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COVER: Research plays a vital role in assuring that today's homemaker can always find a wide variety of tasteful, wholesome foods at the supermarket. For more about research and better living, see the report beginning on page 4.

Photo: Gwil Evans

New goals for OSU research

by G. B. Wood
Director
Oregon Agricultural
Experiment Station

EVER SINCE Congress passed the Hatch Act in 1887, research has been a vital part of the land-grant university program. In the beginning, the most immediate beneficiary of the results of this research was the agricultural public. Of course, virtually the nation's entire population was "agricultural."

More diverse needs

As our farms become more and more efficient, however, and as more and more people move to urban areas, the needs of the public are becoming more diverse. And the OSU Agricultural Experiment Station is expanding its research goals to meet those new needs.

Most of this issue of *Oregon's Agricultural Progress* is devoted to a report on some—but by no means all—of the ways that OSU research means a better life for you and your family . . . whether you live on a farm or in the city.

As several of the following articles indicate, one of the Experiment Station's more important goals is the development of new, wholesome food products. In particular, OSU scientists are working to find ways of protecting food from harmful micro-organisms during its long journey from farm to dining table.

This effort has two primary objectives: first, to develop improved techniques of detecting the presence of these organisms; second, to improve food handling and processing methods so that conditions which encourage the presence of such organisms can be eliminated.

Many recognized authorities on food protection and safety are on the OSU staff. For example, one OSU researcher is widely known for his work in the identification and control of salmonella and botulinus organisms. He spends considerable time with food-processing plants in Oregon, assisting them in developing effective sanitation practices. He also serves as a consultant to the State Department of Agriculture in the course of its inspections of food processing, wholesaling, and retailing establishments.

Educational programs

The findings made by these scientists have been incorporated into educational programs now being used by several Oregon firms to improve their food handling and processing operations. These programs have achieved considerable success in creating an awareness of the need for cleanliness and proper sanitation in food processing and handling.

As Oregon's population continues to increase, so do its transportation problems. For example, motor vehicle registrations in Oregon in 1940 totaled about 400,000. Today, more than 1.2 million vehicles are registered in the state. To help solve the problems brought about by this tremendous increase, an OSU researcher has launched a study to evaluate the future needs of our highway system and to develop a more equitable procedure for allocating costs of the system among its various beneficiaries.

All Oregon citizens are vitally interested in the continued growth and economic development of the state. We want to see existing industries prosper. We want to see new factories and businesses come into the state, increasing employment opportunities and producing new income. We want to see an expanded use of the state's bountiful recreational resources which already generate many jobs and dollars.

Yet we must not permit this development to come at the expense of our environment. Thus, OSU scientists are working to learn how this economic development can take place without impairing those environmental values which make Oregon such an enjoyable place to live.

One team of researchers is studying such questions as: How much is a camping trip worth? What is the monetary value of being able to go fishing on a wooded stream? The ability to answer such questions will enable a more sound use of both the monetary and natural resources of the state.

Water quality

OSU is in the enviable position of having one of the finest research programs in existence dealing with the problems of water quality. Many Experiment Station scientists are involved in this effort.

The results of this program have contributed significantly to a reduction in the pollution of Oregon waters, and will surely help reduce it even further. These findings also have been of help to various state and local agencies responsible for the regulation of potentially pollutant activities.

Recently, a center for the study of air resources was established at OSU. This center will coordinate an already intensive research program aimed at solving such air pollution problems as those associated with field burning, pulp and paper production, and other forms of timber processing.

The problem of waste disposal also is under investigation at the newly established OSU environmental health sciences center. A major effort of this center, the program of which is financed entirely by federal funds, is finding ways to utilize the solid waste materials that are becoming a burden to every community in the state.

An enormous problem

Recent studies indicate that a typical municipality produces from 5 to 10 pounds of refuse per capita per day. This means that the city of Portland, for example, is faced with the enormous problem of disposing of from 2,000 to 4,000 tons of refuse every day. Scientists at the new center are seeking to learn methods by which this material can be converted into useful products. Preliminary results of their work have been most encouraging.

That many new goals have been set by OSU research (continued on page 15)

Research for better living

A report on some benefits of recent OSU research

More convenience built into fruits, vegetables

MANY exciting changes are taking place in today's foods. Not only are new types and kinds of foods becoming available, but they are much easier and quicker to prepare. At OSU, food scientist Lois Sather directs an intensive research effort aimed at building more convenience into fruits and vegetables. Here's a review of some of the achievements to date:

In 1957, Mrs. Sather and her associates tackled the problem of making canned and frozen vegetables—particularly green beans—more convenient to use. Two years later, this work resulted in the development of some two dozen canned and frozen vegetable products with various seasonings and sauces already added.

These included frozen green beans in cheese sauce with mushrooms, ham, or onion seasoning; frozen green beans in tomato sauce; canned green beans with onion, pimento, or smoke flavoring; frozen mixed-vegetable fritters; and frozen french-fried vegetable sticks. Today, of course, frozen and canned vegetables with pre-added seasonings and sauces are widely used.

In another study, the OSU food scientists have found that cabbage can

be frozen in many acceptable forms. Cabbage wedges, chunks, or shredded cabbage are blanched either in steam or boiling water for about three minutes, air-cooled, combined with various ingredients, and frozen either in "heat-in-the-bag" pouches or foil casserole trays.

Products proved acceptable

Products which have proved acceptable after a full year in frozen storage include cabbage wedges and slices of corned beef—with and without horseradish-flavored butter sauce; cabbage chunks in butter and cheese sauce; stuffed cabbage rolls in tomato sauce; and "Hawaiian" shredded cabbage with pineapple and brown sugar added.

Such frozen cabbage products are not yet available. However, for those who enjoy cooked cabbage but find unpleasant the odor it produces during cooking, they would be a most convenient answer.

Recent developments

Early this year, Mrs. Sather and her associates completed work on some more convenience foods—frozen french-fried "cocktail" onions and several new combinations of frozen mixed vegetables for use in salads and casseroles. The onions need only to be heated in an oven for about 15 minutes, and are then served as an hors d'oeuvre or snack. Among the new vegetable products are various salad combinations of lima, kidney, and garbanzo beans with celery, onions, and green pepper, all of which remain highly acceptable after a full year in frozen storage.

An effort is now under way to build more convenience into Italian prunes.

Food scientist Lois Sather examines new combination of frozen vegetables.

A. G. Isley interprets aerial photos of range land with this stereoscope.

Both canned and frozen products, prepared from whole and halved pitted prunes with and without skins, will be studied. Currently, the OSU food scientists are assessing what role the pit plays in prune flavor and what texture and color changes occur when the skin is removed before processing.

Range inventory paves way for boost in schools support

IMAGINE what it would take to determine the physical and biological resources of more than 600,000 acres of eastern Oregon range, situated mostly in remote areas and separated into more than 1,000 individual parcels.

That's the big job a team of OSU range scientists, led by C. E. Poulton, tackled in launching an inventory of state-owned range lands—balance of the lands granted Oregon for "the use of the schools" when it joined the Union.

A wealth of information

Thanks to the knowledge gained in nearly two decades of research on eastern Oregon ranges, the big job is rapidly being completed. And with the wealth of information obtained, the State Land Board and the Division of State Lands will be better equipped than ever before to administer, manage, and improve state-owned range.

As a result, these lands are expected to provide far greater educational sup-

Autumn color for your yard

OREGON may be a land of evergreens. But your yard can be one of glorious autumn color . . . if you plant the right deciduous trees. That's the report from OSU horticulturists R. L. Ticknor and A. N. Roberts.

A colorful autumn landscape is not easy to develop in most parts of Oregon, especially western Oregon. There are some native trees, such as the vine maple, which color very well in the mountains and drier locations. In an irrigated and fertilized yard, however, their foliage seldom becomes colorful. Introduced trees can be equally disappointing. For example, one of two sweetgums growing side by side may produce beautifully colored leaves, while the other provides virtually no color.

Extreme variations

The problem is that extreme variations in inherent color potential often occur in trees that are grown directly from seed. Budded or grafted trees, on the other hand, are not variable. Thus, Ticknor and Roberts are conducting tree evaluation trials with two goals in mind: first, to determine the species which possess good color potential; then, to select from these species superior trees that provide the budwood needed to propagate consistently colorful trees.

At Corvallis, a large collection of selected flowering cherries and crabapples has been maintained for some time. Recently, several colorful selections of sweetgum, sourwood, willow oak, pear, and blackgum were made. Roberts notes that budwood from these selected trees soon will be made available to nurserymen.

At the Southern Oregon Experiment Station near Medford, 46 different trees are being surveyed for their color and overall performance. John McLoughlin, county extension agent, is working on this trial.

At the North Willamette Experiment Station near Aurora, 227 types of trees are being tested. Ticknor points out that in addition to autumn color, these trees are being evaluated for growth rate and habit, time of foliation and leaf fall, and resistance to cold, wind, insects, and diseases.

Consistent color producers

Trees which have given consistently good autumn color in this extensive trial include three strains of red maple named Autumn Flame, October Glory, and Red Sunset; two strains of flowering dogwood named Rainbow and Welch; pin, red, and scarlet oaks; Chinese and western dogwood; and Stewartia, a small, white-flowered tree.

Ticknor and Roberts note that some of these named trees are quite new and temporarily may be hard to obtain. Trees also can be selected simply on the basis of their color in the nursery, and probably will maintain their color in your yard if not watered and fertilized excessively.

Horticulturist R. L. Ticknor checks colorful maple being tested.

port in the future. Enhanced wildlife, watershed, and recreation values also are anticipated, in addition to increased forage output.

How is it possible to conduct a detailed, accurate inventory of more than 1,000 parcels of remote range? An examination on foot of every parcel is hardly feasible. However, the backlog of previous research, combined with an aerial photo interpretation system, enabled the OSU scientists to conduct the inventory while checking only about 200 parcels on foot. They even can provide information about the activity of ants, as represented by ant discs on the surface of the ground.

The inventory procedure

First step was to obtain and organize aerial photo coverage of the various parcels. Next, the boundaries of each parcel were located on the appropriate photographs. Workers with both field and photographic experience then interpreted the photos to determine each parcel's characteristics. Accuracy was verified by checking about 20% of the parcels.

The remaining 800-plus parcels are now being stereoscopically mapped and interpreted. With this technique, the images in two overlapping photographs of the same area, taken from slightly different points, are combined to achieve a three-dimensional effect. So the nature of the landform is revealed, as well as the nature of vegetation and soil resources.

The OSU range scientists note that this information is in a form that will permit future computerization and, thereby, be ready for rapid recall when a management decision is required.

Special collar makes it easy to keep pets flea-free

FLEAS are no fun. Just ask any dog or cat that plays host to these pesty, blood-sucking insects. You can easily keep your pet flea-free, though, thanks to research.

Several years ago, OSU entomologist R. L. Goulding went to work on the need for a better means of controlling

fleas on pets. Many of the measures then available were inconvenient or unpleasant to use. Others did not always do the job. The result: a simple, inexpensive collar that is safe, highly effective, and virtually self-operating. You need only replace it about every three months.

Resin plus insecticide

The collar is formed out of a plastic resin (polyvinyl chloride) mixed with a volatile insecticide (Vapona). The plastic acts both as a reservoir and metering device for the insecticide. That is, it allows enough of the material to escape into an animal's coat to maintain control of fleas, but not enough to harm either the animal or humans.

Adult dog or cat fleas spend their entire reproductive lives on the host animal. They lay eggs in the animal's coat which inevitably roll off into its bedding, or if the animal is allowed in the house, into rugs, stuffed chairs, and similar furnishings. There, the eggs hatch into larvae which form cocoons. An adult flea then emerges and leaps back onto the host animal at the first opportunity.

Since the collar makes the animal continuously toxic to fleas, it breaks up this reproductive cycle. This, Goulding notes, cuts down the chances for reinfestation and also sharply reduces the number of fleas that may reside in the house. Many people react quite severely to flea bites. If you're one of them, the collar makes your life more pleasant, as well as your pet's.

New equation aids efficient output of retail beef cuts

A NEW, more precise equation for predicting the "cutability" of beef carcasses has been worked out by researchers at the OSU meat science lab.

W. H. Kennick reports that the equation will predict within only 2.3% the actual yield of trimmed retail cuts from 95 out of 100 beef carcasses. Present prediction methods come within about 5% of actual yield.

Among other things, the new equa-

New sausage is nutritious, low in fat, and easy to prepare.

Fish sausage is developed

RESEARCH has written the recipe for a new treat for your table. It's a frozen brown-and-serve sausage, and it makes use of an abundant marine resource now virtually going to waste—the Oregon shad.

Developed at the OSU seafoods lab in Astoria by D. K. Law, J. E. Langler, and D. L. Crawford, the new sausage is high in protein—higher even than pork sausage. It is low in fat content and what fat it does contain is unsaturated. And it is easy to prepare—you need only pan-fry it for about two minutes per side before serving.

Chief ingredients

Chief ingredients of the product are ground shad, ground rockfish fillets, smoke flavoring, and a typical sausage seasoning of salt, white and black pepper, marjoram, sage, ginger, and nutmeg.

The price for which the new sausage could be sold is extremely attractive. The seafood researchers estimate that the total cost—including labor—of producing finished sausages in a convenient 8-ounce package would be about $825 per ton. Assuming standard or better returns throughout the marketing chain, this means the sausages could retail for only about 42¢ per package.

In an extensive series of taste tests, both trained and untrained tasters were asked to score the new sausage, prepared by pan-frying, for juiciness, tenderness, texture, taste, and overall desirability. Both groups found it highly acceptable.

Problems encountered

Many problems were encountered in developing the product. For example, the shad is an extremely bony fish. The OSU seafood researchers found this could be overcome, first by removing the shad's backbone, then grinding up the rest of the flesh in a common meat chopper. And if a high-speed grinding mill is used, removal of the backbone may not be necessary. This would mean the sausage could be produced at an even lower price.

Another hurdle was the rather elastic property of ground shad which resulted in undesirable texture characteristics in a sausage made only of shad. The researchers solved this by adding an equal quantity of ground rockfish fillets.

As for the product's storage potential, after 12 months in frozen storage, the tasters continued to rate it highly acceptable. In fact, the scores increased slightly. Law, Langler, and Crawford feel this increase probably was due to accumulated exposure to the sausage. In other words, the more familiar you become with it, the more you enjoy it.

Commercial fish processors have shown a keen interest in the new product. Thus, fish sausages soon may be available at your grocer's.

tion will help the beef cattle industry produce animals with carcasses of superior cutability. This is beneficial all the way from the cattle ranch to the dining table. It not only costs more to produce and market a "wastey" animal; it costs more to purchase the retail cuts such an animal yields.

44 steers used

To work out the equation, Kennick and his associates used 44 steers that had been finished out to an average slaughter weight of 1,050 pounds. Following slaughter and proper aging, the left side of each carcass was cut into trimmed retail cuts.

The information obtained on 18 major variables of each steer—for instance, cold carcass weight, fat thickness, and rib-eye area—was then fed into a computer. Next, what is known as a step-wise multiple linear regression analysis was run on all this information.

In this type of analysis, the computer chooses the variable with the greatest amount of influence on what is to be predicted and develops an equation based on that variable. Then, in succession, each progressively less influential variable is considered, until all the variables are accounted for. Kennick notes that without the computer, the many millions of calculations involved in developing the equation would have been virtually impossible to make.

After studying the results of this analysis, the OSU researchers chose six variables which would be the easiest and most practical to obtain in a typical carcass evaluation. These included cold carcass weight, conformation score, rib-eye area, fat thickness, round weight, and flank weight. From a further computer analysis of these variables, the new cutability equation was achieved.

Study provides detailed look at local government costs

THE COST of local government in Oregon has become quite substantial. To illustrate: in fiscal year 1963-64, town

Not all Oregon citizens are familiar with agriculture's substantial contribution to the growth and well-being of the state's economy. Much valuable information on this contribution was compiled recently by OSU agricultural economist G. E. Korzan, and soon will be available in a new publication titled "Oregon's Food and Fiber Industry." Ask your county agent for a copy or write the OSU bulletin clerk. Meanwhile . . .

Do you know that...

¶ Oregon farmers received $525 million in 1967 for the commodities they produced. Processing and handling added $310 million, bringing Oregon's processed pack to $834 million—a new record.

¶ Production tonnage in 1967 totaled 6½ million, 440,000 tons more than in 1963.

¶ This increase in tonnage was produced with 6,000 fewer farm workers than in 1963. Employment in Oregon's food and fiber industry is increasing at the processing level, however, and increasing considerably—20% in four years—at retail and wholesale levels. sons are employed in food distribution in C

¶ Inshipments of fa food tonnages excee both are important, and motor carriers w lion annually in opera

¶ Oregonians spent in 1967, including n This amounts to an person.

¶ The processed ve gon was worth more modity group—nearly a new record.

¶ Livestock and li 1967 accounted for 2 nage sold and produ income.

¶ Oregon's cattle i expand. Cattle feedin 1963; pounds slaugh creased by 35 million.

¶ Total milk produ tinued to decline, lar son consumption is g

More than 18,000 per-
wholesale and retail
Oregon.

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with at least $42 mil-
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y $200 million in 1967,

ivestock products in
22% of the total ton-
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ndustry continues to
g increased 40% since
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uction in Oregon con-
gely because per per-
going down. Yet, the

industry is more viable than ever with record production per cow, larger herds, and more efficient processing and distribution.

- Wheat, pears, potatoes, and peppermint were among the leaders in pushing Oregon's cash farm sales to record levels in 1967.

- Oregon fruit and nut growers received $29 million or 68% more for their crop in 1967 than in 1963, due to higher tonnage and higher prices.

- More than 11,000 annual worker equivalents were involved in packing Oregon's $350 million fruit and vegetable crop.

- Hops production in Oregon has increased 36% since 1963.

- Mint growers increased production 91% between 1963 and 1967, and they still received a record price.

- Nursery and greenhouse sales increased 43% between 1963 and 1967.

- Tonnage increases in the years ahead likely will be most significant in beef cattle, broilers, vegetables for processing, and grain.

and city governments in the state spent approximately $117 million—the equivalent of more than $50 for each Oregon resident.

OSU agricultural economists R. C. Youmans and R. W. Carkner recently completed a study in which the level of expenditures made during 1963-64 by the governments of every incorporated Oregon community were compared.

The study was undertaken in an effort to provide information that could assist local governments in making management decisions; help communities in evaluating their tax structures, attracting industry, and generally achieving growth; and assist in assessments of overall economic efficiency among local governments. Five categories of expenditure were considered in the study: general government, which covers administrative and management costs; public works, which includes such items as sanitation, sewage, and water works; fire protection; police; and parks and recreation.

Cost varies widely

The OSU researchers found that the cost of providing these services varies quite widely. For example, of 63 communities with less than 500 population, one provided the services for 71¢ per capita. Another provided the services for $88.58 per capita.

Considerable variation also exists between towns of differing population. For example, among 40 communities ranging in population from 1,000 to 2,500, lowest per capita cost for providing the fire services was $6.76. Among 30 communities ranging in population from 2,500 to 5,000, highest per capita cost was $80.64.

Specific services

The cost of providing a specific service also varies according to population. For example, the per capita expenditure made for police in Portland—the state's only community with a population in excess of 100,000—was $15.79. The cost for police then dropped immediately to an average of about $9 per capita in communities with less than 100,000 down to 2,500 population. It then dropped again to an average of $3.21 for communities with less than 500 population.

Youmans and Carkner point out that this study is only a starting point. What

explains the wide variations in costs? Is it merely a matter of efficiency? Is the quality of the service being provided the deciding factor? Further research will be needed to answer these important questions.

Ways found to help maintain and improve food flavors

NUTRITIOUS, reasonably priced, attractive, and pleasing in texture. A food may have all these qualities, but it won't create much interest on your dining table if its flavor is poor. Indeed, poorly flavored foods often are likely to go to waste—even in countries where people are suffering from severe malnutrition.

Working to maintain and improve food flavors are OSU food scientists D. D. Bills, R. C. Lindsay, R. A. Scanlan, and L. M. Libbey. Many dairy products are being studied, including milk, cream, butter, cheese, sour cream, cottage cheese, and buttermilk. The flavor of green beans, sweet corn, strawberries, blackberries, filberts, and other similar foods also is under investigation.

What chemical compounds make up a food's flavor? How are these compounds formed? How can their loss be avoided during processing and distribution? Little research was devoted to such questions prior to the 1960's. The chief reason: adequate methods of isolating and identifying flavor compounds were not yet known. Bills points out that there are many compounds which significantly influence flavor at levels of only one part flavor compound per million parts of food.

Two essential devices

However, the recent development of two highly sensitive devices—the gas chromatograph and the mass spectrometer—has made it possible to determine the chemical makeup of food flavors. Using these devices and other specialized techniques, the OSU scientists already have made some important findings.

For example, Lindsay has found that

Study shows blacktail "tough"

HOW MUCH hunting pressure can Oregon's black-tailed deer herds tolerate? An important question, for every year finds more and more hunters eager to test their skill against the wily blacktail.

For some time, OSU wildlife researchers, in cooperation with the Oregon State Game Commission, have been studying a herd of blacktails under very heavy hunting pressure. The report from L. W. Kuhn and H. F. Horton: the blacktail "can really take it."

Deer herd buildup

In the early 1950's, black-tailed deer became a serious problem at McDonald Forest, an 11,500-acre tract located near Corvallis and the site of considerable OSU forestry research. A large herd had built up, and young Douglas-fir plantings, experimental plots, and even natural tree reproduction were suffering from severe browse damage. To reduce deer numbers, the area was opened to controlled hunting by the public.

It soon became clear that McDonald Forest offered an unusually good opportunity to measure the effect of heavy hunting on a blacktail herd. So every year since 1953, hunters have been invited to try their luck for four weekends during the regular hunting season on a come-one, come-all basis. They are required only to check in and out of the area each day.

During 1953 through 1959, the number of hunter-days averaged about 1,500 per year. Since 1960, hunter-days in the area have averaged nearly 3,500 per year—ranging from a high of 4,750 to a low of 2,500. Kuhn and Horton point out that this probably is the heaviest sustained hunting pressure exerted anywhere in the state. Yet McDonald Forest's black-tailed deer herd has easily held its own.

Over the 15-year period, a total of about 4,650 deer has been harvested —an average of 310 per year. Last season (the most recent figure available), 338 blacktails were harvested. Hunter success over the entire period has averaged about 13%, and it has remained quite steady since 1960 at around 10%.

An annual crop

Adding up this information, the OSU researchers conclude that hunters now are simply harvesting an annual crop of fat, healthy deer. To put it another way, the blacktail is a tough competitor and one that will continue to provide a real challenge for Oregon sportsmen.

Above, hunters checking in. Below, L. W. Kuhn (right) and a student weigh a hunter's big four-pointer.

Above, a steelhead that didn't get away. Below, L. D. Calvin uses a computer for processing survey data.

Sport fishery survey conducted

MORE THAN 950,000 sport fishing licenses were issued in Oregon last year, compared with less than half that many a decade ago. How can the Deschutes, the Alsea, Siltcoos Lake, Yaquina Bay, and the state's many other famous waters be kept productive under this ever-mounting pressure?

To help pin down the answers, OSU statisticians L. D. Calvin and T. D. Burnett have assembled the first complete picture of a year's total angling effort in Oregon. The picture is based on detailed surveys of the fishing activity of 20,000 resident families and 2,300 nonresident anglers during 1965. Among the findings:

For the entire state the effort totaled 4.5 million angler days and produced a catch of 10.5 million fish. Most of the effort (62%) and the catch (74%) took place from May through August.

The effort by region

Nearly 53% of the effort (2.4 million angler days) was concentrated in the northwestern region of the state; 17% in the southwestern region; 19% in the central region; 7% in the northeastern region; and 4% in the southeastern region. Anglers living in a given region, on the average, devoted 75% of their effort to waters in that region.

The OSU statisticians also learned that 230,000-plus of the 4.5 million total angler days were by nonresident anglers: 36,000 by Washington residents; 26,000 by Idaho residents; 116,000 by California residents; and 56,000 by residents of all other states.

Angling success

As for angling success and species of fish caught, 7.6 million trout were caught in 2.8 million angler days. Of these trout, 3.2 million were unidentified as to species, and were caught in 1.8 million angler days. Next was the rainbow, of which 3.1 million were caught in 680,000 angler days.

Among anadromous game species, 1.6 million angler days produced a catch of 1 million fish. Of these, 365,000 were unidentified as to species, and were caught in 900,000 angler days. Next was the steelhead, of which 245,000 were caught in 465,000 angler days, followed by 210,000 coho salmon caught in 95,000 angler days.

Among warm-water game species, 1.5 million fish were caught in 415,000 angler days. Of these fish, 590,000 were perch caught in 175,000 angler days, followed by 585,000 catfish caught in 150,000 angler days.

Among surf and bay species, 85,000 angler days produced a catch of 280,000 fish. Of these, 170,000 were perch caught in 32,000 angler days, followed by 43,000 flounder caught in 7,700 angler days.

five compounds (in the proper proportions) represent the essential flavor of sour cream, cottage cheese, buttermilk, and cultured butter. The compounds are diacetyl, dimethyl sulfide, acetaldehyde, acetic acid, and lactic acid. Now, work is proceeding on methods that can be used by the dairy industry to assure the presence of these flavor compounds at optimum levels.

Flavorful sterile milk

Efforts also are in progress to develop a flavorful sterile milk that can be kept for weeks or even months without refrigeration. The best-known example of such a product is evaporated milk, widely used for cooking and baby formulas. But who would care to drink evaporated milk, rather than fresh milk, with a meal?

Since the undesirable flavor of evaporated milk arises during sterilization, Scanlan is studying the compounds formed in milk during this heating process. Many of the heat-induced compounds have been identified. And even now, tests show that milk with much better flavor than evaporated milk can be prepared by heating for very short periods at very high temperatures. The methods needed to produce an acceptably flavored sterile milk may soon be within reach.

Laundering tests assess washability of new woolen fabric

FABRICS with many new and useful features are being developed for today's homemaker. A good example—a 100%

Fast food poison detection

OSU MICROBIOLOGISTS have developed a rapid, reliable, and simplified means of determining whether foods contain harmful bacterial toxins.

Worked out by A. W. Anderson and his associates, the new method will detect the presence of these poisons in food in 24 hours or less. Procedures now in use require from 48 hours to two weeks — widely acknowledged as too slow for today's fast-moving food industry. Present procedures also are more complex.

To date, the method has proved effective in isolating and identifying such health hazards as the lethal toxin produced by *Clostridium botulinum*, which causes botulism, and staphylococcus toxin, which causes serious infections.

Gel electrophoresis unit

Normally, in testing foods for harmful bacterial toxins, one of the most difficult jobs is separating out the potentially poisonous material. A new "gel electrophoresis" unit, designed by the OSU scientists, makes this job much easier and quicker. Here's how it works:

A sample of the food to be tested is mixed into a gel made of agar, starch, or a similar substance. The gel is then put in the unit and subjected to an electrical field. Since a bacterial poison is a particle of a certain size and electrical charge and the gel can be made to allow only particles of that size to pass when they are placed under electrical pull, the potentially poisonous material is, in effect, "sieved" away.

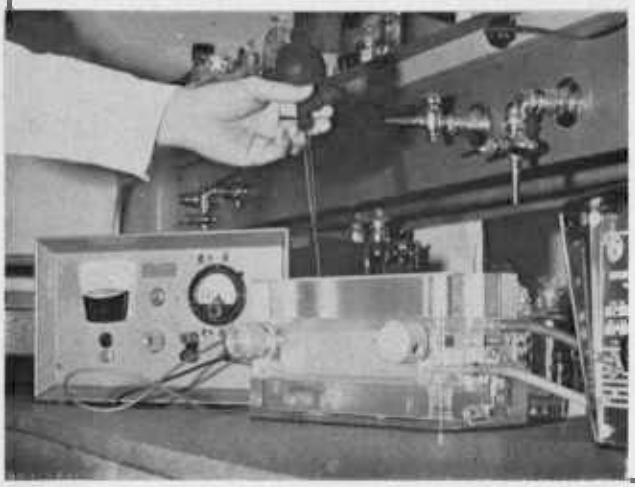
Other particles removed

Many other kinds of particles of almost the same size and electrical charge also are removed, however. Thus, it remains to make sure that the material removed actually contains poison.

If an animal gets a disease and recovers, it becomes immune to that disease. That is, its body produces particles known as antitoxins which combine with the disease-producing toxin to make it nonpoisonous.

Anderson and his associates note that this process also can be made to occur in a test-tube, simply by combining some antitoxin from an immune animal with the potentially poisonous material. Since the antitoxin will combine only with the poison for which it was produced, the combined particles soon become visible if poison is present. This is due to increased size and other changes that take place.

The OSU scientist's detection method is expected to be of major assistance to the food processing industry—particularly in the processing of frozen and dried foods. It will help the industry determine rapidly if harmful toxins are present, as well as assist in their elimination.



Scientist injects test sample into new gel unit.

woolen fabric coated with a very thin finish of nylon to make it washable. How well does this finish, called "Wurlan," do its job?

To find out, OSU textile researchers Marilyn Borchardt and Janet Bubl set up a series of tests in which finished and unfinished samples of the same woolen fabric were compared for overall laundering performance. Both plain and twill weaves were tested, as well as gentle *vs.* no agitation and hot- *vs.* cold-water detergents at 120 degrees F.

Before each of 20 five-minute launderings, the fabric samples were soiled by applying a clay and an oil similar to natural body oils (2% of each by fabric weight). Following 10, 15, and 20 launderings, the percentage content of clay and oil retained by each sample was determined. These measurements were made with the aid of a special X-ray device sensitive to elements contained in the clay and oil.

Better shrink resistance

Among the textile researchers' findings: Both with and without agitation at 120 degrees F., the finished woolen fabric has substantially better shrink resistance than the unfinished. Dimensions of finished samples were stable after 10 launderings, and total shrinkage after 20 launderings averaged less than 2% for both weaves tested. Dimensions of unfinished samples had not yet stabilized after 20 launderings. Unfinished plain-weave samples had shrunk an average of 3.4%, and unfinished twill-weave samples 8.5%.

Agitation proved particularly important in the degree of soil removal. Significantly less clay and oil were retained by samples laundered with gentle agitation than simply by soaking.

More clay and oil

Somewhat more clay and oil were retained by the finished samples. For example, after 20 launderings in hot water with gentle agitation, all clay was removed from unfinished twill-weave samples, while the finished twill-weave samples retained an average of 0.1% of their weight in clay. These samples also retained more than 1% of their weight in oil, compared to 0.5% for the unfinished samples.

Other qualities for which the finished fabric was tested include breaking strength and permanence of finish. On

both counts, the fabric's performance was satisfactory.

Adding up their findings, the OSU textile researchers conclude that this nylon-coated woolen fabric possesses quite good laundering qualities and is well worth the homemaker's consideration—particularly for making such items as slacks, skirts, and sport shirts.

Improved storage lengthens season for fresh fruits

TWO DECADES ago, a fresh, juicy Oregon pear or apple was difficult—if not impossible—to come by once the winter season had passed.

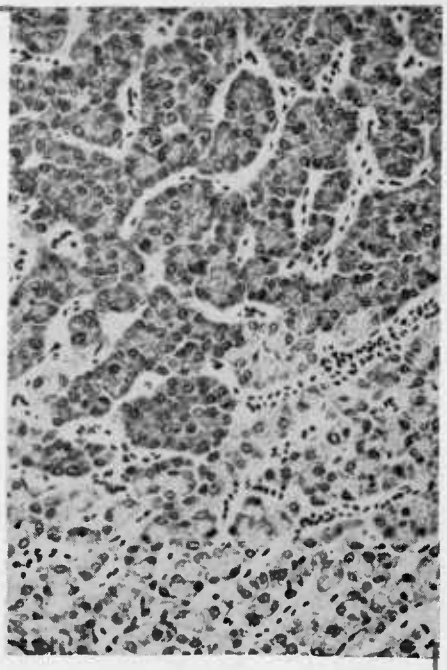
Today, these delicious fruits usually are available well into the summer months . . . thanks to an improved storage method known as CA (controlled atmosphere) storage and to studies conducted by OSU horticulturists E. Hansen and W. M. Mellenthin at the Mid-Columbia Experiment Station near Hood River.

Respiration process

All fresh fruits continue to respire after harvest. That is, they take in oxygen and give off carbon dioxide. As this energy-consuming process continues during storage, a gradual decline occurs in the quality a stored fruit possessed when it was first harvested. If the fruit is kept at reduced temperatures—30 to 32 degrees F., the rate of respiration is greatly lowered. This results in a conservation of energy and quality and is the basic principle of regular cold storage.

However, Hansen and Mellentin point out, refrigeration has its limits. If storage temperatures are lowered much below 30 degrees, there is risk of the fruit freezing. By maintaining the temperature in a storage room at or above 30 degrees, but lowering the oxygen and increasing the carbon dioxide, respiration can be slowed even further. This maintains quality over a much longer period and is the basic principle of CA storage.

With this method, stored fruit is actually put to work in preserving its



Section of test trout liver at edge of cancerous (darker) area.

Answers to cause of cancer

THE RAINBOW TROUT is helping OSU research provide answers to the cause of cancer—perhaps even human cancer.

Several years ago, an epidemic of liver cancer destroyed millions of young rainbows at fish hatcheries across the U. S. and Europe. More than 90% of some hatchery stocks were lost. The outbreak appeared to be related to changes that had just previously occurred in the standard hatchery diet—from raw meat and fish scraps to a dry mixture of many animal and vegetable materials, including wheat middlings, fish and meat meals, and cottonseed meal. Did one or possibly more of these materials trigger the epidemic?

To find out, OSU food scientists have launched trout-feeding studies at a specially constructed fish disease laboratory near Corvallis. Among the significant findings thus far by R. O. Sinnhuber, J. H. Wales, and D. J. Lee: moldy cottonseed meal harbors the most powerful cancer-producing substance yet known.

This substance is the aflatoxin produced by certain strains of a common mold with the scientific name of *Aspergillus flavus*. And trout fed a diet containing just a few parts per billion of this substance contract liver cancer within only four months.

Many questions raised

This finding raises many questions. Does the aflatoxin also produce cancer in other animals? Yes . . . for instance, in the liver, kidneys, and lungs of rats, pigs, dogs, and cattle. Does it produce liver cancer in humans? Scientists are not yet certain. However, the incidence of liver cancer is highest in those areas of the world where moldy foods are common, and on-the-spot studies are now under way in an effort to pin down the answer.

Where do the aflatoxin-producing strains of mold live? Everywhere. In what foods have aflatoxins been found? Cottonseed meal, peanuts, peanut butter, corn, and various corn products. Corn oil and peanut oil are free of aflatoxin, however, because of the refining techniques used in their manufacture. Are these aflatoxins destroyed during processing and heating—in the roasting of contaminated peanuts, for example? To some extent, although traces still may remain in the final product.

Steps to insure safety

Based on this information, the appropriate agencies already are stepping up their inspection, laboratory, and testing activities to insure that food safety is maintained until all questions have been answered.

Recently, the OSU scientists determined that a naturally occurring fatty acid present in cottonseed oil and meal greatly increases the incidence and growth of aflatoxin-produced liver cancer in trout. Efforts to learn more about this material are now in progress.

Seals, sea lions in jeopardy

THERE ARE many reasons why Oregon is an enjoyable place to live and to visit. Not the least of these is the state's enviable and uncommonly accessible variety of wildlife. Cases in point: the harbor seal and the Stellar sea lion, which residents and tourists get great pleasure from seeing in their natural habitat.

The future of these unusual marine animals may be in serious question, however. A survey conducted by OSU wildlife ecologists J. P. Pearson and B. J. Verts, reveals that numbers of both species have dwindled substantially in recent years.

Today, the researchers found, there apparently are fewer than 500 harbor seals along the entire Oregon coast. Yet the population of harbor seals in 1930 is estimated to have been well in excess of 5,000. The researchers also learned that Oregon's total summer breeding population of Stellar sea lions is now from 1,000 to 1,200 animals. In 1925, the population was easily three times that number, and probably more.

Why the decline?

The decline in seal and sea lion numbers stems at least in part from the losses both species are considered to inflict on the commercial salmon fishery. However, Pearson and Verts suspect that the loss—while it can be significant for an individual fisherman — is of negligible economic impact on a industry-wide basis.

In fact, the harbor seal is a friend as well as a foe of the fisherman. Out of 21 seals examined during the survey, two contained the remains of salmon. Five seals, on the other hand, contained the remains of lampreys, a parasite of salmon.

Seals forced out

The survey also revealed much about where seals and sea lions reside on the Oregon coast. At one time, many harbor seals lived year-round in the mouth of the Columbia River. Now, no seals live in the river all year long. It appears they have been forced out of this area, at least to some extent. The largest concentration of harbor seals—200 to 250 animals—is now located on Simpson Reef off Cape Arago near Coos Bay. The OSU researchers point out that this seems to be the safest place for them on the coast.

Two "rookeries" or breeding colonies of Stellar sea lions currently spend their summers on the Oregon coast. The largest—about 500 animals—is located on Oxford Reef off Cape Blanco north of Port Orford. The other rookery is situated near Heceta Head. Another 250 animals are scattered about in various places, but seldom breed.

Pearson and Verts suggest several ways that further declines in Oregon's harbor seal and Stellar sea lion populations might be prevented. These include elimination of the bounty for harbor seals in the Columbia River; establishment of areas where protection is specifically provided for both animals; and regular surveys to determine future trends in abundance and distribution.

The population of Stellar sea lions in Oregon has dwindled substantially.

Photo: K. W. Kenyon, U. S. Bureau of Sport Fisheries and Wildlife.

own quality and extending its own storage life, since the process of respiration is utilized to regulate the amount of oxygen and carbon dioxide in the atmosphere. Excess carbon dioxide is removed by means of various devices known as "scrubbers."

CA storage is not an end in itself, however. Each fruit requires a specific atmosphere for the best results. Thus, Hansen and Mellenthin have devoted considerable effort to determining the best storage atmospheres and temperatures for different varieties of Oregon pears and apples.

Best combinations

For example, they have found that the best combination for D'Anjou winter pears is 2% to 2.5% oxygen and 0.8% to 1% carbon dioxide at a temperature of 30 degrees; for Newton apples, an atmosphere of 3% oxygen and 6% carbon dioxide at 37 to 38 degrees is best.

The OSU horticulturists also have found that a properly operated CA storage helps control or reduce the occurrence of many fruit disorders. These include superficial scald, internal browning, and internal breakdown. Thus, CA storage and research have not only made fresh fruit available

most of the year—it's better fresh fruit, as well.

Nutrition studies increase knowledge of healthful diet

How MUCH vitamin B_6 should your diet provide to assure good health? How can the heart attacks and strokes associated with cholesterol and dietary fats be prevented? The answers are not yet known, but two studies by OSU nutrition researchers are hastening the day when they will be.

¶ Generally, a normal diet supplies the human body with all the vitamin B_6 it needs. When deficiencies do occur, however, the consequences can be extremely serious—particularly for infants. An infant who does not receive enough vitamin B_6 is subject to severe convulsions and even irreversible mental retardation.

Improving methods

A major hurdle in learning more about this vitamin's role in human health is that only very small amounts of it are present in both foods and human tissue. Thus, a team of OSU researchers, led by Clara Storvick, is seeking to improve methods of separating the vitamin from other material and of measuring the vitamin once it is separated. Such methods will make it possible to establish blood and urine levels of vitamin B_6 in healthy people and, therefore, permit detection of a deficiency before visible symptoms occur.

In the first instance, the researchers have worked out an improved technique of separating vitamin B_6 from the material to be analyzed. The technique is simpler, more efficient, and takes less equipment and less rigorous testing conditions than previous methods. Using it, the researchers can separate out more than 90% of the vitamin B_6 present in a given sample.

The research team also has developed a new method of measuring the vitamin after separation. Since it requires only one-tenth as much sample material as previous techniques, the method is particularly valuable for use with infants, where blood or urine samples have to be quite small.

¶ Cardiovascular disease is now the primary cause of death in the United States. Last year, in Oregon alone, more than 10,000 people died from heart attacks, strokes, and similar cardiovascular disorders.

Cholesterol deposits

Heart attacks and strokes occur when the blood supply to the heart or brain is interrupted. There appear to be several reasons why this happens. In most cases, however, large deposits of cholesterol and other fatty substances have formed on the innermost lining of the arteries, causing these vital vessels to narrow, lose elasticity, and clog. These fatty deposits apparently go hand in hand with high levels of fat circulating in the blood.

Both of these conditions can be exaggerated by a high intake of sugar, as well as fat. Thus, another team of OSU nutrition researchers, led by Elisabeth Yearick, is studying the relationships between the level of fat and sugar in the diet and the types of fat that circulate in the blood. The researchers have concentrated to date on making improvements in the procedures used to separate and measure fatty substances in the blood. Now, work is under way to learn how various diets, as well as physical exercise, influence the blood fats that are so high in cardiovascular disease.

(continued from page 3) does not mean that research into more specifically agricultural problems has diminished. Quite the contrary, for all Oregon citizens have an important stake in the continued efficiency of the state's agriculture. Thus, much of the Experiment Station's research program remains devoted to helping Oregon farmers and ranchers do better what they already do very well.

It is estimated that the nation's food producers would have to spend as much as $1 billion per year in additional inputs if they were using the same farming practices today that they were using just a few years ago. Inevitably, this additional cost would be reflected in higher food prices at the retail level.

An additional $150

In 1960, the average Oregon family was spending more than 20% of its disposable income for food. Today, that figure is only 17%. To put it another way, if your disposable income is $5,000 per year, you now have an additional $150 to use for purposes other than food.

This has not come about merely by chance. It is the result of a great deal of hard work by a great many people.

Food plentiful, but . . .

Food generally is so plentiful in the United States today that it is possible to become complacent about the need for a strong, sustained research program to help keep our food production, processing, and marketing methods efficient. Yet it seems clear that if no new technology were added beyond what is being applied today, the state's agricultural industry would soon fail to realize the domestic and export opportunities available to it . . . and, hence, to all of Oregon.

For more than four decades, OSU research has been making substantial contributions to the welfare of every Oregon citizen. It can—and will—continue to do so.

OSU agricultural chemist V. H. Freed is seeking ways to utilize solid wastes.

Agricultural research helps Oregon's economy grow

AGRICULTURAL research benefits the farmer, to be sure. Yet because of its capacity to generate new wealth, it often pays big dividends for each and every citizen. Here's an example of how OSU research has helped Oregon's economy grow.

Back in 1957, the alfalfa seed crop produced in Malheur and Umatilla counties sold for approximately $500,000. Seed yields at that time were averaging around 280 pounds per acre. Six years later, when the results of research by OSU entomologist W. P. Stephen were applied, the alfalfa seed crop produced in those two counties sold for more than $4.5 million—a nine-fold increase. Cost of the research: less than $20,000 per year.

Today, chiefly because of Stephen's findings, Oregon's alfalfa seed acreage averages in excess of 20,000 acres—nearly three times the 1950-54 average; average seed yields now stand at 620 pounds per acre—more than three times the national average; and yields of 1,500 pounds per acre are common.

What made the difference? Methods of increasing the populations of two types of wild bees that are far more effective than honey bees at pollinating alfalfa, but are not present in sufficient numbers under natural conditions.

Boards and soda straws

One of the bees that was successfully increased is a leaf-cutter bee, so named because it cuts sections from leaves which are used to build nests in holes in woody shrubs or trees. Since there were not enough naturally produced holes suitable for nests near the seed production fields, Stephen set up a series of tests to see if the leaf-cutter would nest in boards in which holes had been drilled. Not only did the boards prove acceptable, but the entomologist also found that the bees would nest in plastic-coated soda straws which were glued on one end to the bottom of a milk carton or similar container.

After the bees lay their eggs in the boards or straws and the eggs mature into larvae, the larvae are placed in a refrigerator or cold storage room and kept in a dormant condition. This also protects them from various predators and parasites which attack the leaf-cutter during the pre-pupal stage. When the pollinating season approaches, the larvae are simply moved to a warm place where they develop into mature bees, ready to go to work.

The other successfully increased bee makes its nest in the soil and is known as the alkali bee. Its population also was limited by a shortage of suitable nesting sites.

Artificial soil beds

Stephen, in cooperation with an OSU soil scientist, developed a technique of making artificial soil beds that could be moved from field to field as the bees were needed. The researchers then found that by precisely controlling the physical and chemical properties of the soil, it was possible to produce as many as 1,000 alkali bees from one cubic foot of soil. This finding led to the development of large, permanent, artificial beds along many eastern Oregon alfalfa seed fields.

Under natural conditions, a lack of moisture often causes fluctuations in alkali bee populations and a subsequent reduction in alfalfa pollination. However, since water and salt can be added to the artificial beds in order to maintain proper soil moisture, seed producers are now better able to stabilize the bee population and, accordingly, their incomes.

The bees also have become a substantial business in their own right. More than $1 million is now spent each year on rearing, buying, and selling leaf-cutter bees and in developing and maintaining nesting sites for alkali bees. In addition, several commercial firms have been established which specialize in various phases of bee production.

oregon's agricultural PROGRESS