What Have We Done For You Lately?
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Front cover: Wheat geneticist Pam Zwer examines an experimental variety. For more information, see page 8.

Back cover: OSU agricultural scientists maintain experimental herds to study cattle, sheep, poultry and other livestock.

Thayne Dutson, director, Oregon Agricultural Experiment Station

As I remember growing up on our ranch, I often complimented our agricultural system, what we have to show. But that has been a lot of challenges, the last 40 years, a lot more. But it's been good.

Today, we have quality, low-cost food that is the envy of the world, and that food is what consumers and the food industry. Most of the positive changes in this possible case are the work of agricultural researchers. Our scientists employed by Oregon's Agricultural Experiment Station, and other institutions throughout the United States.

But the research is far from finished. Agriculture is one of our most important industries. Growing crops, raising livestock, diseases, and consumer preferences, markets are for the taking. Also, there's a growing awareness of the

What have we done for you lately?

2 Oregon State University Agricultural Experiment Station
As I remember my years growing up on our farm and ranch, I often compare the agricultural system then to what we have today. There've been a lot of changes over the last 40 years, a lot of them good.

Today, we have a high-quality, low-cost food supply that is the envy of most of the world, and that benefits consumers and the agriculture industry. Many of the positive changes that made this possible came as a result of agricultural research done by scientists such as those employed by OSU's Agricultural Experiment Station and experiment stations at sister institutions throughout the United States.

But the research job is far from finished. Agriculture is one of our most dynamic industries. Growing conditions, diseases, pests, consumer preferences and markets are forever shifting. Also, there's a growing awareness of the need to help farmers and ranchers produce high quality and high value products while exercising conservation practices to protect Oregon's priceless natural resource base—in other words the need to create economic benefits while finding ways to sustain our rich environment.

You can document the excellence of the scientists who work for Oregon's Agricultural Experiment Station in many ways. One is the awards and honors our researchers win. Another is that our experiment station ranks eighth in the country in the number of grants and contracts, which brings money into the state used for the benefit of Oregon and its citizens. Some of our projects have created a return of up to $25 million a year to Oregon’s economy.

This booklet looks at the kinds of research our scientists are doing. You'll notice the projects go beyond the boundaries of traditional agriculture to fishing, forestry and other natural resource areas. But there's only room for a few examples. If you're interested in research projects in a specific geographic area or discipline, give me a call at 737-4251. I'll compile a list for you.

We believe our record speaks for itself. We believe the Agricultural Experiment Station is a resource Oregonians can't afford to ignore—the return on the dollars invested is too great.
PEARS FOR TOMORROW

What do a pear and a paper mill have in common? The answer is a juicy reward for state fruit growers and pear lovers.

Researchers at the Southern Oregon and Mid-Columbia branch agricultural experiment stations, located at Medford and Hood River, have discovered that a byproduct of paper mills helps fight one cause of decay in pears.

Each year fungi trigger decay in pears in long-term cold storage, resulting in economic losses for fruit producers and higher prices for consumers. To handle pears gently, packers routinely float them out of 1,000-pound harvest bins in immersion tanks filled with a salt solution.

OSU researchers found that sodium lignin sulfonate, a byproduct in sulfite-pulping paper mills, can float pears too, and it suppresses spores of the fungi. The compound is easily removed from the pears' surface with a fresh water rinse.

More than half of Oregon's packinghouses have adopted this new method of floating pears. Industry savings are estimated to be $750,000 a year.

This... saves pear growers about $2.8 million a year.

Station research is making other contributions. Examples:

- Developing better ways to monitor orchard pests and control them with biological and selective chemical methods to reduce pesticide use. This decreases the potential for environmental contamination and saves pear growers about $2.8 million a year.

- Helping growers use overhead sprinkler systems to do away with the oil-burning smudge pots many growers use for frost protection. This saves growers $1,000 to $2,500 a year an acre, depending on the weather, and reduces air pollution.

- Contributing to the sale of colorful new red-skinned pears, including varieties developed at the Southern Oregon station. Sale of the pears returned $3 million in 1989. The majority of the trees planted aren't producing fruit yet, so red pears promise to add more green to Oregon's $100-million-a-year pear industry.

OSU's David Sugar with pears floating in a solution that inhibits fruit decay.
Fish are important to OSU’s “stream team,” but the main thing the group tries to land is information that will protect the state’s environment and economy, according to the team’s leader, Stan Gregory.

“Society pays for its past mistakes, for the cost of poor land use management. For example, it may require more than $400 million to clean the Tualatin River,” explains Gregory, a stream ecologist in the OSU Department of Fisheries and Wildlife.

“We’ve stripped the Tualatin of its filters, the wetlands and flood plains that act as its kidneys. I think that river is just the tip of the iceberg. We take clean water for granted in this state. People on the East Coast used to do that.”

Gregory and fellow scientists who specialize in areas such as microbiology, plant ecology, vertebrate ecology, chemistry, hydrology and fisheries make up the stream team. Their ecological studies go beyond the banks of the rivers and creeks that cascade or meander through Oregon.

One example of a relatively short-term project is determining the effect of agriculture and forestry on streams in Lobster Valley at the headwaters of the Alsea River. Others include testing the use of cottonwood trees along a Willamette Valley stream to remove fertilizer runoff from the soil before it enters the water, and examining how forestry practices along eastern Oregon’s John Day River affect the river’s valued fish runs.

The researchers also look at long-term ecological patterns. A stream team study in the H.J. Andrews Experimental Forest in the McKenzie River basin was the first to identify the important role of woody debris in forests.

“Some of these streams in steep areas would be just straight shots if it weren’t for debris,” says Gregory. “Instead, they flow in steps. Most creatures live behind the debris.” Some Oregon forest managers are finding a stream team model helpful. The model predicts how leaving various kinds of woody debris will affect streams.

“We know the face of Oregon is changing because of changing land use patterns,” says Gregory. “Streams and rivers lie at the heart of state land use issues. It will require cooperative and interdisciplinary approaches to develop effective alternatives. Today’s natural resources issues quickly become adversarial, but if we combine our expertise, we can build better solutions.”

The OSU Stream Team’s Linda Ashkenas studies western Oregon’s Alsea River.
A DANGEROUS GAME

Club wheat is a risky bet in the wheat growing business. It's extremely susceptible to a fungal disease called stripe rust.

Pam Zwer, an OSU Agricultural Experiment Station wheat breeder, is working overtime to tackle this tough problem. She's developing a disease-resistant club wheat.

Before 1959, white club wheat made up 80 percent of the wheat produced in the Pacific Northwest. Then stripe rust hit. By 1966, the rust had knocked club wheat production down to only 8 percent of the wheat produced in the region.

Today, though the acreage is modest, club wheat holds the key to a small, but important, chunk of the Oregon wheat export market. It makes up about 10 percent of western white wheat, a market class of wheat sold largely to Pacific Rim countries. About a quarter of Oregon's export wheat is sold in this market class.

Zwer hopes her breeding program helps take the risk out of growing club wheat. She is breeding a diverse genetic background into lines of club wheat. In the process, she's incorporating not only stripe rust resistance, but also tolerance to the Russian wheat aphid, a new pest. She's also trying to give the new variety superior growing characteristics such as high yield and adaptability to growing methods that prevent soil erosion.

It usually takes about 10 years to develop a new variety of wheat. But in 1991, Zwer expects to release some advanced breeding lines of rust-tolerant club wheat for seed increase.

The implications? Oregon may have a better chance of maintaining Pacific Rim markets for western white wheat. Also, with the new club wheat there may be less need for fungicides to combat stripe rust, saving growers money and protecting the environment.

OSU wheat breeder Pam Zwer in an experimental plot at the Columbia Basin Agricultural Research Center at Pendleton.
A BETTER WAY TO PEEL

“Beulah, peel me a grape,” demanded Mae West in “She Done Him Wrong.”

If the fabulous Mae had asked instead for a peeled shrimp, Beulah would have been smart to contact the OSU Agricultural Experiment Station. She’d have learned, as did Oregon shrimp processors, that there’s a better way to peel a shrimp.

Dave Crawford, a researcher for the Oregon Coastal Marine Experiment Station, developed a new method for processing shrimp that increased the yield of edible meat and reduced the amount of seafood waste. The result is an estimated $55 to $60 million in added profits since its widespread adoption by the Oregon shrimp industry in 1980.

Crawford began his research because he saw a tremendous opportunity for improving the shrimp peeling process. “There was so much yield being lost that it seemed like there should be some way to solve the problem,” he says.

He showed that dipping the shrimp in a mild phosphate bath and carefully controlling the cooking time resulted in higher yields. Processors had been obtaining average yields of 20-22 percent. With the new procedures, the yield jumped to 27-30 percent.

The result is an estimated $55 to $60 million in added profits.

Crawford’s shrimp peeling work dates back to the days when Experiment Station research on commercial fishing and seafood was spread among various academic departments at OSU. Now these activities have been brought together under the newest branch of the Agricultural Experiment Station, the Coastal Oregon Marine Experiment Station. Established in 1988, the coastal branch is headquartered at the OSU Hatfield Marine Science Center in Newport.

The coastal branch station is conducting research that will allow us to use ocean food resources more effectively, efficiently and wisely. Examples:

- Investigating new seafood product forms and potential new seafood markets.
- Studying the nutritional requirements of oyster larvae that may result in better, less expensive pelleted feed.
- Investigating pond polyculture systems—that is, growing crops such as seaweed and clams along with salmon.
- Studying the causes and prevention of fish diseases.
A WAYWARD TREE

Rick Miller thinks eastern Oregon’s livestock and wildlife could use a home where the junipers don’t roam.

His specialty is studying the native and introduced grasses and herbs that cover vast expanses of eastern Oregon and are important foods for the animals that live there. But these days he spends a lot of time experimenting with the wayward trees.

“We’re studying the historical, present and future expansion of the western juniper,” says the range scientist at the Eastern Oregon Agricultural Research Center at Burns.

An overall goal of Miller’s, and of colleagues at the branch agricultural experiment station and in the OSU Department of Rangeland Resources, is to determine the causes and impact of what’s been described as a juniper “invasion.” The researchers also are outlining how public land managers and private land owners should respond.

The juniper has a natural niche in upland plant communities, between the desert floor and pine forests. Researchers believe its expansion into other areas, including grassland valuable to livestock and wildlife, is related to fire. They suspect range fires blocked the spread of the hearty trees until settlers showed up and suppressed them.

Today, it’s estimated junipers cover more than 2 million acres of eastern Oregon rangeland. The trees outcompete other plants for available moisture, often leaving soil bare underneath their canopies.

Miller’s juniper research is simply one example of research focused on agricultural and environmental problems and opportunities in eastern Oregon. Others include a study of how to improve winter grazing for livestock, research with white top and other undesirable weeds on rangeland, a long-term study of the effect of livestock and wildlife on forest plantations in northeastern Oregon, and experimentation with turning grass straw into nutritious food for livestock.

Oregon is famous for its forests, coast, rivers and lakes. But Agricultural Experiment Station scientists continually study the rich natural resource that covers the majority of the state: grassland.

Junipers cover more than 2 million acres of eastern Oregon.

Junipers like this one rob wildlife and livestock of forage and water, says Rick Miller, range scientist at the Eastern Oregon Agricultural Research Center at Burns.
You may not think the work of scientists in entomology, horticulture or plant pathology has much to do with water quality, but you should.

They’re working with soil scientists, bioresource (agricultural) engineers and others on new farming recommendations to help maintain and improve the quality of Oregon’s water. For instance, researchers in the plant-related sciences helped develop systems to control runoff in Christmas trees, vineyards and orchards.

Researchers throughout the Agricultural Experiment Station are contributing to water quality knowledge, stresses Benno Warkentin, soil scientist and director of OSU’s Water Resources Research Institute.

The focus is “non-point” pollution such as the movement of pesticides and fertilizers in surface water into lakes and streams and through the soil into ground water supplies.

The need to protect the state’s water was highlighted when the intensive agricultural area of Malheur County was designated one of the nation’s 37 “hydrologic units” eligible for special federal funding for research and monitoring.

Researchers throughout the Agricultural Experiment Station are contributing.

OSU researchers were already at work. Research projects at the Malheur branch experiment station at Ontario deal with irrigation practices necessary to avoid excessive leaching of nitrogen fertilizer out of the plant root zone.

Future management practice recommendations will aim to keep pesticides and fertilizers in the root zone. “Allowing the chemicals to move below the root zone is wasteful and costs producers unnecessary money,” Warkentin points out.

Management practices are important, because growers have to manage water, soil and chemical resources carefully to protect and improve water quality.

There are no fast and easy answers. While range scientists study how best to manage riparian zones along streams in grazing areas, scientists in the Laboratory for Nitrogen Fixation Research in OSU’s Department of Botany and Plant Pathology are involved in bio-chemical research in an effort to inhibit the soil bacteria that change ammonia into nitrate. The work is part of a study of slow-release fertilizers that keep more nitrogen in the root zone.

Soil scientist Benno Warkentin, director of OSU’s Water Resources Research Institute
DITCH CONTAINS POTENTIAL HAZARDS TO HUMANS/ANIMALS
AVOID CONTACT WITH WATER
INFORMATION 757 6841
Agricultural Experiment Station researchers helped wine growers dodge a bullet when a smoking gun called mesurol threatened to shoot down Oregon wine's sparkling reputation for quality.

The problem began a few years ago after routine laboratory analysis of Oregon wine samples showed a mesurol level of 1500 parts per million, far in excess of the U.S. Department of Agriculture's limit of 80 parts per million, says Max Deinzer, an OSU agricultural chemist. Mesurol is a chemical bird repellent used to reduce damage to ripening fruit. It is no longer registered by the government for vineyard use.

The mesurol levels seemed excessively high to growers, who were afraid if the test results were publicized Oregon wine's reputation for quality would be seriously damaged, explains Deinzer.

Experiment Station researchers in the OSU Department of Agricultural Chemistry had developed the procedures for analyzing mesurol content in wine. So the growers asked Deinzer to check the initial test results—quickly. He found errors and discovered the wine samples contained less than 1 part per million of mesurol.

"The harm to the industry... could have been catastrophic."

"If we hadn't checked out the first test results the harm to the industry from bad publicity could have been catastrophic," says Deinzer.

Not all OSU research in support of Oregon's rapidly growing wine industry is so dramatic.

Researchers are developing new varieties of Oregon wine grapes and collecting vineyard plant material from throughout the world to give Oregon wine growers as broad a selection of wine grape varieties as possible.

Barney Watson, OSU enology researcher, is monitoring the development of flavor and aroma in Pinot Noir grape plant varieties during ripening. His goal is to find the best time to harvest for wine flavor, aroma and color.

"Quality is a top concern in our research, but we want to increase wine grape yields and the diversity of varieties available to growers for future use," says Watson.

Agricultural chemist Max Deinzer responded quickly when the state wine industry needed to find out if Oregon wine was contaminated. It wasn't, Deinzer discovered.
THE COST OF SMOG

We call it smog, but technically it's ozone. More specifically, it's ground level ozone—as opposed to the ozone layer in the upper atmosphere that shields the earth from ultraviolet radiation.

Ozone, or smog, is primarily created by the action of sunlight on exhaust from cars and trucks. We used to believe it was a problem for teary-eyed residents of large cities. But Richard Adams, an agricultural economist with the OSU Agricultural Experiment Station, participated in a national research project that found ground level ozone causes damage in rural areas, too. And we're all paying for it with higher food costs.

The 7-year study sought to understand the relationship of smog and crop yields. Adams' role was to estimate the economic damage suffered by the agricultural community because of air pollution. The researchers concluded that air pollution reduces the yield of major crops as much as 10-15 percent. The cost of the crop loss to consumers and farmers is estimated at $2 billion a year.

The loss ... to consumers and farmers is estimated at $2 billion.

"Consumers pay higher prices for food because of lower yields. And livestock producers pay more for feed grains," Adams says.

His calculations show that wheat yields under current ozone levels in Oregon are 10 percent below what they would be with cleaner air.

"I think the general perception is that Oregon doesn't have high levels of air pollution, except perhaps around Medford. But the results of this study show that yields of wheat and other crops are being reduced by ozone levels found in many areas of the state," says Adams.

The study has influenced the U.S. Environmental Protection Agency to consider tougher ozone standards to protect agriculture and recover some of that $2 billion. It has also provided an impetus for increased crop breeding research to develop plants that will tolerate pollution.
BUILDING BETTER BERRIES

Lloyd Martin, superintendent of the center and an Agricultural Experiment Station researcher, heads the variety development program. The work is important, Martin says, "because the small fruits industry in Oregon believes it's important."

Cooperative research by OSU and the U.S. Department of Agriculture has developed several berries over the last few years, each intended to overcome a particular production problem.

For example, the recently released Redcrest strawberry has extremely high quality for processing (it maintains a uniform red color after freezing and thawing), is easy to pick, and has easily removed stems.

"We developed Redcrest in response to processor interest in a strawberry that would consistently exceed the quality of strawberries from other areas," says Martin.

Another soon-to-be named variety, now simply called strawberry OR-US #4688, has potential for mechanical harvesting.

Growers prefer thornless blackberries because they're easier to cultivate and harvest. OSU and USDA researchers developed a new variety of thornless blackberry named Waldo. Also, in cooperation with a scientist at the University of Illinois, they developed a genetically thornless evergreen blackberry to be released soon.

The traditional goal of variety development is to overcome production problems related to disease, insect pests, low yields, or other undesirable plant or fruit characteristics, according to Martin. A new research direction is developing varieties that have potential for fresh markets.

"The industry is interested in fresh marketing because of growing fresh markets for small fruits in Oregon and throughout the country," says Martin. "The major emphasis, however, remains in developing berries for processing."

Agricultural Experiment Station campus horticulture researcher Daryl Richardson, a specialist in post-harvest physiology, also is interested in the fresh market trend in small fruits.

Richardson is developing packaging that can increase the shelf life of fresh raspberries, blackberries and blueberries, which may allow Oregon producers to increase shipment of Oregon berries to fresh markets in northern Europe and on the Pacific Rim.

Lloyd Martin, superintendent of OSU's North Willamette Agricultural Research and Extension Center at Aurora, shows off a plump, juicy blackberry variety.
Monopoly. For most of us it's a game. It's Boardwalk and Park Place and cutthroat competition. In the business world, monopoly refers to a situation in which there is only one seller of a commodity or service. Monopoly has its opposite—a circumstance in which there is only one buyer.

In either case, competition is at a minimum because one group exercises enough control over the marketplace to influence the price. For private firms it's an opportunity to maximize profits. In the case of governments this market power can be used to stabilize prices, increase government revenues, or improve profits for producers.

The Japanese government, through the Japanese Food Agency, buys and sells all the wheat, both domestic and imported, that is consumed in Japan. As a result, according to a study by OSU Agricultural Experiment Station researcher Alan Love, the Japanese are able to help their own wheat producers at the expense of wheat farmers in the rest of the world.

"The Japanese can keep the domestic price of wheat high in order to subsidize their own wheat growers. On the other hand, Japanese consumers pay a higher price for wheat products than the rest of the world, and that puts a damper on wheat consumption in Japan," Love says.

According to his study, Japan imports 360,000 metric tons less than it would if it had a competitive market for wheat. Japan's lower consumption means less wheat is traded around the world, which drives the world price of wheat down about 58 cents a metric ton.

Love estimates that if Japan changed its wheat marketing structure, world producers would earn $220 million more a year. Much of those earnings would come to U.S. wheat farmers, who supply about 60 percent of Japan's wheat imports.

Research findings by Love and other Agricultural Experiment Station economists provide knowledge that can be used in international trade negotiations such as the current round of talks on the General Agreement on Tariffs and Trade that seek to lower trade barriers between major trading countries.

OSU agricultural economist
Alan Love
Everybody knows putting all your eggs in one basket is risky.

That’s why researchers and Extension agents at Oregon State University’s Hermiston Agricultural Research and Extension Center teamed up with local business leaders, local and state government leaders, and farmers to develop a “regional strategy” that helped attract a $9 million processing plant to quick-freeze vegetables.

“Before the regional strategy we had about 160,000 acres in center-pivot irrigation on the Oregon side of the river, and almost that much on the Washington side, economically dependent on the potato crop. That’s dangerous,” explains Gary Reed, superintendent of the OSU facility.

Now growers have more opportunities to branch out to protect themselves from disease or marketing problems that can be disastrous when they depend upon a single crop. They’re increasing their acreage of peas, asparagus, carrots and other crops whose value is multiplied when they’re processed at the Hermiston plant. OSU researchers still spend at least half their time studying ways to fight disease and increase production in the area’s high-value potato crop.

Researchers... helped attract a $9 million processing plant.

Hermiston isn’t unusual. The headquarters for the Oregon Agricultural Experiment Station is on the Corvallis campus. But the Station operates a network of branch research facilities around the state. Scientists permanently assigned to the branch stations do research to improve agriculture, and the economy, in each region.

The other branch agricultural experiment stations and related research facilities are at Aurora near Portland, Hood River, Moro, Pendleton, Union, Ontario, Burns, Squaw Butte, Klamath Falls, Medford, Newport and Astoria.

The on-the-spot research, backed by campus scientists and equipment, focuses on crops ranging from fruits and vegetables to grains, livestock and seafood, depending on the location of the branch station.

Campus researchers also do experiments at the branch stations to learn more about how Oregon’s varied soils, climates and related factors influence agriculture and the environment.

Gary Reed of OSU’s Hermiston Agricultural Research and Extension Center at Hermiston’s new vegetable processing plant.