmidt Farm just north of Corvallis.

The study, funded by the U.S. Environmental Protection Agency and conducted by Experiment Station researchers from OSU's crop science department, is examining how 18 major field crops, ranging from tomatoes to tall fescue (a pasture grass), react to acid rain.

You may wonder how plain old rain becomes acid rain.

The term was coined in 1972 by researchers in the northeastern United States who were studying lakes where fish were dying because of high acid levels in the water. The culprit, it was discovered, was acid in snow runoff and rain that had been formed by a series of chemical reactions that began when pollutants—sulfur dioxides and nitrogen oxides—were spewed into the air from industrial plants (such as electrical generating plants burning coal, oil or gas fuel). Automobile exhausts, too, were found to be contributing to formation of sulfuric and nitric acid in the snow and rain.

Later, with acid rain-related environmental problems on the rise, EPA decided to conduct studies around the country to assess the hazards, including the potential impact on farmland and on crops.

Did the federal agency pick Oregon as the site of its major crop study (soil studies are being conducted elsewhere) because acid rain is a problem in the state?

Quite the opposite. EPA wanted the crop study done in an area generally unexposed to the phenomenon so controlled testing would not be influenced by naturally occurring acid showers, and Oregon fit the bill (although acid rain has fallen on the state a couple of times since in isolated incidents caused by volcanic fallout from Mount St. Helens).

The location of an EPA research laboratory in Corvallis, and a link between that facility and OSU crop scientists who were studying the effects of gaseous pollutants on crops as part of a contract with EPA, contributed to Oregon's selection as the study site, too, explains Cynthia Cohen. She is overseeing the acid rain project along with fellow OSU crop science research assistants Shelton Perrigan and Lou Grothaus, and biologist Jeff Lee and agronomist Grady Neely, both of EPA's Corvallis laboratory.

When the acid rain project commenced, rows of blue sheds, used in the earlier study to house crops being fumigated with gases, already had given Schmidt Farm an unusual look. These days, the facility resembles a science fiction "moon colony": transparent plastic bubbles dot the landscape.

The bubbles are "rain chambers." Some, about 15 feet in diameter, and others, about 8 feet in diameter, are stationary and contain tiny patches of lettuce, onions, alfalfa and other plants. Mobile chambers (about 10 feet in diameter) stacked in line nearby are

Left: Crop scientist Cynthia Cohen, above. Mobile plastic bubbles are used at OSU's Schmitt Farm to cover field stands (as here) during coastal "rain events." Right: Workers lift a bubble over test plants.

AIN

used to cover field stands of corn and other crops three times a week during simulated acid rain showers (the crops also receive supplemental irrigation).

The source of the manmade rain is planted firmly on earth. It is a small combination pumphouse-chemistry laboratory. From the pumphouse technicians direct various mixtures of acids and water to sprinklers in the chambers.

It is a set-up Mother Nature might admire.

The researchers plant the same crops in each of the bubbles, then during their growing cycle the plants are sprinkled, some with one acid concoction, some with another, and some with a mixture similar to "normal" rain. Day after day, the researchers record exactly what rains down on the crops, and how the plants react. Then they analyze the yields.

In last year's initial study, three strengths of sulfuric acid rain (which is not "terribly realistic," said Cohen, because most acid rain is a combination of sulfuric and nitric acid) were applied to test crops.

The results may surprise you.

the Threat Scale: 7.0 is neutral

The threat to agriculture from acid rain is a matter of scale.

Although the impact of weak acid concentrations on crops may be negligible, or even positive, some researchers believe higher concentrations may be able to destroy plant tissue, remove nutrients from the soil, interfere with photosynthesis, and cause other problems for farmers (see "Rain of Troubles" in the July/August issue of *Science 80,* magazine of the American Association for the Advancement of Science, for more details).

Chief goals of OSU crop scientists in their study are to find the points on the pH scale (the chemical system for ranking acidity and alkalinity) where acid rain affects various crops, and to learn what the effects are.

On the pH scale, a rating of 7.0 is neutral, a pH above 7.0, alkaline, and a pH below 7.0, acid.

In their crop testing, the OSU researchers are applying acid rain with pH levels of 4.0, 3.5 and 3.0.

In last year's experiments with sulfuric acid rain, most crop damage occurred in chambers where plants were subjected to acid rain with a pH of 3.0 (about the acidity of vinegar).

How strong is "real" acid rain where it occurs these days?

According to the *Science 80* article, rain with a pH of about 1.5 has been recorded in Wheeling, West Virginia, on occasion, and the average pH of precipitation in large areas of the East has dropped from well above 6.0 in the 1950s to a range of 4.5 to 4.0.

Although winds can carry the pollutants that cause acid rain thousands of miles, wind patterns and a lack of industrial pollution sources have left the Pacific Northwest generally unscathed . . . so far.

Left: "Acid rains" at Schmidt Farm come from a bottle. Above: Plants inside a stationary test chamber glisten with manmade rain.

Researchers record the precise amount of acid rain used in the plastic bubbles . . . and exactly how plants react.

Some plants were damaged by the acid rain, some were not, and some (tomatoes, for example) actually produced better yields, Cohen said, adding that the researchers examined the acids' influence on the plants as a whole, as well as the marketable parts.

This year the researchers are trying to make the acid rain tests more realistic by applying combinations of sulfuric and nitric acid, as well as conducting a second year of tests with sulfuric acid rain. They also are testing crops growing in the field by placing the mobile bubbles over the same field areas during regularly scheduled "rain events." The field work will tell them if plants react the same way there as in the chambers.

But the scientists are, themselves, realistic.

"Let's face it," said Cohen. "We aren't creating a lifelike situation. Our rain is scheduled whether it's cloudy or sunny, and the acid level doesn't start high and drop like it may during naturally occurring acid rains. This just gives us a place to start."

It is too early to discuss the effect of acid rain on particular crops, said Cohen, who believes that some people—members of the news media in particular—may be premature in citing acid rain as a major threat to agriculture.

"The crop studies are in an early phase," she said, "and we really don't know if the overall effect will turn out to be positive or negative. Some think acid rain will help meet plant nutrient requirements. Others think it will be damaging. From a scientific point of view, it's too early to generalize. What happens in one year with corn, or spinach, can be misleading. We have to stay in business awhile before we can draw general conclusions."

And that—staying in business—depends on EPA. The OSU researchers are completing the final year of a two-year contract with the agency. They plan to submit a proposal calling for five additional years of cooperative crop study, with EPA funding the work and helping plan research, said Cohen, adding confidently, "I'm sure we'll be here for a while."

So will acid rains, say scientists across the country who point to the increasing number occurring not only in the highly industrialized Northeast, but also in the southeastern United States, the Midwest, the Rocky Mountains, Southern California and other areas.

How much of a problem could acid rain become if researchers, industry and you and I (representing the nation's automobile operators) ignored it?

"Someone told me there are places in the East now, like Wheeling, West Virginia, where during the first 15 minutes of a storm the rain is so acid it's capable of melting the nylon hose right off the sole of a woman's foot if she steps in a puddle," said EPA researcher Grady Neely.

Enough said?

Who owns rural Oregon?

It's a recurring dream that seems to torment more than a few Oregonians: A horde of "foreigners" has slipped over the state border and is gobbling up the deeds to huge parcels of rural land.

But it is a nightmare with no base in reality, reports an Experiment Station researcher who looked into the matter.

The truth is, "foreigners own less than one percent of the private, rural land in Oregon," said Ludwig M. Eisgruber, head of OSU's department of agricultural and resource economics.

"About 82 percent of the private, rural landowners, holding deeds to about 66 percent of the property, live in the state," he said, adding that almost all the remaining 34 percent of the land is owned by people who live in other states.

Eisgruber and former research assistant R. Proffitt Shirack, now employed by Oregon's Land Conservation and Development Commission, came to those conclusions while examining 1975 property tax records for the state's 36 counties as part of a study intended to check the validity of growing public concerns about land ownership characteristics, land use and the rights of landowners.

To get at their objectives, the researchers not only pored over the tax records but sent questionnaires to thousands of landowners to gather other types of information, explained Eisgruber, who said 1975 property tax records still were useful because land ownership turnover in Oregon averages less than 3 percent a year.

The agricultural economist said the survey results pinpointed some misconceptions about privately owned rural land.

The study suggested, for example, the notion that foreign purchases in Oregon are driving up land prices is off target.

"We found no evidence that foreigners pay more for land," said Eisgruber. "They do seem to buy quality land, so it seems they are paying a higher price. But they pay no more for good, quality land than American buyers."

According to OSU agricultural economist Ludwig Eisgruber, right, "foreigners" own less than 1 percent of the private, rural land in Oregon. Most foreign owners are from western Europe—not oil-rich Middle East countries as some might suspect, he adds.

The study suggested that "the rich" do not own most of the land, as some suspect. Two-thirds of the rural landowners studied, owning 40 percent of the land covered by the survey, earned less than $20,000 a year. People with incomes of $50,000 a year or more made up 8 percent of the owners and owned 38 percent of the land.

False is the assumption that "the only way to acquire land is through inheritance," the survey indicated. About 85 percent of the owners said they bought their land. Only 7 percent had inherited it.

For the study, Eisgruber and Shirack divided Oregon into six regions: Coast (Clatsop, Columbia, Coos, Curry, Lincoln and Tillamook counties); Valley (Benton, Clackamas, Lane, Linn, Marion, Multnomah, Polk, Washington and Yamhill counties); Southwestern (Douglas, Jackson and Josephine counties); Northcentral (Gilliam, Hood River, Morrow, Sherman, Umatilla and Wasco counties); Southcentral (Crook, Deschutes, Grant, Harney, Jefferson, Klamath, Lake and Wheeler counties), and Eastern (Baker, Malheur, Union and Wallowa counties).

Among other landowner characteristics suggested by the questionnaires' results:

- The percent of Oregon land owned by local residents is highest in the Eastern region (87 percent) and lowest in the Coast region (28 percent). But the percent of resident owners is highest in the Valley region (83 percent) and lowest in the Southcentral region (41 percent).
- Only 14 percent of the state's rural, private landowners are farmers. They own 29 percent of the private, rural land (which makes up about 40 percent of Oregon land; about 51 percent is publicly owned).
- Nonfamily corporations with timber or agricultural interests own 51 percent of the private, rural land but make up only 4 percent of the landowners. (However, this may be an overestimate, said Eisgruber, because an unusually high percentage of nonfamily corporations responded to the survey).
- Ownership of the remaining 20 percent of the rural acreage is divided equally among retirees (who make up 23 percent of the owners) and "all other occupations" (making up 56 percent of the owners, including people who live in unincorporated surburban areas).
- More owners in the Southwestern region than any other expect their land to be developed in the next five years. But the majority of owners studied—54 percent—said they were not holding their land for development.

How does foreign land ownership in Oregon today compare with that of 25 years ago?

"I don't know for sure," said Eisgruber. "No studies I know of were done until we started. What we have is a snapshot. We have no historical information to compare the data to. But, nationally, we know foreigners just started buying U.S. land, to any substantial degree, about 15 years ago. The most popular area now is the Southeast. Land is cheaper there, they don't have the water problems we do out west, and forestry—an industry that interests foreign buyers—is booming in that area. There is no evidence that suggests the pattern we found in Oregon is out of line. USDA just released a study that shows less than 1 percent of U.S. land is foreign-owned."

How about out-of-staters? Are they gobbling up land in rural Oregon?

"That's another area with no historical documentation," Eisgruber said. "We don't know what out-of-state ownership was in the past. We're thinking maybe we need to do a study of that every 15 years or so from now on.

"This is just an educated guess," he added, "but I don't think there is a big trend toward a greater percentage of out-of-state ownership of rural land . . . on an acreage basis. I've seen nothing to suggest that."

Skepticism about 'gougers'

Pity the poor "side-hill gouger." The elusive critter (never actually sighted by anyone we know of) always has had to put up with shorter legs on one side than the other.

As if that wasn't enough, now an OSU researcher is challenging its very existence, trying to explain away its legendary role in nature.

The story—most often told with a twinkle in the eye—goes that it is the round-the-hill grazing pattern of the four-legged beast that carves out the narrow terraces that circle many hillsides in the Northwest.

Geology and the weather are more likely causes of the formations, called "terracettes," contends John Buckhouse, an OSU rangeland resources professor who studied the topic with former OSU colleague Bill Krueger, now at Colorado State University.

"This really is more of an observation than a scientific look," said Buckhouse. "But Bill and I are guessing it takes relatively deep soils—like those on north slopes in the Northwest—and a process of freezing and thawing to make the ground heave and form those terracettes."

The researcher said he and Krueger inspected and photographed many terraced slopes, reviewed scientific articles, talked with farmers and ranchers and questioned geologists to come up with their theory.

According to Buckhouse, many gouger skeptics think the terraces, also referred to as cat steps or stock trails, were formed 75 to 100 years ago by livestock overgrazing.

He believes cattle, sheep and wild animals do accentuate the terraces by using them as convenient pathways. But he said he has seen a number of terracettes in Oregon's Columbia River Gorge and elsewhere bounded on all sides by cliffs and rock outcroppings and inaccessible to livestock.

Buckhouse doubts there ever were enough wild animals in the areas to create the terraces.

Other clues he said point to a geologic origin:

- Many terracettes end apruptly at the meeting point of different soil types.
- Almost all he has seen are on north slopes, where soils tend to be deeper, wetter and subjected to more freezing and thawing because they receive less direct sunlight.

Buckhouse said federal Bureau of Land Management researchers are studying terracettes to find out if they help or hurt rangeland. They may help curb erosion.

He and Krueger plan to publish an article on the terraces in an upcoming issue of *Rangelands,* a range management journal.

A new step in winemaking

Oregon wine should be made with Oregon bacteria, two Experiment Station scientists have decided.

So the researchers, microbiologist Bill Sandine and food scientist David Heatherbell, are working to give winemakers a home-grown type of "lactic acid" bacteria.

When needed, they explained, such bacteria can be added to wine after it is initially fermented to improve the wine's flavor and aroma, primarily by reducing acidity.

Heatherbell, a winemaking specialist, said many of Oregon's 30 or so bonded wineries now use a "quite acceptable general type" of lactic acid bacteria—isolated from California wine—for secondary fermentation of their product (the process is called "malo-lactic fermentation").

"But here in Oregon, although we produce highly regarded wines, we do have years when the weather causes conditions of high acidity," he said. "It would help to have an organism adapted specifically to Oregon. The big payoff would be being in a position to deacidify and modify quality more consistently."

Bacteria carry out malo-lactic fermentation naturally, explained the researcher. But the natural process can result in sweeping differences in wine quality.

By inoculating wine with bacteria, winemakers can control the process, including making sure it takes place before the wine is bottled. After bottling, such fermentation can cause buildups of carbon dioxide, undesirable flavors and buildups of haze and sediment.

"We have isolated about half a dozen varieties of bacteria—and about 20 strains of those—in the laboratory and we plan to start inoculating wine from the 1980 grape harvest this fall to find out which works best," said Sandine, who is being assisted by graduate students Tom Dohman, Yakubu Izuagbe and Thomas Kling.

Sandine said he hopes to identify a bacteria Oregon winemakers can use during the 1981 wine season.

According to Heatherbell, malo-lactic fermentation generally is more effective in red wine than white. He and Sandine hope to identify bacteria for both.

He said an increasing number of French winemakers use bacterial inoculation to induce secondary fermentation. Most German winemakers favor using a chemical, calcium carbonate, he said.

If young women eat vegetables, do they reduce cancer risks?

Experiment Station nutrition researchers have found that, at least among volunteers they studied, younger women who are vegetarians have lower levels of estrogen hormones which have been linked to breast, uterine and ovarian cancer.

The finding was made recently with 23 pre-menopausal women who were among 140 Corvallis men and women participating in a study of vitamin B6.

"The nonvegetarian women tended to have higher levels of two types of estrogen than did the vegetarian women," said Terry Shultz, a doctoral student in nutrition who conducted special analyses of the blood of the 23 women—under the supervision of nutrition professor Jim Leklem—for his dissertation.

Nine of the volunteers were nonvegetarians and 14 were from the Seventh-day Adventist Church, whose vegetarian members are known to have a lower-than-average cancer rate. Leklem said the nonvegetarians had roughly 30 percent higher levels of the two types of estrogen.

"We suspected diet was altering the hormone picture," said the professor. "This confirms it. Now we'd like to recheck the finding with a larger sampling of people and look more closely at a vegetable diet. Will it take estrogen levels down? If so, how fast?"

Medical researchers think high levels of estrogen, which in humans regulates parts of the menstrual cycle and the growth of breast and other tissue, increase the risk of tumor development somehow when stimulating more rapid tissue growth.

Shultz said he was unable to pinpoint in his study why estrogen levels were higher in the blood of nonvegetarians.

"The original hypothesis we were working with was that fat in the diet might be altering hormone levels," he said. "Vegetarians eat less fat. But we were able to correlate only one type of fat component—linoleic acid—with estrogen hormone levels."

Leklem said he and Shultz found no link between diet and estrogen levels in women who had undergone menopause. But he said women produce less estrogen after menopause and different organs are involved.

Checks of the levels of other female hormones that have been linked to cancer, such as prolactin, which influences breast tissue growth and tells the body to produce breast milk, revealed no difference between vegetarians and nonvegetarians, the researcher said.

According to Shultz, factors besides vegetarian eating, including abstension from smoking and drinking alcoholic beverages, may help account for the lower cancer rate of Seventh-day Adventists.

Onion breath affects taste

How an onion breathes affects how it tastes . . . and how long it tastes that way.

On that premise hinges a new storage technique which is helping growers in Oregon's $30-million-a-year onion industry prolong the life and quality of their product.

The strategy, developed at OSU's campus Postharvest Physiology Laboratory, focuses on the curing stage, which is when an onion's neck seals up and layers of dry, outer scales form and slow the process of respiration or breathing—putting the onion in a dormant state.

"Normally, curing takes about a month after fall harvest," said Daryl Richardson, lab researcher. "But we have found if you circulate air through the onions you can get to the low respiration state in about two weeks.

"Accelerating curing prolongs storage life and helps onions retain sugars and acids that add to their good taste qualities," Richardson explained.

The air also helps remove pockets of humidity that can cause undesirable sprouting and fungal or bacterial growth, he added.

A number of growers in the Salem area already are storing their crops in tote bins in modified barns, said the researcher. They use an intake fan and air ducts to circulate air at the desired rate—about two cubic feet of air per minute per cubic foot of onions.

Several eastern Oregon growers are achieving the same result by storing their onions loose in a shed with a subfloor ventilation system.

Average annual storage losses range from 10 to 12 percent in the Willamette Valley to 15 to 40 percent in eastern Oregon, Richardson estimated.

It is too early to assess the precise benefit of circulating air, he said.

MALCOLM

Springs of late, Malcolm Johnson has noticed it takes a little longer to chase the soreness from his body when he returns to the fields after the relative inactivity of winter. August seems hotter. Frosty fall mornings chill him deeper.

After nurturing high-desert agriculture for more than 30 years, helping men and women find ways to scratch the most they can from farms he likens to "potholes among the rock ridges," the first and only superintendent ever of the Central Oregon Agricultural Experiment Station at Redmond says he is ready for "a long, long vacation with my wife." Retirement is on his mind.

And when it comes—December 31, although he will work part time until his replacement is hired and oriented—OSU will lose a veteran scientist whose career spans a period of dramatic change in central Oregon agriculture.

"Horses were just going out of use when I got here," he recalls of the February day in 1948 when the Agricultural Experiment Station sent him to Redmond to help farmers adapt to the new strategy in Jefferson County at the northern end of the central Oregon area—irrigated agriculture.

"I had a pair of household scales and a woodshed," he says, smiling as he surveys the memorabilia in his office and remembers how that assignment as supervisor of what then was called the Deschutes Experimental Project grew into the branch station of today, with its buildings, machinery and research sites at Redmond, Madras and Powell Butte.

"There was a lot of agriculture when I got here," he continues, "and the people weren't doing all that badly. But after awhile it became apparent they weren't going to be able to get by anymore on a 40-acre farm. It was taking more and more acres to justify the equipment you needed to make a living by farming."

Johnson changed with the times, redirecting his station's research to try and solve farmers' problems as they came along, and he grew fond of his job.

"In those early days the system we used kept me very close to the farmers," he explains. "We did the research right on their land. One of the things I liked about that was getting to know people as individuals, and it kept you in close contact with their problems."

But there were drawbacks, too.

"The big hitch, of course, was that you couldn't do any long-term or specialized research on a farmer's land," he says, pointing out why the branch station later acquired property for research.

Johnson, his colleagues say, eventually constructed a program that combined personal problem-solving with other types of research—but with main emphasis always on meeting farmers' needs. By 1957, when he took 2½ years off to go to the Midwest and earn a doctorate in physiology and ecology ("glorified crop production," he says) to add to his bachelor's and master's degrees in agriculture from OSU, his professional path was firmly set.

Returning to Redmond, Johnson slipped back into the quiet, mild-mannered, reliable stance that has earned him respect and gratitude from farmers, fellow scientists and administrators, including current Experiment Station Director John R. Davis, the last of several bosses who have evaluated his performance.

"We're going to miss Malcolm when he retires," says Davis, "because the people of central Oregon rely on him a great deal for new knowledge. When I'm over there it seems they're always swamping him with questions about how to do this or that with those goofy volcanic soils they farm. He's developed a research program that's 'right on' as far as they're concerned."

Davis's comment is typical of what many at OSU are saying these days. But George Carter, superintendent of the branch agricultural research station at Klamath Falls and Johnson's friend for 20 years, offers an appraisal that may cause more people in central Oregon to nod their heads in agreement:

"The philosophy that still water runs deep applies to Malcolm," says Carter. "He doesn't say much. But when he does you better listen, cause there's a lot more there than meets the eye. Those people must hate to lose him."

Director
Agricultural Experiment Station
Oregon State University
Corvallis, OR 97331

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