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E55
no. 667
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OREGON AGRICULTURAL EXPERIMENT STATION, OREGON STATE UNIVERSITY, CORVALLIS, OREGON

REPLACEMENT
IMPACT

Contributions To The State's Economy



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Special Report 667
Agricultural Experiment Station
Oregon State University

October 1982

This publication was printed without state or federal funds.

Cover: The economic impact of wheat stretches from the fields of the Willamette Valley and eastern Oregon to downtown Portland, shown here at dusk. OSU research is helping farmers produce wheat more efficiently. (Photo: Dave King)

SR 667 prepared by
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An Introduction

"Let's make that gutsy decision to invest in the future . . . while we still have one."

These days our lives are touched by tough financial problems—some cleverly disguised as challenges and some clearly devastating to people who cannot find a job or provide for a family. Obviously, Oregon's leaders face some challenges and some difficult decisions in attempting to restore a healthy economy, to increase job opportunities and to provide hope for the future.

The most difficult decisions involve the wise use of state revenues—putting these resources in priority in order to provide the best balance between solving immediate problems such as road repairs or law enforcement and finding long-range economic solutions such as industrial diversification and development or investments in research and education. When tax revenues are decreasing, the need to make decisions, such as revising the tax system, also becomes obvious. But people out of work or companies going broke or bankrupt still don't pay taxes.

We know all these things, and we all generally agree that basic human needs and services should be properly supported by state funds. The point I'd like to make here is that this is the critical time when the state of Oregon must decide whether to postpone things needed today and put its chips on economic recovery, or to use its limited resources to meet the most current needs and just try to ride out our current economic difficulties.

Every public meeting and every public survey I have seen indicates that Oregonians desire to do the former—to do everything possible to stimulate our economy, to create new wealth and new jobs and to invest in a stronger future. If this is the case, we must move aggressively to support research in agriculture and forestry, Oregon's major economic base, because we are lagging far behind in ability to generate those new initiatives to serve these vital industries.

The economic returns to society from public investments in agricultural research are very favorable (in the range of 30 to 50 percent each year for each dollar spent). The reductions in real costs of producing agricultural products as a result of research are transferred in large measure to consumers. In Oregon, where we export almost 85 percent of our agricultural products, reduced costs make us more competitive in national and international markets and strengthen our entire economy as a result.

Interestingly, on a national scale, recent studies have shown that the benefits and costs of publicly supported research in agriculture tend to redistribute income from higher-income to

lower-income families—that low-income families receive greater net benefits from research than high-income families.

There is no question that agricultural research represents a sound and desirable investment; but we also need to think aggressively in developing new products and markets, exciting and innovative ideas for new crops, new or expanding industries, new jobs—in developing a better economic future. This publication features some of the fruits of our recent investments in agricultural research. Let your mind explore what more can be done as you read through just a few examples of our successes.

This is the bottom line for Oregonians: ideas and hope. Investments in new ideas will bring new hope. The articles in this report prove it. Let's maintain our momentum. Let's make that gutsy decision to invest in the future . . . while we still have one. **IMPACT**



**John R. Davis, director
Oregon Agricultural
Experiment Station**

OSU's Fertilizer Groundwork Rewarding Farmers, Consumers

These days in Oregon, the smart use of fertilizer offers farmers and consumers great opportunities for economic gain, and Oregon State University researchers are helping them cash in on the rewards.

Farmers are faced with skyrocketing fertilization costs, linked to escalating energy costs, and with the double-whammy of demand for high-quality food at the lowest possible prices, explains Tom Jackson, OSU soil scientist.

In 1981, wise fertilizer investments helped farmers hold down product costs and make a profit, and that stimulated the state economy and helped give consumers relatively low-cost food, Jackson said.

The \$115 million Oregon farmers spent on fertilizer and lime last year returned more than \$3 for each \$1 invested—a total of about \$370 million that is weaving its way through the

state's economy as farmers spend their incomes on food, clothing, equipment, labor, taxes, more fertilizer and a host of other items produced by small and large businesses, Jackson estimated.

OSU laid the groundwork, the researcher said.

"Where do you think all this information these fertilizer salesmen give out came from originally?" he said. "Ask a grower and he'll tell you about the system he's worked out, how he does things. But go back 30 or 40 years and you'll find that the basic practices used were developed at OSU and WSU and other land grant universities.

"When I started working on soil fertility in wheat just after World War II there was virtually no use of fertilizer on winter wheat in eastern Oregon and Washington. Today, in areas where they used to get 25 to 30 bushels of wheat an

acre they're getting 75 to 80 with good rainfall. It's a combination of fertilization, better weed and disease control, and new, better wheat strains."

There are many fertilizer "success stories" with vegetables, fruits, grains and forages, Jackson said, emphasizing that each advance helps make Oregon products more competitive in world markets and helps keep down prices for Oregon consumers.

For example, recent potato fertilization studies done by Jackson and other campus researchers in cooperation with scientists at branch experiment stations near Redmond, Klamath Falls, Hermiston and Ontario have shown growers how to reduce production costs by \$30 to \$60 per acre, he said.

The Willamette Valley and central Oregon garlic seed industry, worth about \$2 million a



Tom Jackson, OSU soil scientist, checks wheat grown in a fertilizer experiment on the farm of Bob and Jean Nixon, near Junction City.

This Rare Oregon Deer 'Seems Fairly Stable'

"These deer represent a unique gene pool."

year, would have been lost without OSU research that showed how lime could be used to eliminate a problem caused by acid soils, he added.

Another benefit of fertilizer research involves soil erosion, although few recognize it, according to Jackson. When farmers get high yields on prime, relatively flat land, they farm less on hilly terrain that is apt to erode easily.

"Cheaper food for the public is an overall benefit of the efficient use of fertilizer," Jackson said. "Look at prices in Oregon grocery stores, and then look in France or some other country. You'll see what I mean."

Now that the research base is in place, could all fertilizer research be taken over by private industry?

"I don't think they'd tackle it," said Jackson, whose work is funded by a combination of state and federal funds and by fertilizer companies and grower organizations. "If they could, they would. You need the whole system—scientists from several disciplines, Extension agents and graduate students—to identify problems and carry through.

"We are in something of a unique position in soil science," he added. "Fertilizers are not patented. There are 16 basic elements that make plants grow and that's that. Every company has much the same fertilizers available. So, while some companies support our research more than others, no one company gets the benefits. The benefits are shared by companies, growers, processors and consumers.

"And you haven't seen anything yet," he continued. "We're on the verge of discovering how certain fertilizers can control plant diseases and reduce drought effects. We think fertilizers can be used to do much more than provide for plant nutrition." **IMPACT**

The country's largest herd of rare and endangered Columbian white-tailed deer is in Oregon and "seems to be fairly stable," says Winston Smith—which means it may be possible to take the animals off federal protection lists.

The researcher spent two years examining a relatively unstudied population of Columbian white-tailed deer in the oak-covered valleys along the North Umpqua River east of Roseburg for his doctoral thesis under supervision of Oregon State University fisheries and wildlife professor Bruce Coblenz, an Oregon Agricultural Experiment Station scientist.

"We spotlighted more deer down there in one night than are living on the whole federal refuge up in Washington," said Smith, explaining that a herd of about 300 of the same type deer living on a federal refuge on the lower Columbia River near Cathlamet, Washington, once was thought to be the largest group of the animals in existence.

Columbian white-tailed deer were taken under the federal government's protective wing in 1967 when they were classified as rare and endangered.

Because Smith determined there are 2,000 to 2,500 of the deer in Douglas County (the animals in that herd once were considered a hybridized breed of the black-tailed deer common in Oregon), the federal government may reclassify Douglas County whitetails from rare and endangered to threatened status (which means hunting could be allowed in some circumstances) or take them off federal protection lists altogether.

Some of the river bottomland around the North Umpqua should be preserved, though, Smith concluded.

"These riparian systems (areas around streams) represent a very important part of the life history of this subspecies of deer," he said. "They expand their range along them. The continued existence of the Columbian white-tailed deer in western Oregon—and these deer represent a unique gene pool—clearly is contingent on the existence of their riparian habitat." **IMPACT**



Fisheries and wildlife researcher Winston Smith examines a Columbian white-tailed deer fawn near Roseburg. There are between 2,000 and 2,500 of the rare deer in Douglas County, Smith found in a two-year study.

Eastern Oregon Center Steers Beef Production

When you get down to it, it's not easy to put a price tag on some research.

That's true of the livestock and range studies done year after year at the Eastern Oregon Agricultural Research Center, even though they provide big benefits to Oregon's \$300-million-a-year beef cattle industry and to Oregon consumers, says Bob Raleigh, the Oregon State University center's superintendent.

"The research at our facilities at Burns (the headquarters) and Union (a branch near La Grande) is unusual in that it provides the opportunity for a total-system study of range beef cattle production, nutrition and management," said Raleigh.

"The staff includes scientists working in forage improvements, management and utilization, which not only involves studying factors influencing forage production but studying the final product, whether it is cattle or wild animals (game and non-game species)," he said.

"Every part of our program has an impact on the total system. It is difficult to say something like 'supplementing yearlings' increased production by 20 percent, or what have you. It goes back to management and improvement of rangeland. They give a rancher the flexibility to adopt a production practice like that."

Range improvement practices in at least five areas—stemming from the center's research—have given Oregon ranchers and other land managers useful options, Raleigh said. Research that generated the improved practices included:

- Studies that permitted the introduction of new or improved range forage.
- Studies that improved the control of undesirable plants that compete with forage (like juniper and sagebrush) and plants toxic to animals.
- Research that outlined seasonal changes in the nutritional quality of range plants.
- Data compiled on the competitive and compatible behaviors of livestock and wild animals like horses, deer and antelope.
- Studies of range fertility, climate and other environmental characteristics.

The center maintains its own experimental herd of cattle at several sites. Applying scientists' findings to managing the center's land and livestock has had dramatic impact, said Raleigh (findings are disseminated to ranchers through Experiment Station publications, Extension agents and personal contacts).

In 20 years, the research station has increased its livestock carrying capacity threefold and increased the pounds of beef it produces fourfold.

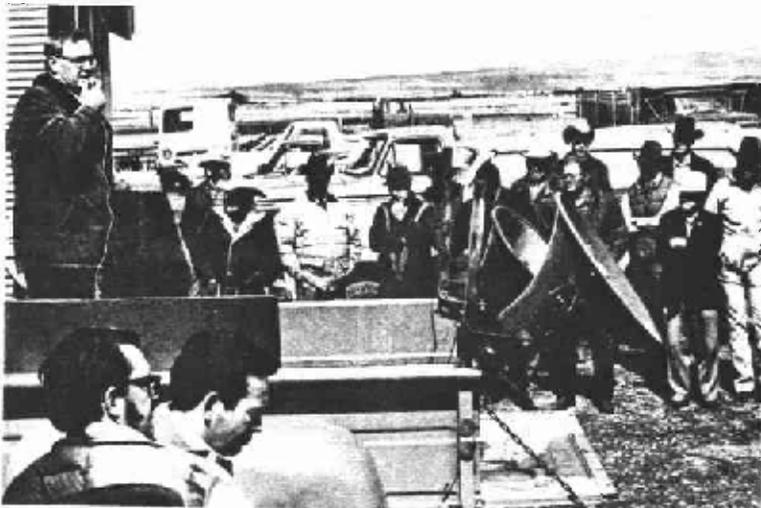
"The people who use our findings know how valuable they are."

Using range improvement practices to keep animals in a smaller area, the station has boosted its breeding conception rate by 15 percent, producing more uniform cattle in the process.

Experimenting with byproducts of the grain, grass seed and other Oregon industries, and with pasture irrigation, the station has demonstrated how to reduce by 20 percent the amount

of increasingly expensive grain that must be fed to cattle.

Other research contributions, Raleigh pointed out, include developing a system for adjusting calving time from spring to fall to take advantage of better weather and other benefits, developing an early weaning system that gives ranchers options for weaner calves and helps



Bob Raleigh, superintendent of OSU's Eastern Oregon Agricultural Research Center, discusses research findings with ranchers at a station field day at Burns.



OSU range scientists study wild animals, like these horses in the Sheepshead Mountains southeast of Burns, to find where their diets overlap with livestock. That information can help ranchers and public land managers.

The Team that Tackled Take-all

brood cows go into winter in better condition, lowering winter feeding costs, and studies of feed additives and growth stimulants that increase cattle weight gains.

The research has had a big impact in Oregon but it's hard to "plug in" dollars and cents values here and there, said Raleigh.

"The people who use our findings know how valuable they are," he said. **IMPACT**



Setting up a total production system and studying it helps researchers at OSU's Eastern Oregon center support the state's \$300-million-a-year beef cattle industry.

The interdisciplinary approach, where scientists from several fields combine efforts, is a good way to solve some problems in agriculture.

That's how a team of Oregon State University specialists in plant diseases, soil fertility and plant-water relationships developed a new crop management program for an increasingly destructive disease afflicting Oregon's number one cash crop, wheat.

"You might call it root surface farming," said OSU plant pathologist Bob Powelson, explaining how he and colleagues Tom Jackson (soil fertility) and Neil Christensen (plant-water relationships) developed a strategy that is saving Oregon farmers millions of dollars a year by helping them combat take-all, one of the world's worst wheat diseases.

Take-all is a soil-borne fungus that causes root and stem rotting and reduces grain yields. The disease thrives when winter wheat crops (planted in the fall) are grown back-to-back in fields in wetter areas such as the Willamette Valley and the irrigated fields of eastern Oregon.

Nature has its own way of controlling take-all. But it's not quick enough to shield wheat farmers from serious crop losses.

Generally, there's no problem the first year a farmer grows wheat. But by the second or third straight year take-all establishes a toehold and cuts yields. By the fifth year, bacteria—called pseudomads—that attack the take-all fungus establish themselves on wheat roots, bringing the disease under control in an ecolog-

ical balance researchers call "take-all decline."

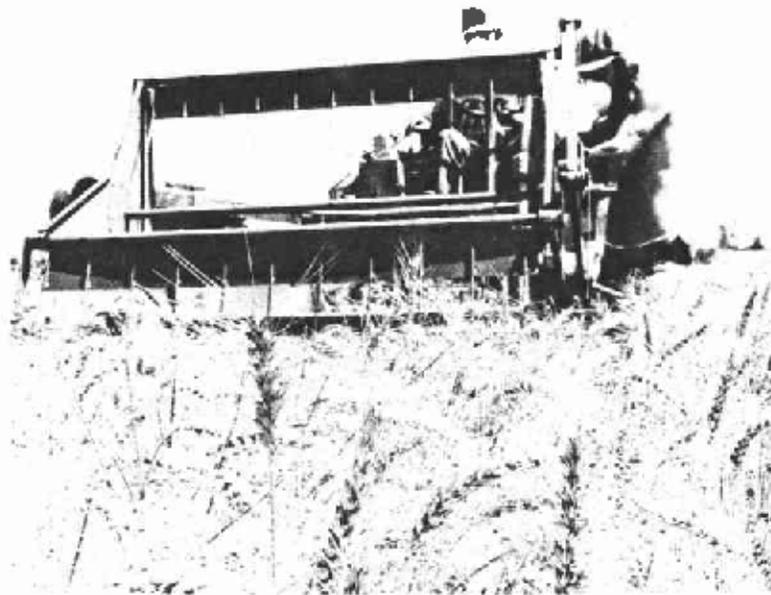
"Once you reach the take-all decline plateau, it lasts as long as you keep growing wheat on the land. The bacteria produce antibiotics that inhibit the attack by take-all fungus," Powelson said. "But how many growers can afford those reduced yields in the second, third and fourth years they grow wheat?"

In Oregon, the take-all problem was getting worse when Powelson and Jackson joined forces six years ago (Christensen joined the research team later). Economic damage from take-all was rising as crops like mint, beets and potatoes faltered at the marketplace and farmers increased their wheat acreage and the frequency of wheat in their crop rotation.

The researchers were experimenting with test plots at the North Willamette Agricultural Experiment Station near Aurora (just south of Portland) when they discovered a way to combat take-all.

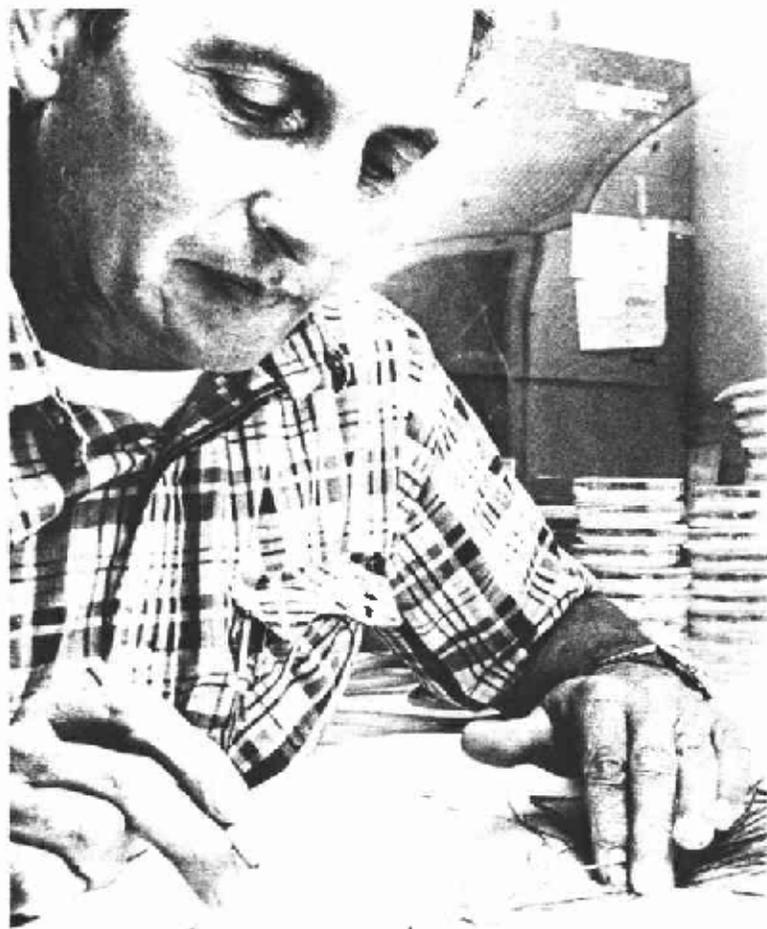
"Bob and I started trying to explain why we got suppression of take-all symptoms and higher yield responses with spring applications of ammonium chloride (fertilizer) than with ammonium sulfate," said Jackson. "We knew from previous research by others that take-all damage was suppressed when seedling wheat plants utilized nitrogen in the ammonium form."

The researchers learned that banding a fertilizer containing chloride around wheat seeds as they were planted boosted yields significantly in plots infested with take-all.



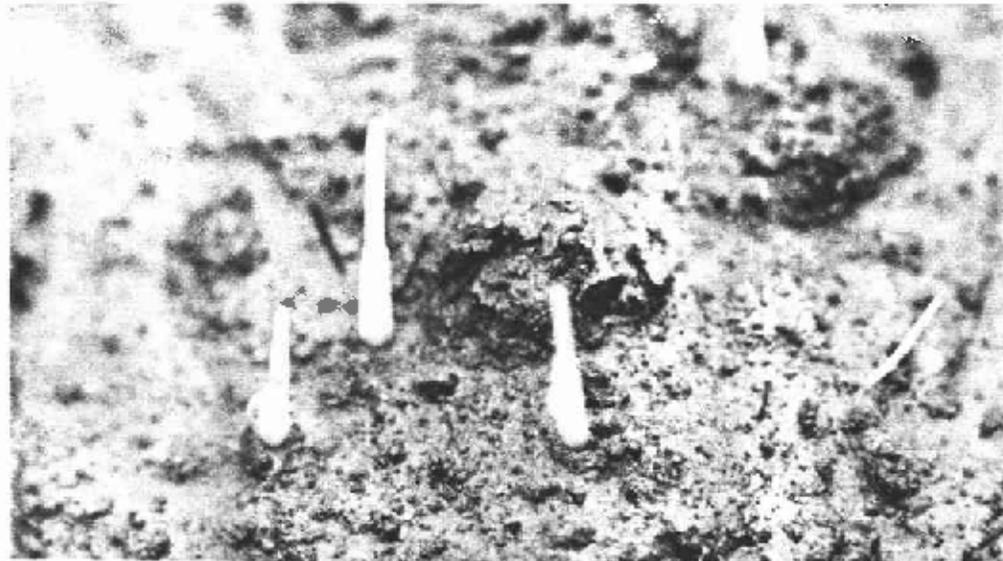
OSU technicians harvest wheat from a test plot treated with an ammonium-chloride fertilizer. The fertilizer seems to inhibit take-all, one of the world's worst wheat diseases.

The researchers' recommendations...added about \$6.7 million to growers' profits.



Plant pathologist Bob Powelson examines the roots of a wheat plant infected with take-all fungus.

Planting winter wheat— shown here just after emerging from the ground—later in the fall reduces take-all damage. OSU researchers have found.



Using Powelson's knowledge of plant diseases, Jackson's knowledge of fertilizers and Christensen's knowledge of plant-water relationships, the scientists refined a system Oregon farmers could use to prevent yield reductions caused by take-all.

Some key steps in the procedure include banding an ammonium-nitrogen fertilizer containing chloride and phosphorus (phosphorus helps wheat produce vigorous root systems in cool, wet soils) around seeds, planting winter wheat later in the fall (after October 20) to keep take-all from getting established before cold weather sets in, and applying a fertilizer containing chloride to the crop in the spring.

Overall, the procedure seems to create an environment around wheat roots, and within wheat cells, that reduces the severity of the attack by take-all, said Powelson. But many factors affect wheat yields and the researchers aren't sure they've identified all the reasons their system boosts yields, Jackson added.

Whatever the reasons, last year the researchers' recommendations saved Oregon wheat farmers about 14 bushels of grain an acre on 120,000 acres in western and eastern Oregon susceptible to take-all yield reductions. That added about \$6.7 million to growers' profits, Powelson calculated.

That's not the only payoff.

Christensen has helped Powelson and Jackson pinpoint some reasons why their anti-take-all strategy seems to reduce the threat from wheat leaf diseases such as stripe rust and Septoria (an outbreak of Septoria in the Willamette Valley last year reduced wheat yield an estimated 30 percent, costing growers about \$18 million).

Applying chloride in the spring affects the water relationship in wheat leaf cells, which may make it difficult for fungi that cause stripe rust and Septoria to get water from the leaves and form spores and spread, Christensen said.

In addition, planting winter wheat later in the fall helps farmers avoid aphids that transmit a virus that causes yellow dwarf, another leaf disease, the researchers said.

"There are risks with our methods," said Jackson. "Seeding late means you may have trouble getting into fields that are wet, or your wheat may not be well-established and you may get winterkill. But growers have been enthusiastic about the results they've gotten."

IMPACT



Soil scientist Tom Jackson records data about grain harvested from a plot used in take-all research.

Power Pole Pills?

Agricultural research is used outside farming, too.

The cooperative work of Oregon State University plant pathologist Malcolm Corden and Robert Graham, wood preservation scientist in OSU's forest products department, is saving the Bonneville Power Administration (and taxpayers) an estimated \$2.25 million annually by extending the life of Douglas-fir and red cedar utility poles 10 to 15 years.

The researchers discovered how to use a fungicide developed for agriculture to kill decay fungi in utility poles, laminated beams, pole frame structures and fence posts.

The treatment offers potential benefits to commercial builders and other wood products users, Corden pointed out.

Conventional wood preservatives are ineffective for controlling internal decay of western wood species because the preservatives don't penetrate enough. In utility poles, they protect the relatively thin sapwood shell but dry and crack once in service, exposing untreated wood to fungi.

Two fungicides, used in agriculture as soil fumigants, penetrate deeply into utility poles to kill decay fungi, the researchers demonstrated.

Corden and Graham are working on a pill that will be safer, easier and more versatile to use than the liquid fumigants now injected into utility poles to preserve them. **IMPACT**

Sandine Made Cheddar Just A Little Bit Better

Last year, the Tillamook County Creamery Association's plant in the city of Tillamook near the northern Oregon coast sold about \$63 million worth of cheese and related products.

It was a healthy shot in the state of Oregon's economic arm that Oregon State University microbiologist Bill Sandine helped deliver.

Sandine and his students are helping the association, a cooperative of about 200 dairy farmers that some days buys 30 percent of all the milk sold in Oregon for use in its plant, and similar cheese plants in Oregon and other states, save millions of dollars a year and maintain high product quality by working more effectively with bacteria.

One of the microbiologist's major contributions has been a system that makers of cheddar cheese—the Tillamook plant's specialty—and

The total payoff to Oregon cheesemaking is about \$20 million a year.

several other types of cheese can use to thwart troublesome viruses. The viruses attack starter culture bacteria that ferment milk into curd in the first step of cheesemaking.

In the past, cheesemakers had to maintain as many as 20 cultures of different starter bacteria strains during a work week so that, when the starter bacteria in a huge vat of milk was attacked by a virus, they could switch to a different bacteria strain that "might" be resistant to the virus. The "might" involved considerable guesswork.

"We make cheese in 3,000-pound batches, and we're getting about \$1.80 a pound for our cheddar," said D.R. "Pete" Sutton, general manager of the Tillamook County Creamery Association, pointing out the economic damage when a virus degraded, or completely spoiled, a vat



OSU microbiologist Bill Sandine eyes a colony of virus-resistant starter bacteria he developed. The bacteria eliminate problems in fermenting milk in cheesemaking.

The Seafoods Laboratory: Friend of the Fisherman

"The thing to do is . . . show fishermen how they can get involved in processing. That's where the money is."

Fishermen from several states delivered 28 million pounds of bug-eyed, two-inch-long creatures to Oregon seafood processors in 1981.

A couple of techniques developed by researchers at Oregon State University's Seafood Laboratory at Astoria, part of the Oregon Agricultural Experiment Station, boosted the potential value of those shrimp by nearly 25 percent.

Here's how:

Three years ago, David Crawford, OSU food scientist and the seafood lab's director, and some co-workers discovered that keeping shrimp under constant cold temperature and dipping them in a solution containing phosphate salt before peeling them with the usual steam-cooking process increased the yield of meat from about 22 percent of the shrimp's unprocessed weight to about 30 percent.

"With 28 million pounds of shrimp, that means the potential yield jumps from about 6.1 to about 8.4 million pounds," said Crawford. "If you figure shrimp are worth about \$4 a pound wholesale, that means the potential value jumps from about \$24.4 million to about \$33.6 million. That's an extra \$9.2 million."

"Not all processors in Oregon are using our methods correctly, and not all are using them," the researcher added. "But a large percentage are using a phosphate bath and some refrigeration, getting at least partial benefits."



Additional study has convinced Crawford that if fishermen bathe shrimp in a phosphate solution and refrigerate them immediately after catching them, the meat yield at processing time could be boosted to about 35 percent of the unprocessed weight.

And reducing shrimp processing wastes isn't the only benefit of the refrigeration and phosphate bath, according to the researcher.

"I think we can extend the shelf life of shrimp, from a bacteriological point of view, up to 14 days," he said, noting that bacteria cause shrimp meat to deteriorate. "From a quality point of view, 14 days may be too long. But I think we can deliver nine-day-old shrimp off boats that will be much better than the four-day-old shrimp taken off boats now."

That means shrimp from Alaska could be brought to Oregon for processing, processors could fit their work into regular hours and avoid costly overtime paid when shrimp must be peeled on weekends, and fresh Oregon shrimp could wind up in new, distant markets.

That's only one example of how the seafood lab, whose projects have been funded since 1968 primarily by the OSU Sea Grant program and small grants from private industry, is helping Oregon's seafood industry. Some other examples:

- Crawford has developed a dip for fish fillets that stops "drip loss," which is unsightly and strips fillets of nutritious juices. The dip, patented by a chemical company based in California and New Jersey, is being tested by Oregon fish processors, who stand to benefit from it when it is released commercially.
- Researchers are searching for ways to improve processing techniques for Dungeness crab.
- Food scientist Duncan Law of the lab developed a food for fish that is having economic and environmental impact in Oregon.

Research at OSU's seafoods lab at Astoria helped boost the potential value of shrimp like these by 25 percent.

of milk being fermented to produce a batch of cheese.

With Sandine's system, cheesemakers start the fermentation process with a combination of six virus-resistant strains of starter bacteria. If a virus manages to alter its genetic make-up and invade one of the resistant bacteria strains, the cheesemaker continues making cheese with the remaining healthy organisms while the attacked strain is taken out of the vat. The removed strain is replaced in a few days with a new virus-resistant strain of the bacteria attacked.

That way, several strains of bacteria are always in the vat fermenting milk, and new virus-resistant starter bacteria are available when needed.

"It's had a significant impact on our operation—caused a direct cost reduction," said Sutton. "It's a very dependable thing. You can count on a consistent action from your bacteria and that's a big benefit."

Sandine said other Oregon plants are benefiting from the system and calculated the total payoff to Oregon cheesemaking is about \$20 million a year.

Plants that have employed the system report "a night and day difference. They no longer live in fear of viruses," Sandine said.

Cost savings and reduced management headaches provided by the system will allow one Oregon cheese plant to expand its production and increase sales by \$15 million a year, Sandine estimated.

The researcher has not rested on that success.

Along with OSU pharmacy professor James Ayres and some graduate students, Sandine developed a new type of medium (food) for starter culture bacteria that is highly effective in keeping them healthy.

Sandine is working with OSU food scientist David Heatherbell on finding ways to help Oregon winemakers by improving their use of fermentation bacteria, and the microbiologist is busy developing cloning techniques that might reproduce virus-resistant cheese starter bacteria more efficiently.

A special payoff for helping Oregon's cheese and wine industries is that a large percentage of the sales (more than 60 percent in the case of the Tillamook cheese plant) are in other states and countries.

"That brings new money into Oregon," said Sandine. **IMPACT**

The Hood River Station Gives You Better Fruit

The Oregon Moist Pellet, developed in the 1950s in cooperation with the Oregon Department of Fisheries and Wildlife, is nothing more than fish carcass wastes combined with oil and pressed into a cake, but it has proved to be a superior food for hatchery fish used to stock Oregon's lakes and streams.

The pellet helps state fish hatcheries keep feeding costs down and maintain healthy supplies of fish for stocking.

- Law also developed a powder called Fish Protein Concentrate that shows promise for use in upgrading the protein content of foods in poor parts of the world and livestock foods in the United States. The concentrate is being evaluated by an Oregon company in cooperation with a Mexican company. The companies have

built a pilot plant in Astoria to produce the powder from hake, an underutilized fish found off the Oregon coast.

There's a key to helping Oregon's seafood industry in these days of sky-high interest rates, said Crawford.

"The way to contribute is not through resource-based research—how to use shad and dogfish and other underutilized species," he said. "Money is too expensive for people to make development and marketing investments. The thing to do is to find ways processors can improve their yield and quality; show fishermen how they can get involved in processing what they catch instead of selling a commodity—show them how to bread fillets. That's where the money is." **IMPACT**



John Crawford, director of the OSU Seafoods Laboratory, prepares shrimp for experimental processing. Newly discovered ways of extending the shelf life of shrimp processed in Oregon could put the product in new, distant markets, Crawford says.

Researchers at the Mid-Columbia branch (Hood River) of the Oregon Agricultural Experiment Station have developed five ways to store pears in recent years that have two things in common: They give consumers better fruit and give Oregon's \$100-million-a-year pear growing and processing industry more marketing options.

The storage techniques, and the scientists' other research on the maturity, handling and storage of pears, fit hand-in-glove with growers' advances in pear production, said Walt Mellenthin, OSU horticulturist and superintendent of the Hood River station.

Example: Studies in the last 10 years of when to pick and how to handle and store "d'Anjou" and "Bosc" pears, winter varieties that are usually eaten as dessert fruit and are growing in production and popularity, are giving Oregon's pear industry a \$600,000-a-year boost by showing the industry how to control a scald problem in "d'Anjou" pears and by lengthening the marketing season for both varieties, Mellenthin said.

"I try to be pretty conservative with these estimates, too," said Mellenthin, a veteran of 30 years' research at the Hood River facility. "I sit down with these industry people every year and they tell me their losses and we try to find ways to solve problems. Then I calculate how much good we've done them."

The techniques developed at the facility for storing pears in "artificial atmosphere" rooms kept at various temperatures and containing combinations of gases like carbon dioxide, oxygen and nitrogen, help the pear industry avoid flooding the U.S. market and help the industry ship pears to far-away spots like Western Europe, the Far East, South America and a rich, emerging market in the Middle East.

The Hood River researchers are trying to help steamship lines improve their facilities for storing pears, and apples, during trips to foreign markets.

Hood River growers have exported pears and apples since the 1930s, Mellenthin noted.

The OSU branch station's success has made it a world leader in the postharvest study of pears. Scientists there also are applying their research, where possible, to apples.

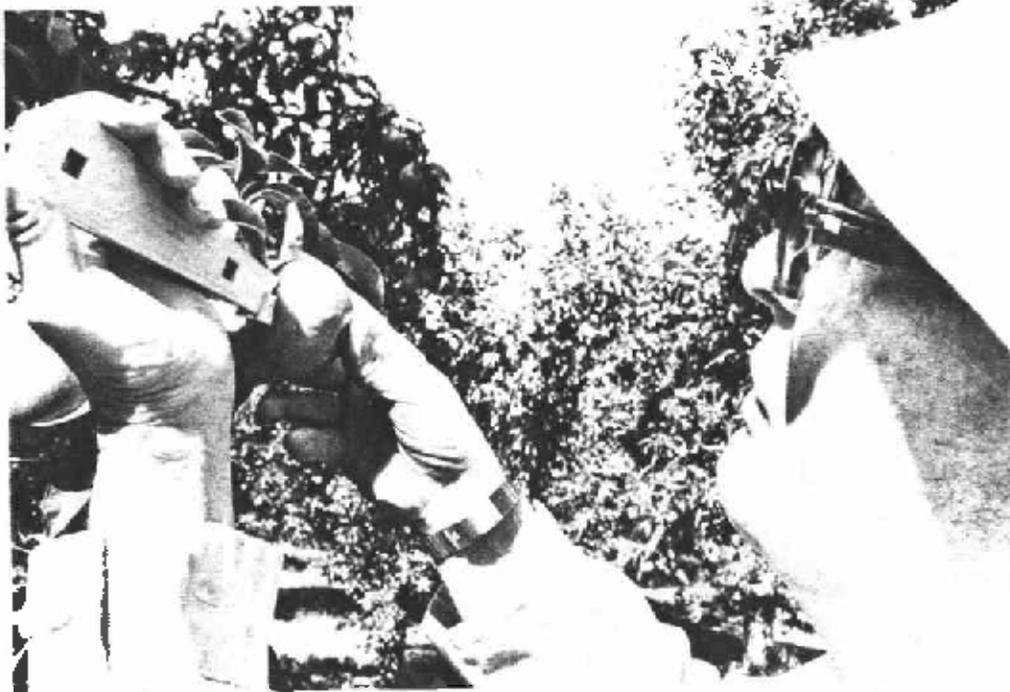
In a cooperative agreement, researchers in the state of Washington, where the apple is king, share their findings with Oregon growers and Mellenthin's staff and other OSU researchers share their pear research with Washington growers.

"Our ultimate goal, of course, is to give consumers top quality pears and apples 12 months a year."

Roughly 30 percent of the pears produced in Oregon are stored in controlled atmosphere rooms so they can be pulled out at various times during the off-season and shipped to grocery stores and other markets, said Mellenthin.

"Growing and marketing pears is truly a scientific business these days," he said. "You've got to know when to pick your fruit and how long you can store varieties with these different treatments—you've got to have a harvest strategy and marketing strategy. It can't be haphazard. And you've got to have communication among the growers, the field men, the receivers, the packers, the shippers and the marketers. If anyone falls down, it can upset the whole process.

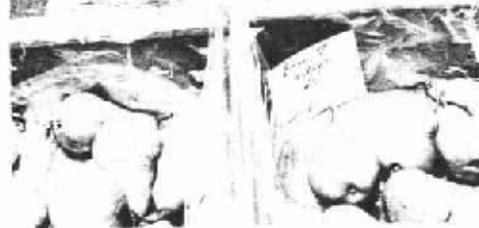
"That makes it quite a challenge for us to deliver these harvest and handling and storage techniques," he added. "Our ultimate goal, of course, is to give consumers top-quality pears and apples 12 months a year." **IMPACT**



Walt Mellenthin, superintendent of OSU's Mid-Columbia Agricultural Experiment Station at Hood River, measures the pressure in a pear to find out if it's ready for harvest.



Rising pear yields are making improved storage a necessity, says Walt Mellenthin. The Hood River research station he supervises is a world leader in pear storage studies.



OSU crop scientists placed potted vegetables and other plants in a plastic chamber to test the effect of man-made "acid rain," which is produced by industrial pollutants and is killing fish and melting granite statues in some parts of the country. The results: Acid rain doesn't seem to bother most vegetable crops, say the researchers.



Research Helped Unlock Our Vegetable Treasure

The home gardener has not been forgotten.

Oregon State University researchers have added a new color to the mostly reds and greens of vegetables rolling out of Oregon fields: black, the successful business kind.

In 1981, the commercial crop of the vegetable industry—fresh and processed—was valued at \$128,578,000, up from \$126,806,000 the year before. The totals do not include the value of numerous small crops of vegetables.

Processed snap beans alone were valued at \$23,826,000 last year. OSU began in 1958 to develop varieties of the successful Blue Lake type of bush bean. In the 1960s, most producers began to switch to it from the Blue Lake pole bean because of labor savings and retained quality. For the last 12 years, OSU bush bean varieties have been used substantially by the processing industry.

"During the next few years, 'Oregon 1604,' which we developed and now is widely used, most likely will be replaced to some degree by one or more other OSU varieties," said James R. Baggett, vegetable breeder.

"Three varieties were released in 1980 and two others in 1981; additional high-yielding lines are in advanced stages of evaluation."

The work of Baggett and other researchers has made Oregon the No. 2 snap bean producer in the nation, both in tons produced and the amount of money realized. (Wisconsin is first.)

Oregon's sweet corn crop was valued at \$23,792,000 in 1981. OSU scientists, studying the inheritance of head smut resistance in corn, are looking for more resistant parents to help corn breeders develop resistant varieties.

The processed valued of the green pea crop in the state was evaluated at \$7,404,000 last year.

Three OSU pea lines were increased in 1980. Major production of one of these lines could occur within four years with a possible 20 percent yield increase, Baggett said. One line, "OSU 605," was released in 1981 and will be grown for several years at least.

Another pea that Baggett developed, "Oregon Sugarpod," is an edible pod pea released in 1973. It now is becoming a standard variety for home garden and markets in the United States, so its economic value is not possible to assess yet.

This year "Oregon Sugarpod II" was released as a powdery mildew-resistant version of the other sugarpod. The new variety should make culture of edible pod peas possible in the fall as well as in spring and early summer, Baggett pointed out.

The work of OSU plant breeders helps produce luscious-looking—and marketable—foods like this cabbage.



Other crop totals for the state include the 1981 cauliflower crop, valued at \$4,618,000. Recent studies at the North Willamette Agricultural Experiment Station indicate that a new dimension may be added for cauliflower producers. Horticulturist Delbert Hemphill successfully proved that cauliflower can be a commercial overwinter crop and can fit nicely into growers' schedules for a second crop on the same land.

Hemphill, working on spinach and other crops, hopes to add more vegetables to the overwinter list.

Baggett also is working on new, high-yielding varieties of broccoli for the industry to freeze. He has developed "Oregon CR-1," believed to be the only club-root-resistant variety of commercial broccoli available in the world. His success has attracted the attention of more processing companies, which is expected to increase the economic importance of processed broccoli in Oregon.

The home gardener has not been forgotten. The "Willamette" tomato, released in 1964, has become a standard for home gardens and markets in Oregon and adjacent areas. The

dollar value of the "Willamette" is difficult to assess because home garden use predominates. New tomato varieties are coming, Baggett said, which will have ripe fruit two to three weeks earlier than today's commercial varieties, a big plus in marketing.

Oregon's potato crop usually is considered separately from the state's other vegetable crops because of its value—\$95 million last year.

Because of the work of many OSU scientists, Oregon has taken the national lead in producing quality virus-free potato seed.

"Approximately 10 percent of Oregon's potatoes are grown from our virus-tested seed," said Thomas C. Allen, plant pathologist. "The virus-free seed added about \$6 million to the value of the 1981 crop."

He estimated that if the state's potato acreage is not increased, the raw potato crop can be increased \$18 million a year, with the processed value increased to nearly \$42 million a year, because of virus-free seed.

"Ten percent of Oregon's potatoes are now grown from virus-tested seed," Allen said. "It is hoped that within five years, that total will be up to 90 percent."

IMPACT

Jim Baggett, OSU vegetable breeder, has developed new bush beans, tomatoes, carrots, cabbage, peas and other vegetables for commercial producers, home gardeners, and ultimately of course, consumers. Here, Baggett looks at kohlrabi, which is eaten like turnips.



Tiny potato plantlets in bottles like these, produced at OSU from tissue cultures, helped produce virus-free seed potatoes that added about \$6 million to the value of Oregon's 1981 potato crop.



Lights and Straw Cut Broiler Costs

Turning out the lights and using some of the straw produced by the Willamette Valley cereal grain and grass seed industries can save money for poultry producers, an Oregon State University researcher has found.

Normally, producers in the state's \$28.5-million-a-year broiler industry use sawdust as litter on the floors of chicken houses to keep animals from rubbing blisters on themselves and to make cleanup easier. Producers also keep broilers in natural and artificial light 24 hours a day.

"We've found using chopped Willamette Valley straw as litter and using intermittent lighting can save about \$.24 and \$1.36 a broiler, respectively," said Harry Nakaue, OSU poultry scientist.

Nakaue said the supply of sawdust is dwindling and the price is going up, making chopped straw cheaper to use as litter. Lighting broiler houses on a one-hour-on, three-hour-off schedule reduces the animals' weight gains slightly but puts a producer ahead economically because of savings on electricity and feed consumption, he said.

Oregon producers would save about \$259,000 a year on the more than 15 million broilers produced annually if all used the new procedures, the researchers estimated.

An Oregon company has expressed interest in buying straw mixed with manure—from chicken houses—for growing mushrooms, which would help poultry producers recoup some of their litter costs, Nakaue noted. **IMPACT**

This Industry's Hopping

An up-by-the bootstraps effort by two Oregon State University researchers has helped a small-scale Oregon industry get hopping.

Four years ago, armed with the conviction that "the dawn is just breaking for the rabbit industry," and little else, OSU veterinarian Nephi Patton and animal scientist Peter Cheeke established the OSU Rabbit Research Center, the only public research facility of its kind in the country.

Since starting on a shoestring, the researchers and their graduate students have come a long way.

A seed grant from the Oregon Agricultural Experiment Station helped Patton, the center's director, and Cheeke, director of research, do what was necessary to convince the federal government to provide a small amount of annual funding (about \$30,000 a year) for rabbit research at OSU.

One of the center's first payoffs to Oregon's commercial rabbit raisers, who sell about 600,000 rabbits a year (the majority out of state) worth about \$1.8 million, was a high-fiber, grainless feed formula that cuts feed costs and the incidence of enteritis, an internal ailment that kills domestic rabbits.

Now the center has developed and released a better rabbit—one resistant to snuffles, a respiratory disease that kills as many as 15 percent of the animals in some rabbitries, according to Patton.

"This rabbit has the potential to revolutionize rabbit raising in Oregon and all over the world," he said. "It will markedly reduce disease losses and increase profits for commercial-scale rabbit raisers. It will also mean added success and satisfaction for those who raise rabbits in the backyard as a source of low-cost, high-protein meat."

The researchers are studying ways to improve conception rates in rabbits and have become known worldwide for a quarterly publication they produce, *The Journal of Applied Rabbit Research*.

The bulk of the center's research funding now comes from donations from appreciative rabbit raisers, subscriptions to the journal, royalties on a rabbit book Patton and Cheeke published and donations from companies that make rabbit feed. **IMPACT**

Now the center has developed and released a better rabbit.



OSU's Rabbit Research Center is helping keep rabbits healthy with a new high-fiber diet.

Wheat Breeding Makes Cents

You could think of Warren Kronstad as an architect.

In the last 15 years, the Oregon State University crop scientist's research group restructured most of the grain grown in Oregon's \$300-million-a-year wheat industry, shortening plants to give them stronger stems that support unusually large grain heads and kernels.

Along the way he and his associates also tinkered with the wheat varieties they developed so they contained genes making them resistant to various diseases and adapted to growing conditions in differing regions of the state.

The impact? The varieties boosted yields by 10 to 20 percent. In 1981, Oregon was sixth in the country in total wheat production and the state's average yield of 57 bushels per acre on the 1.3 million acres planted was the highest in any state.

Kronstad certainly wouldn't accept all the applause for those statistics. But a lot of Oregon wheat growers believe he deserves a generous share of the credit.

There is no doubt about one thing. The OSU researcher's agricultural architecture packs tremendous economic wallop.

An estimate made several years ago by economists—and considered conservative by many—is that, over any five-year period since Kronstad's research group released its first wheat variety, "Yamhill," in 1971, genetically improved wheat varieties from OSU have contributed about \$35 million to the Oregon economy by boosting wheat yields.

The economic payoff to the state is much higher if you add the effect of the higher yields on agriculture-related activities such as fertilizer and equipment sales, grain processing at flour mills and bakery activities.

Also, as wheat travels from farmers through the marketing and transportation system to U.S. destinations and export points it increases in value. Last year, wheat worth nearly a billion dollars (including much of Oregon's soft white wheat) passed through the Port of Portland, creating jobs and other economic activity in Portland and up and down the Columbia River.

Economists have found that, in Oregon, multiplying gross farm sales of a commodity by three produces a fairly accurate figure for the total economic impact of a crop. That puts the 1981 impact of Oregon wheat close to a billion dollars.

But sizing up the benefits of wheat variety development research, called wheat breeding,

Last year, wheat worth nearly a billion dollars passed through the Port of Portland.



Warren Kronstad, left, chats with fellow OSU cereals breeder Mathias Kolding. "The whole wheat industry could get wiped out if we didn't have these new varieties coming out regularly," says Kronstad.

by focusing only on yield improvements skirts the most important aspect, Kronstad believes.

"I've had people tell me the impact of our varieties is more like \$120 million over a five-year period," he said. "But that's not the point. You're not talking about \$35 million or \$120 million over five years. You're talking about \$300 million every year—the whole wheat industry could get wiped out if we didn't have these new varieties coming out regularly."

Kronstad is talking about the threat posed by diseases, primarily, "Stripe rust" and other diseases that attack wheat in Oregon can alter themselves rapidly and overcome resistance in wheat varieties.

"We figure we need a new variety about every five years to stay ahead," he said. "It's like the Hong Kong flu—the way these diseases change to attack previously resistant varieties."

That five-year goal keeps Kronstad and other researchers on the OSU campus and at branch OSU experiment stations in areas such as the Columbia Basin mighty busy, because it takes an average of about 12 years to produce a new variety.

"We figure it costs about \$259,000 over a 10- to 14-year period to produce a wheat variety," Kronstad said. "But very little state money goes into funding our work. About 90 percent comes from the U.S. Agency for International Development, the Oregon Wheat Commission and other outside sources."

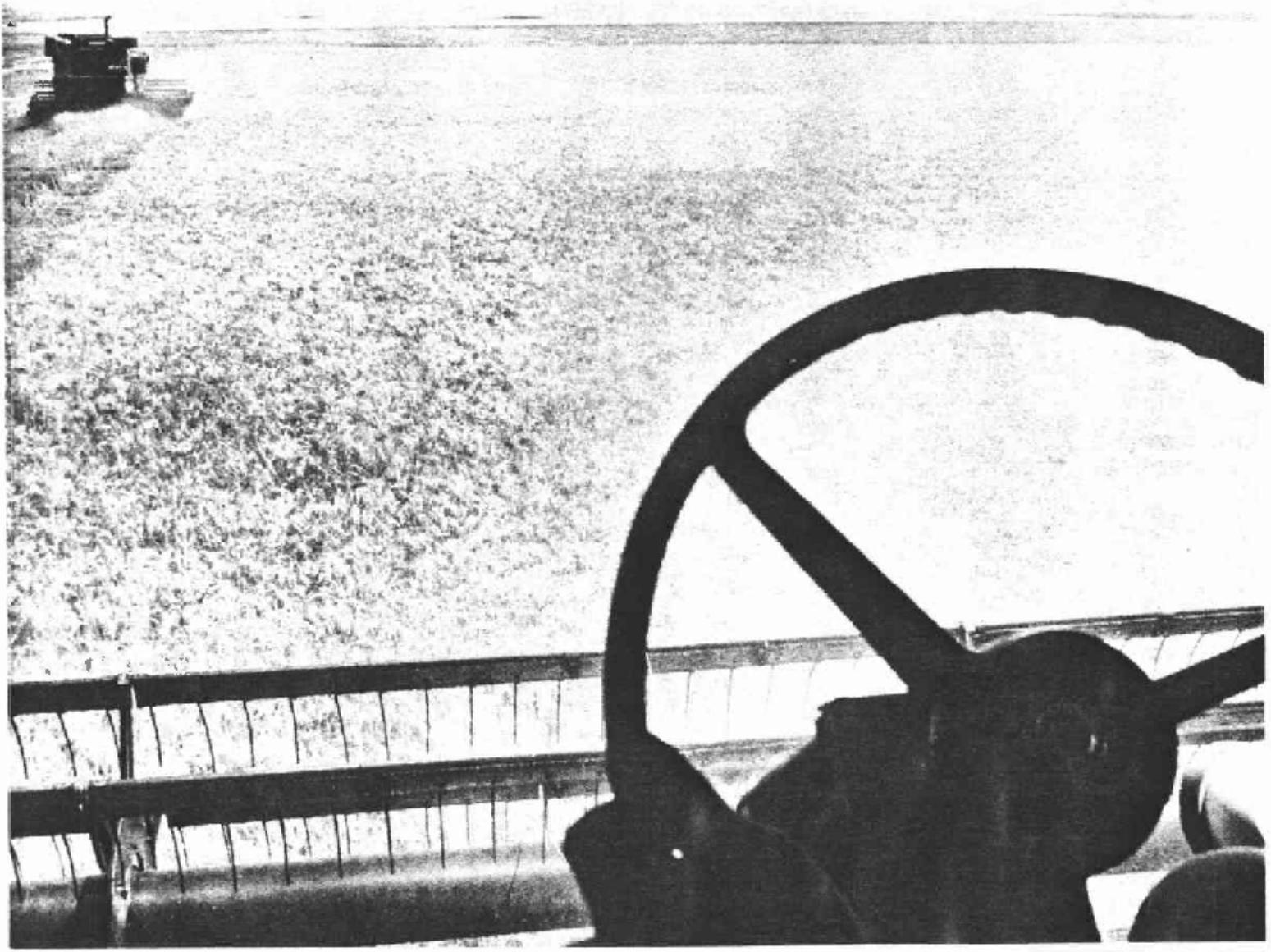
"Oregon has something here not many states have," he said. "We've been able to put together a breeding program at OSU that con-

tains the 'critical mass' of qualified and really dedicated people you need to get the job done."

Money, equipment, and international connections (so you have access to other countries' wheat for crossing experiments) are important, but dedicated people are essential for success, in Kronstad's opinion.

"I'd never have gotten very far without our team concept, without the Mat Koldings and Nan Scotts and Mary Verhoevens and Willy McGuistens," he said, ticking off names of members of his research group. "We've come a long way from the early days when just me and a few graduate students would go to Eastern Oregon and sleep out by our plots in sleeping bags. OSU has constructed one of the best cereal breeding programs in the world." **IMPACT**

In 1981, Oregon's average wheat yield of 57 bushels an acre was the highest in any state. Economists estimate the 1981 wheat crop had a total impact of nearly a billion dollars on the state's economy.



A Rhody for St. Patrick

One of the beauties of Oregon's nursery crops is their value.

Last year, it was \$91.1 million.

Another plus for the crops, of course, is the colorful vistas that fields show off to visitors and other passersby.

Horticulturist Robert L. Ticknor, who works at the Oregon State University Agricultural Experiment Station at Aurora in the heart of Oregon's productive nursery area, sees both sides of the nursery benefits.

"Keeping Oregon growers competitive with other nursery production areas by offering new plants is important to the continued economic health of Oregon's multi-million-dollar nursery industry," he said.

Among the plants Ticknor has introduced are three cultivars of *Pieris*, an ornamental shrub, and three rhododendrons.

Pieris japonica 'Valley Rose' is being marketed throughout the United States in climatically suitable areas and in Europe, where it received top rating in Holland trials. *Pieris japonica* 'Valley Valentine' and *P. japonica* "Valley Fire" also have been widely distributed.

Green flowers for St. Patrick's Day now are available on Ticknor's rhododendron "Shamrock." The new variety joins other year-round attractive plants in Oregon's \$8 million rhododendron industry.

"Our research in plant nutrition has developed leaf diagnostic standards that have increased the efficiency of production of the rhododendron industry and the \$15 million shade tree industry," said Ticknor.

"Nutrition experiments with slow-release fertilizers resulted in the North Willamette Container Fertilizer now produced by three Oregon formulators and marketed throughout the Pacific Northwest," he said.

His research in nutrition and growth regulators also has resulted in production programs for dual-purpose pot plants. These plants, traditionally used as landscape scrubs, can be made to flower in small pots before they are planted in the landscape.

"In 1981, 41,000 rhododendrons were produced for this purpose," said Ticknor. "And azaleas, forced for Christmas bloom, now are a \$1.5 million Oregon industry."

The problem of erratic blooming that once threatened that industry essentially can be eliminated in some varieties by using gibberellic acid, tested by the North Willamette station, as a supplement to the chilling requirement of azaleas, he pointed out.

New ornamental plants from OSU are helping keep the nursery industry in the green.

Last year, Oregon produced \$17.1 million in greenhouse crops, mostly in the Willamette Valley. The crops include cut flowers, bedding plants, house and garden plants and starts for nursery crops.

Turf sod represents another \$4.3 million, and the state's Christmas tree production is valued at \$24.6 million annually. William M. Proebsting, horticulturist, and graduate students are doing research on extending the life of the

Christmas symbols and working on practices and varieties that will help produce better and longer-lasting trees.

Lily bulb research at OSU during the last 40 years has established and maintained Oregon's position as the world's leading producer of white Easter lilies for greenhouse forcing and colored lilies for greenhouse garden use.

"The 10 to 12 million Easter lilies produced annually on the southern Oregon and northern



Bob Ticknor, horticulturist at the North Willamette Agricultural Experiment Station at Aurora, shows off "strawdust," a potting mixture made of straw produced in Oregon's wheat and grass seed industries.



Tom Allen, OSU plant pathologist, helped develop virus-free plants like these for the \$5-million-a-year Easter Lily industry in southern Oregon and northern California.



OSU horticulturist Al Roberts inspects dwarf mugo pines he developed for the state's nursery industry.

California coasts have a farm gate value of more than \$4 million wholesale," said A.N. Roberts, an OSU horticulturist internationally known for his lily work.

"After greenhouse forcing across the United States, the retail value of this crop to hundreds of flower growers is more than \$30 million," he said.

The breeding of dwarf forms for pot lilies and cut flowers is a bright spot in the expanding ornamentals industry of the north Willamette Valley and coastal production areas, Roberts said.

He pointed out that growers have invested heavily in research and credits this support with keeping the industry alive.

"They supplied OSU researchers with land, technical assistance, graduate research assistant stipends, and bulb station operating budgets for 25 years," said Roberts.

Problems nursery growers face include disease. Crown gall disease, for example, takes an annual toll in cullage of diseased nursery crops (\$200,000 a year), homeowner replacement of debilitated landscape plants and up to 25 percent reduction in yield of some caneberrys.

"We have adapted a biocontrol against crown gall that has been quite successful, thus greatly reducing these losses," said plant pathologist Larry W. Moore. "Unfortunately, not all strains of the pathogen are controlled by this treatment and our investigations must be continued for biocontrol agents and control methods."

And in another project, plant pathologist H.R. Cameron has supplied nearly 5,000 virus-indexed trees for nursery propagation. The trees will be the source material for millions of Oregon-grown nursery trees.

"The program also has distributed more than 50,000 virus-indexed rootstocks for clonal propagation," Cameron said. "The first certified rootstock was sold in 1981 and the first finished trees will be available this year."

More than 100 additional clones are being indexed for virus content.

"The program enables Oregon nurseries to keep their markets and will give them a competitive advantage in the future," said Cameron. "The estimated value of the certification program, when completely operational, is more than a million dollars a year." **IMPACT**

The Price of Weeds

Food prices in Oregon grocery stores would shoot up like a, well, weed if weeds had their way, according to Arnold Appleby, an Oregon State University crop scientist working hard to make sure that doesn't happen.

"The results of research can be absolutely spectacular," said the weed control specialist.

He calculates a herbicide called Hoelon he evaluated with OSU crop scientist Bill Brewster is saving winter wheat growers in western Oregon, where Italian ryegrass infestation is a problem, about 2 million bushels of wheat a year by boosting yields 10 bushels an acre on 200,000 acres.

"If wheat is \$3 a bushel, and that's conservative, that's more than \$6 million a year," Appleby said, pointing out the economic benefit to farmers and adding that when weeds reduce the size of crop harvests they drive up food prices for consumers.

Other new herbicides OSU helped develop are saving Oregon peppermint growers about \$1.5 million a year, alfalfa growers about \$.5 million a year, corn growers about \$.5 million a year and farmers who maintain pastures about \$1.5 million a year, Appleby estimated.

"I think an exciting new development is a class of herbicides for winter wheat in eastern Oregon that controls broadleaf weeds like pigweed, mustard and about a hundred others," he said. "These herbicides—Glean is an example—are effective at extremely low dose levels and do not present the possible environmental problems of some herbicides suspected of hurting surrounding plants like grapes."

The herbicides are available on an experimental sales basis and probably will be fully available to farmers next year, the researcher said.

OSU scientists are working on a new herbicide that is highly selective in killing troublesome grasses that infest fields of potatoes, carrots, sugar beets and other broadleaf crops, and it should be available to farmers in about two years, Appleby said. **IMPACT**

She Helps Thwart Bugs in Our Food

It's a good bet that only the common cold makes Americans sick more frequently than microbes in food and their toxins, says Margy J. Woodburn, an Oregon State University food scientist trying to reduce the personal, social, medical and other costs of food-borne illnesses.

Research in Woodburn's laboratory identified potential hazards in cooked meats, gravies, Mexican style beans, cooked rice and entree salads and contributed to recommendations on ways to cut down on such problems by reducing the "holding time" without refrigeration for such foods in restaurants and private homes.

In another study, Woodburn and her colleagues identified deadly botulism toxin in foil-wrapped baked potatoes stored improperly and recommended that, after baking, such potatoes

be refrigerated to prevent production of the toxin.

Other Woodburn research revealed that alfalfa and bean sprouts carry a large number of bacteria that have caused infection in persons with low resistance. Her suggestion that sprouts not be on the menu for hospital patients will reduce the number of hospital-acquired, food-related infections, she believes.

The economic benefit, the savings, from such research?

"They cannot be known for sure since the illnesses themselves are seldom identified. However, one large restaurant-based outbreak of salmonellosis (a food-borne illness) had a total cost of \$28,733," Woodburn said, "and a death from botulism, which often is the outcome, causes the loss of one productive life." **IMPACT**



Many human illnesses are never linked to the microbes in foods that cause them, says Margy Woodburn, OSU food scientist. Here, Woodburn experiments with bean sprouts that carry a large number of bacteria.

A Cheaper, Safer Way to Control Crop Pests

An insect—believe it or not—may have helped hold down the cost of the last juicy Oregon pear you ate.

If so, it was probably an offshoot of Oregon State University research with Integrated Pest Management (IPM for short), a program scientists say is going to have far-reaching impact on agriculture in Oregon and on the state's environment.

Using "good insects" that prey on pests to protect crops is one IPM technique farmers can use to hold down production costs. It allows them to use fewer expensive and potentially dangerous chemical pesticides.

But such biological pest control isn't all there is to IPM. It is a multipronged program that also includes using chemical pesticides to protect crops and using cultural tricks, such as altering planting times to avoid pests, when possible.

With IPM, a farmer controls pests with the most cost-efficient strategy available rather than blanketing crops with chemical pesticides, as has often been the case since they became popular after World War II.

Sometimes, if methods of monitoring pests (developed by OSU researchers and presented to farmers by Extension agents) show the damage the pests could do is less than the cost of controlling them, the farmer might simply let the pests eat their fill.

Growers are using 50 percent less active chemicals.

Other times, a pesticide might be needed—but researchers stress that a grower should always consider the potential impact of pesticides on insects that can help by preying on pests.

The IPM answer often is cheaper and more environmentally safe than the blanket application of pesticides, according to Pete Westigard, an entomologist at OSU's Southern Oregon Agricultural Experiment Station at Medford.

"The program we have for pears now calls for the minimal use of pesticides to achieve depression of pests and avoid major disruption of helpful insects," Westigard said. "Growers are spending more than ever on pesticides. But that's because pesticide costs are going up fast. Growers are using about 50 percent less active chemicals than they did 20 years ago."

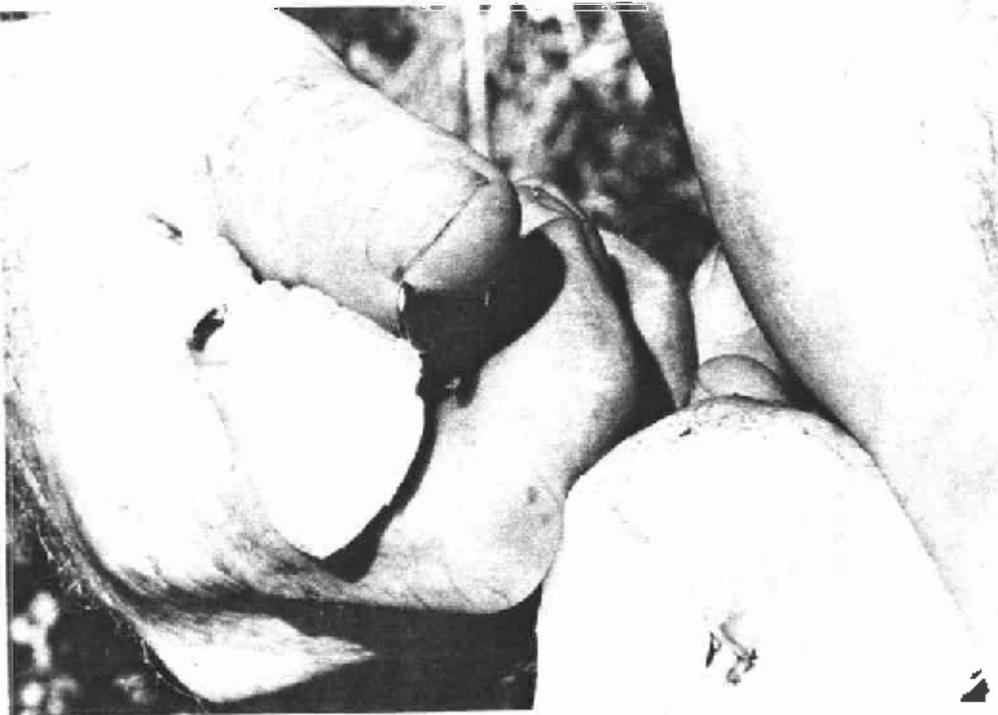
IPM has reduced the number of pesticide applications needed to control pear pests in southern Oregon by about two applications a year, saving pear growers about \$600,000 annually, Westigard estimated.

"More importantly, it is improving pest control," he said.

The potential for biological control of pear psylla and spider mites, important pear pests, has been demonstrated and OSU researchers and Extension agents are trying to integrate the methods into grower practices, Westigard said.



"Some of the real success stories are yet to come" in IPM, says OSU entomologist Pete Westigard, shown checking for pear pests in a southern Oregon orchard.



Codling moth worms like this one bore into pears, damaging the fruit. OSU researchers are trying to help growers control the pest with a manmade sex attractant that confuses codling moths, keeping them from mating.



noting that could save growers \$200 an acre annually and reduce pesticide use by 70 percent.

IPM is helping trim production and food costs and helping protect the environment in several other parts of the state, too.

Entomologist Bob Zwick of OSU's Mid-Columbia Agricultural Experiment Station at Hood River is studying how apple, pear and cherry growers in that area might apply IPM to their crops.

In the Willamette Valley and central Oregon, an IPM effort in the mint industry led by OSU entomologist Ralph Berry and Glenn Fisher, entomology specialist with the Extension Service, is saving participating growers \$35 to \$40 an acre.

In addition, IPM strategies saved Oregon's snap bean growers about \$2.5 million in 1981, Berry said.

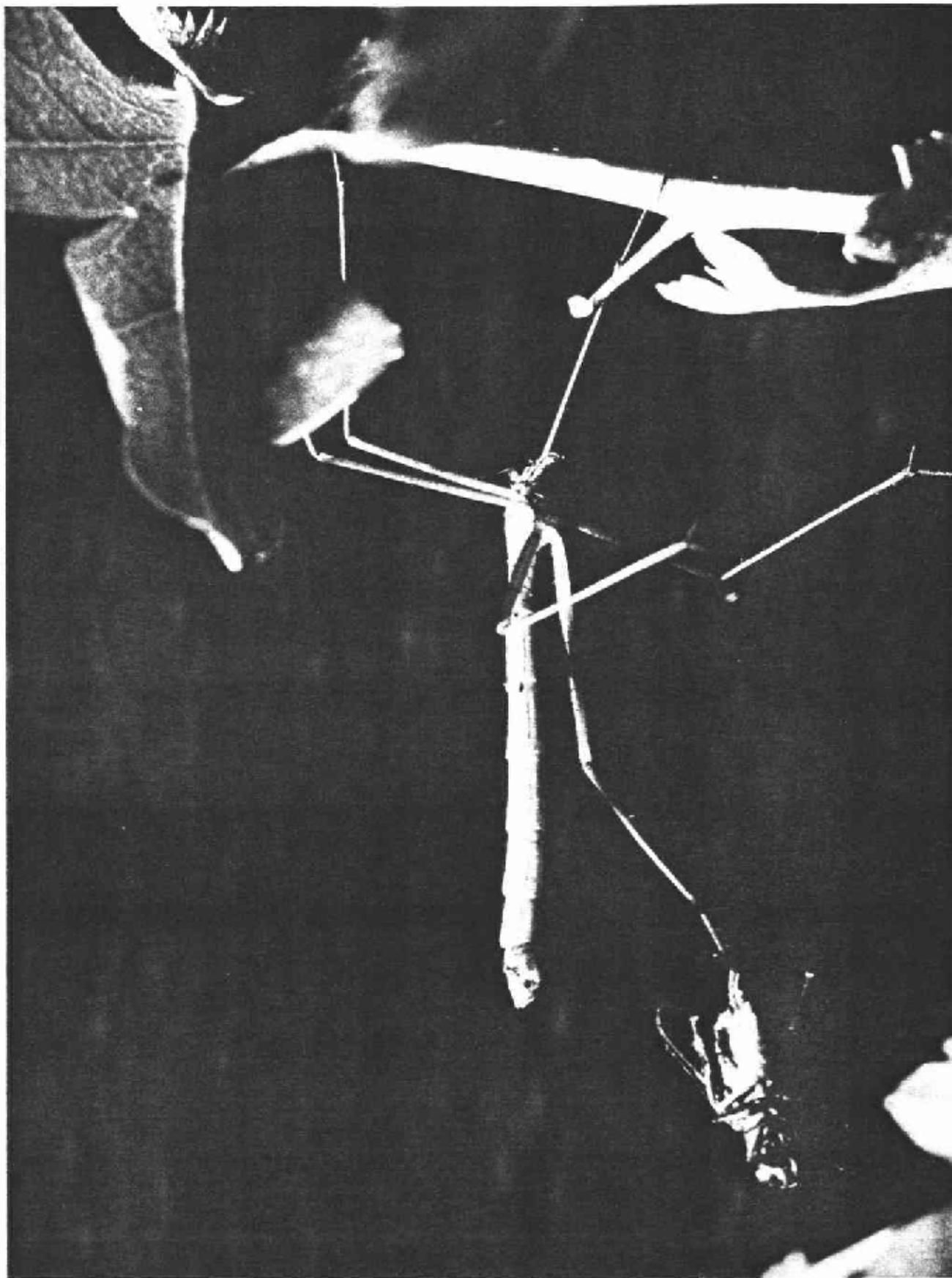
M. T. AliNiazee, an entomologist on the OSU campus, is finding new ways to control pests in the filbert, cherry and apple industries, such as using an artificial sex attractant to confuse pests and keep them from reproducing.

AliNiazee is searching for ways to control the apple maggot, a relatively new pest in the Northwest he estimates could cause as much as \$25 million a year damage to the region's apple industry if not controlled.

IPM also has been applied to other vegetable crops in the Willamette Valley, to alfalfa seed crops in eastern Oregon's Treasure Valley and to the control of tansy ragwort, a weed that poisons Oregon livestock.

"The next five to 10 years are when you'll really see some advances in IPM," said Westgard. "Some of the real success stories are yet to come." **IMPACT**

M. T. AliNiazee, entomologist on the OSU campus, is searching for cost-efficient ways of controlling crop pests such as the cherry fruit flies under the microscope.



Helping natural predators destroy crop pests is one IPM strategy. Here, a scorpion fly claims its prey, a common housefly.

Where the Heck Is the Station?

In Oregon, the Oregon Agricultural Experiment Station is never far away.

The headquarters are on the Oregon State University campus in Corvallis. But there are branch stations just about everywhere people farm or ranch.

The Experiment Station network is a good example of how much can be accomplished with a successful, basic and applied research partnership. With basic scientific support from campus scientists, branch station researchers conduct on-the-spot studies needed to solve problems tied closely to the soils, climates or other characteristics of various regions of the state.

Campus researchers do more than laboratory work, too. They conduct experiments at the branch stations and operate experimental farms in the Corvallis area that, as a whole, serve as sort of a branch station for much of the Willamette Valley.

Since the first branch experiment station was established in Union County (near La Grande) in 1901, research at each branch station has had a strong influence on the economic stability of its surrounding region.

Here is a list of branch stations and their specialties:

- North Willamette Agricultural Experiment Station near Aurora—The staff works on ornamental and nursery production and small fruits and vegetables. It serves growers, large and small, from Salem to Portland.

- Mid-Columbia Agricultural Experiment Station at Hood River—The station provides research for the high-value pear and cherry growing areas around Hood River and The Dalles, as well as parts of the state of Washington. In exchange, Washington scientists assist Oregon growers in apple production.

- Columbia Basin Agricultural Research Center at Pendleton, Hermiston and Moro—The center, headquartered at Pendleton in facilities provided by the Agricultural Research Service, U.S. Department of Agriculture, serves wheat and barley growers in Oregon's dryland grain-producing areas and provides research support for irrigated areas in the Columbia Basin, especially the potato-producing areas near Boardman and Hermiston. Facilities are maintained at Moro in Sherman County and at Hermiston.

- Malheur Agricultural Experiment Station at Ontario—The station, in the Treasure Valley, one of the state's most intensively farmed areas, provides research for growers producing onions and potatoes on irrigated land. It also provides pasture production research.

There are branch stations just about everywhere people farm or ranch.

- Central Oregon Agricultural Experiment Station at Redmond—The station, which has branch research sites at Powell Butte and Madras, is the main location for the Experiment Station's potato variety development program and also supports the region's farmers with studies of mint, grass, alfalfa and alternate crops.

- Klamath Falls Agricultural Experiment Station at Klamath Falls—The station primarily serves Klamath County, which produces mainly potatoes and livestock. Growers need special research attention because of the area's unique soil and climatic conditions.

- Eastern Oregon Agricultural Research Center at Burns and Union—The center specializes in rangeland management and animal production research. The center's scientists are nationally known for their studies of rangeland plants and ecology and range animal manipulation (including game animals).

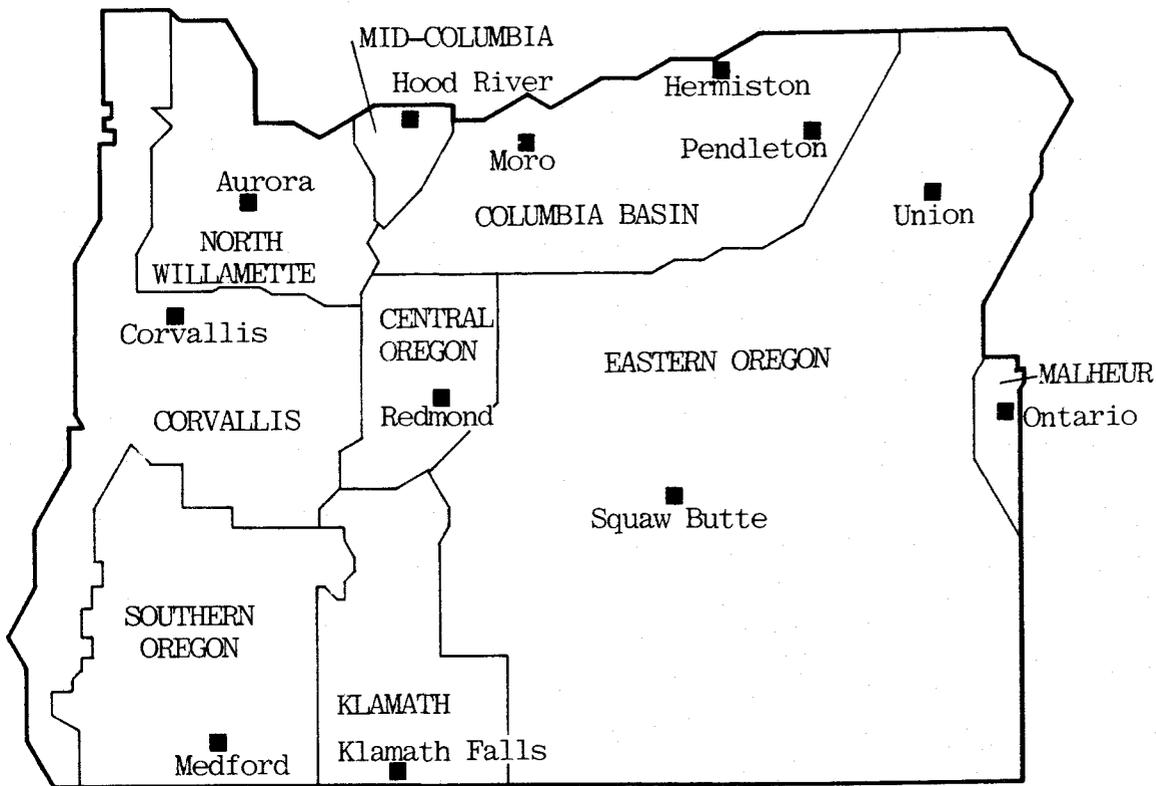
- Southern Oregon Agricultural Experiment Station at Medford—The station operates one of the nation's top research programs on pest management in pears, as well as providing other services to the area's pear growers. The station also evaluates the performance of wine grapes and studies other crops, including seed crops.

- Corvallis-area experimental farms—Working at facilities such as the Hyslop Crop Science Field Laboratory, the Lewis-Brown Horticulture Farm and the OSU Vegetable Farm, campus scientists provide practical research support for Willamette Valley farmers producing cereal grains, tree fruits, vegetables, livestock and other crops.

The Oregon Agricultural Experiment Station helps operate other research facilities in the state that are not part of the branch station network. They include a facility at Harbor on the southern Oregon coast near Brookings that specializes in lily bulb research, a program based at the OSU Marine Science Center at Newport and operated in cooperation with the marine center and the OSU Sea Grant program that specializes in research on fisheries, oysters, hatcheries, fish diseases and marine mammals, and the OSU Seafoods Laboratory at Astoria, designed to serve the fisheries industries of all coastal Oregon.

A recent study by several prominent economists on the value and economic impact of production agriculture research in the United States concluded that decentralizing scientists by appointing them to substations in states "had a positive effect on the productivity of state research."

A large number of Oregon farmers have seen those positive effects. **IMPACT**



Back: John Yungen, superintendent of the Southern Oregon Agricultural Experiment Station at Medford, examines an experimental crop of Jerusalem artichokes. The plant shows potential as a source of starch for alcohol fuel production. (Photo: Dave King)

Branch stations:

North Willamette

15210 NE Miley Road
Aurora, Oregon 97002
678-1264

Mid-Columbia

3005 Experiment Station Road
Hood River, Oregon 97031
386-2030

Columbia Basin

Highway 11/Experiment Station Road
Box 370
Pendleton, Oregon 97801
276-5721

Experiment Station Road
Box 105
Hermiston, Oregon 97838
567-6337

Lone Rock Road
Star Route, Box 1A
Moro, Oregon 97039
565-3522

Malheur

Oregon Avenue
Route 1, Box 320
Ontario, Oregon 97914
889-2174

Central Oregon

Sisters Avenue
Box 246
Redmond, Oregon 97756
548-3340

Klamath

6941 Washburn Way
Box 399
Klamath Falls, Oregon 97601
882-2501 (Ext. 400)

Eastern Oregon

4551 Highway 205
Star Route 1
Burns, Oregon 97720
573-2064

Tenth Street
Box E
Union, Oregon 97883
562-5129

Southern Oregon

569 Hanley Street
Medford, Oregon 97502
772-5165

Station main office:

127 Agriculture Hall
Oregon State University
Corvallis, Oregon 97331
754-4251

