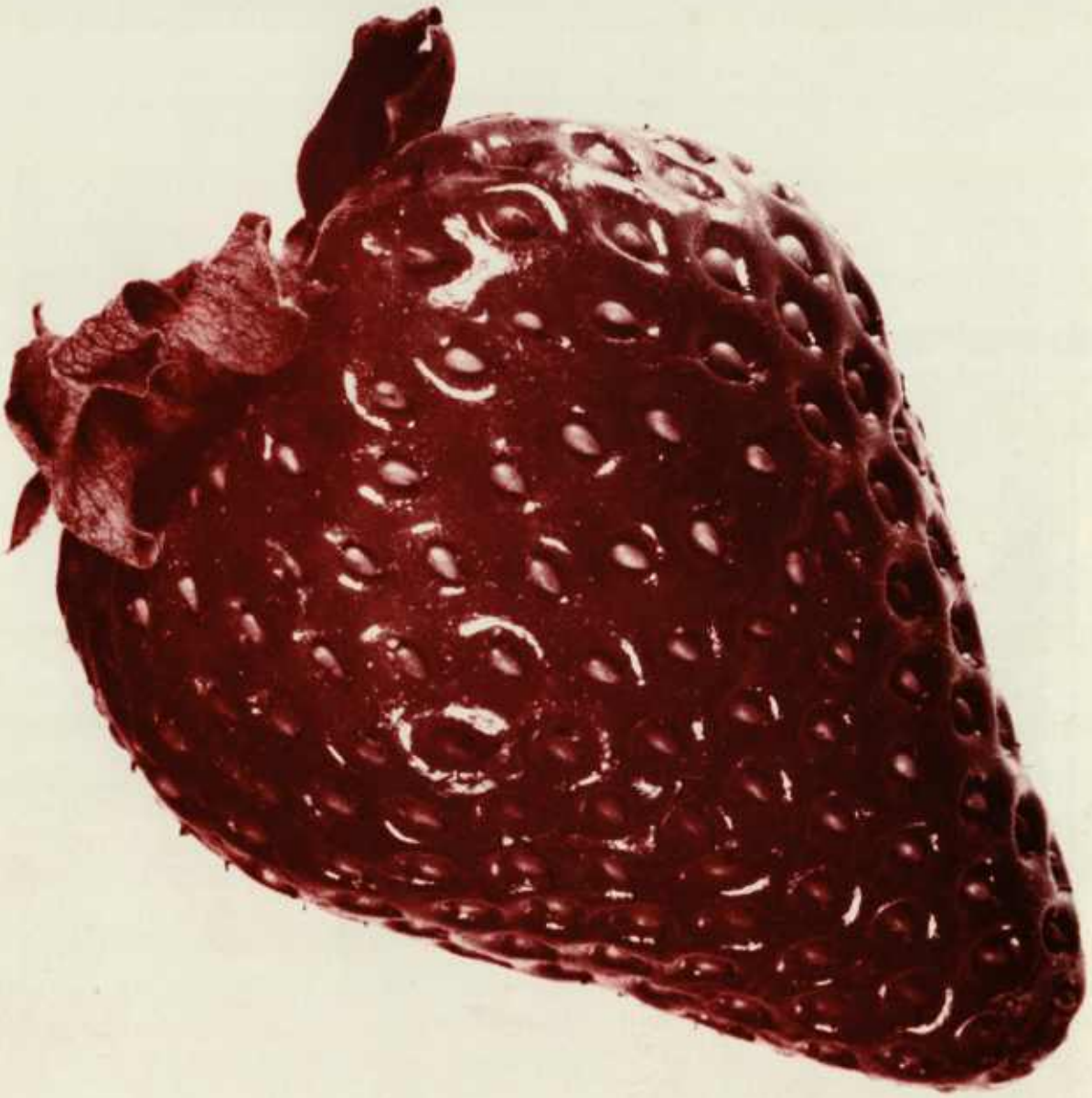
OREGON'S AGRICULTURAL PROGRESS



Oregon State University, Corvallis
Spring 1973

Treehouses

Enclosed trees keep unwanted pollen from foiling planned crosses in OSU's filbert breeding program. Objectives of the four-year-old program under the direction of horticulturalist Maxine Thompson are to develop a higher producing and earlier maturing filbert than the widely used Barcelonia variety. Dr. Thompson also wants to develop a filbert with larger kernels and a thinner shell to increase marketability of filberts both in-the-shell and as processed kernels. The filberts are at the North Willamette Branch Station.

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Oregon processing strawberries are headed toward mechanization. Story on page 3.

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The strawberry shapes up

Much of Oregon's strawberry crop is destined for mechanization—if it is to survive.

Increasing labor costs, an uncertain labor supply, and competition from other strawberry-producing areas such as Mexico are cited as some of the pressures forcing Oregon growers into mechanical strawberry harvesting.

OSU research, involving the Agricultural Experiment Station and USDA Agricultural Research Service, is helping the industry—which produces mostly for the frozen strawberry market—meet the mechanization challenge.

The research has three major areas of emphasis: developing a mechanical harvester, breeding a strawberry adaptable to mechanical harvesting, and meeting field handling and processing changes brought about by mechanical harvesting.

Agricultural engineer Dean Booster has directed research leading to the development of two methods for machine harvesting of strawberries. One involves stripping the fruit from the plants with mechanical fingers; the other involves a mowing process which cuts the plant off just above the ground.

An experimental harvester operating on the stripping principle was field tested in 1967 and again during the 1968, 1969, and 1970 seasons. In 1970, an experimental harvester operating on the mowing (clipping) principle also was field tested. The clipper emerged as the most promising machine for harvesting and was improved during the 1971 and 1972 seasons. The agricultural engineers now feel that major improvements in operating efficiency of the machine depend on improving the strawberry to be harvested rather than by more modifications to the harvester.

Developing a strawberry adaptable to mechanical harvesting is a time-consuming task. Several unique characteristics must be built into the strawberry. It must hold its fruit off the ground so it can be picked up by the harvester. It must have most of its fruit ripen at the same time so the harvester can get good yields with one trip over the field. The fruit must not bruise or otherwise damage easily. In face of these changes, the product of

(Continued on page 15)

The secret life of sour dough

San Francisco's sour dough bread is unique.

Visitors to San Francisco, relishing the crusty tastiness, have been saying that for more than a century. Now, Oregon State University microbiologists have confirmed the uniqueness of the sour dough bacterium involved.

U.S. Department of Agriculture scientists had determined that the bread's special qualities do not come from the climate or secret baking process but from two unique organisms, special high-gluten flour and special handling and baking procedures.

Most early prospectors carried sour dough in their saddle bags and became known as "sour doughs." As they moved west, their use of sour dough in making delicious biscuits and "flapjacks" became well known. In San Francisco, the knack blossomed into a sizable industry and today at least six bakeries there provide many cities with the famous bread.

But like the prospectors, today's bakers still rely on "starters," a small portion of the previous batter, to give life to the bread. The starter has to be renewed every eight hours, a costly process which wastes time and manpower.

Several years ago, Leo Kline and colleagues at the USDA Regional Research Laboratory in Albany, California, found what really happens in the 100-year-old baking process. These scientists found two organisms in sour dough: an acid-tolerant yeast identified as *Saccharomyces exiguus*, and a rod-shaped bacterium which resembled certain lactic acid bacteria and which they suggested might be called *Lactobacillus sanfrancisco* if found to be previously undescribed in the scientific literature.

The OSU microbiologists, under a research grant from the USDA, were asked to determine the identity of the rod-shaped bacterium. The OSU Department of Microbiology was picked because it has focused on lactic acid bacteria, important in food fermentations, for two decades.

The USDA scientists had found that two things are important in sour dough starters: something to cause souring and something to cause leavening or rising of the dough.

The newly discovered lactic acid bacteria cause souring. Lactic and acetic acids are produced by fermentation of carbohydrates in the flour and provide the sour flavor. The acetic acid primarily keeps spoilage and disease-producing bacteria from growing in the dough.

Yeast cells do the leavening. Carbon dioxide gas is produced by yeast during fermentation of carbohydrates in flour. Ethyl alcohol, also produced by the yeast cells, evaporates during cooking. The carbon dioxide provides the light, fluffy texture important in bread, biscuits, and pancakes.

To identify the rod-shaped bacteria from sour dough, William E. Sandine and colleagues used DNA-DNA hybridization, a new genetic technique. The technique compares the genetic material (DNA) from one cell with the genetic material from another. The DNA of cells of one bacterium is made radioactive or "hot" by growing the cells in a medium containing a radioactive building block of the DNA.

Then the hot DNA is isolated, sheared into fragments, and hybridized on thin filters with non-radioactive DNA isolated from another strain of bacteria. If the two bacteria are identical, extensive hybridization will occur which will reduce or dilute the radioactivity of the hot DNA.

If the two bacteria are different, little reduction in radioactivity will occur.

Using this technique, OSU microbiologists found that DNA from all the known species of rod-shaped lactic acid bacteria failed to hybridize with the organisms responsible for the souring reaction in San Francisco sour dough bread, confirming a new species—*Lactobacillus sanfrancisco*.

The microbiologists also are studying home-type sour dough starters to see if there are any San Francisco sour dough similarities and to see if there are any disease-producing bacteria in starters in kitchens. The starters were collected by mail from all over the United States by Janet Woodward, undergraduate science honors student.

"Some of the ingredients of the home starters are interesting but, so far, we have not found *Lactobacillus sanfrancisco* in them," said Sandine.

"The San Francisco starter, which uses water for liquid, apparently evolved from years of use, producing a distinctive yeast and bacterium in a successful fermentation partnership."

During fermentation, natural flour enzymes release maltose, a sugar, which the *Lactobacillus sanfrancisco* require to grow. The bacteria produce acetic acid and lactic acid from this maltose to sour the bread (sour dough bread is 10 times more acid than conventional bread).

The yeast uses flour carbohydrates other than maltose to grow and produce carbon dioxide gas which is responsible for the leavening or rising of the dough.

The leavened dough is baked 45 to 55 minutes at 370 to 390 degrees Fahrenheit in a wet oven.

The microbiologists hope to eliminate the starter renewal step, improving the baking process and implementing production of this bread in other areas. It also may mean that smaller bakeries and home kitchens can turn out sour dough bread now baked only in San Francisco.

The scientists also are studying the classification of the sour dough bacteria to insure that they will not cause health problems when widely distributed and are investigating the nutrition of the San Francisco lactic acid bacterium to learn how to grow it in large quantities.

The Recipe

Starter sponge

*100 parts sponge**
100 parts flour
50 parts water

leave 8 hours at 80° and pH (acidity) 3.8

** from last batch of bread*

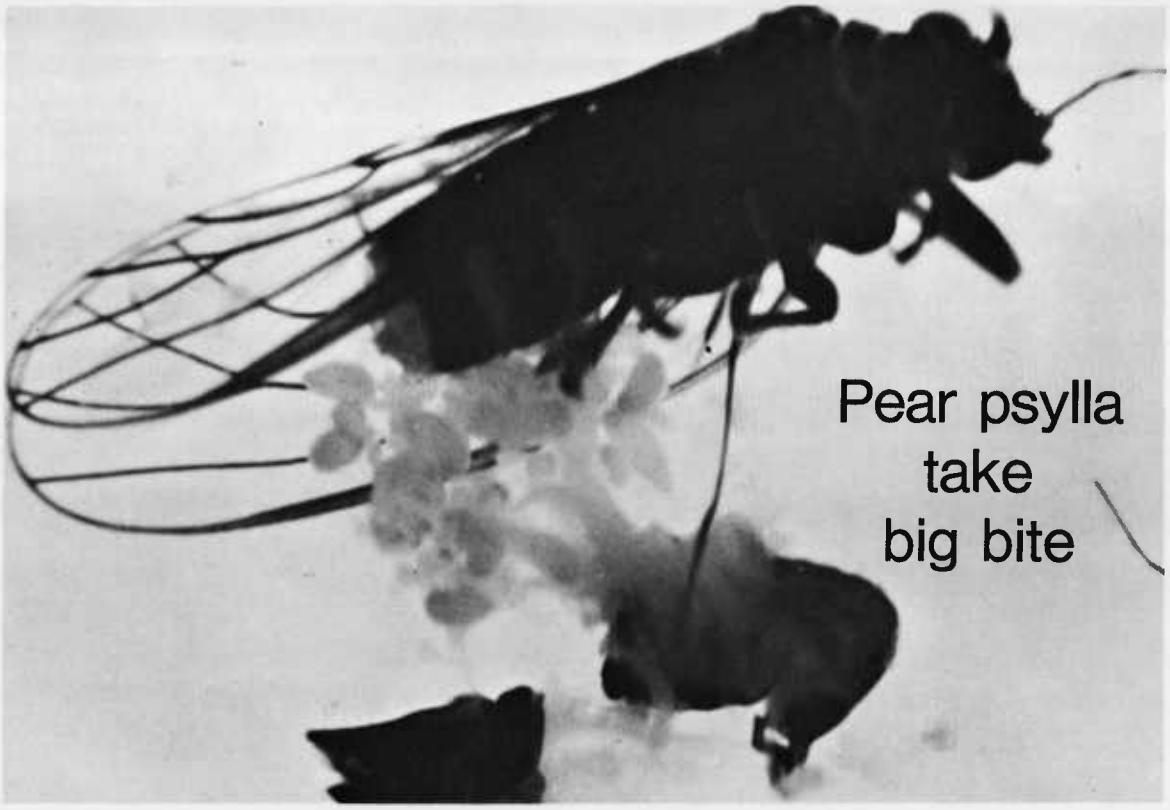
Bread

20 parts sponge
100 parts flour
60 parts water
2 parts salt

leave 8 hours at 86° and pH 3.9

Baking

Make cuts in upper surface. Place directly on hearth 45-55 minutes at 375-390°. Live , low pressure steam until crust browns. Package in open, non-plastic bag.



Pear psylla take big bite

Pear psylla vs. pears.

For 27 years the pesty lice-like insects have been the number one threat to Oregon's leading tree fruit crop.

Oregon State University entomologists have managed to keep the insect from creating economic havoc in the pear industry but the battle is far from over. The extremely adaptive psylla have developed resistance to a number of pesticides formerly effective for control, challenging research to find new controls.

Today, chemicals offer the only means for escaping extensive damage from pear psylla and it is a constant race to find new chemical controls before the old ones become ineffective. Too, research has prolonged the use and increased the effectiveness of some sprays by pinpointing timing of their application to catch the psylla in the most susceptible stages of development. A winter spray to kill the overwintering adult and several pre- and post-bloom sprays are necessary to insure control.

OSU entomologists Peter H. Westigard, Southern Oregon Experiment Station, Medford, and Robert W. Zwick, Mid-Columbia Experiment Station, Hood River, have been active in the fight against pear psylla.

Psylla have several predators and parasites but most of them develop too late in the season to prevent psylla damage in commercial orchards. Westigard found that one predator is effective in reducing psylla in unsprayed orchards in the Medford area, but spray programs for control of codling moth and other pests are detrimental to the predator. In the Hood River region, the predator is too outnumbered by psylla to be effective.

After one year of testing at the Southern Oregon Station, three synthetic compounds that simulate hormones produced by pear psylla show promise for psylla control. The compounds interfere with natural development of insects and, when sprayed on trees, they prevent psylla eggs from hatching. They are selective, affecting only psylla, and do not create residue or pollution problems. If continued tests show consistent success, the new compounds may be the weapon that finally spells defeat for the insect.

Zwick is launching a different attack. He is trying to keep the insects washed off the trees by daily short-interval applications of water from overhead sprinkler systems. Although not yet tested extensively, one hour of

daily sprinkling during the growing season may be successful in keeping psylla off pears.

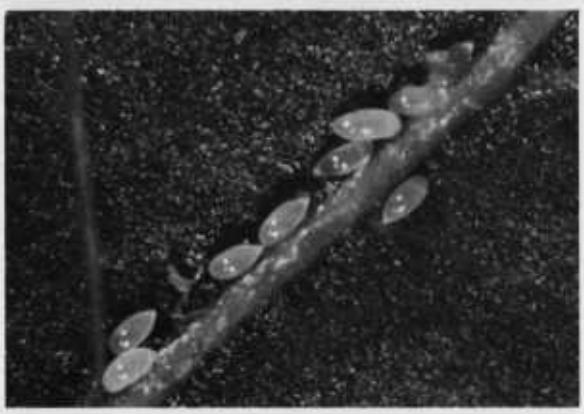
Several forms of damage are caused by psylla. They have been linked to pear decline, a disease which struck the Pacific Northwest in the late 1940s and has been a problem since, killing or greatly weakening trees. In 1957-58, pear decline killed an estimated 10 percent of the trees in Southern Oregon and crippled another 10 percent. Some 25,000 trees, about 15 percent of the total, were killed by pear decline in the Willamette Valley in 1957. The threat of pear decline can be eliminated by making new plantings on rootstocks that are resistant to the disease.

In addition to their role in spreading pear decline, the psylla secrete a toxin that reduces tree vigor, causes undersized fruit, wilts foliage, suppresses root growth, and reduces overall tree productivity. Toxin from several years of high psylla infestation will kill limbs and often entire trees. It also may be the cause of pear decline, but this link has been sclentifically disputed.

Another problem caused by pear psylla is the secretion of honeydew, a sticky substance that scalds the surface of maturing fruit. Honeydew supports a sooty mold fungus that leads to further downgrading of fruit quality and is disliked by pickers.

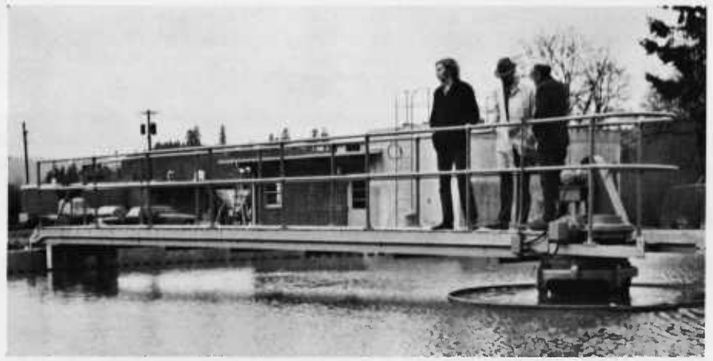
Pear psylla overwinter as adults with mating and egg laying apparently beginning in late January or early February. The first eggs are deposited at the base of unopened fruit or leaf buds. After the buds open, eggs are deposited on leaf tissue. Nymphs go through five stages of development, with the first summer adults appearing in late April or early May. During the summer three more generations develop, ending with the overwintering adults. The last generation for the season is the one that disperses, causing the psylla to spread from localized areas.

Although it took the psylla, first reported on the east coast of the United States in 1832, more than 100 years to get west of the Rocky Mountains, their spread in Oregon has been rapid. Discovered in the Milton-Freewater area in 1946, they spread to Hood River in 1949, the Willamette Valley by 1950, and to most Rogue Valley orchards and down to the California border by 1951. Scientists think the pest originated in southern Europe or Asia Minor.



Top: Honeydew secreted by psylla mark fruit and downgrade quality. Bottom: Psylla eggs can be found among the veins of pear leaves. Right: Psylla have been linked to the spread of pear decline that weakens or kills trees.

Sludge adds up as feed



Primary clarifier removes 50 percent of the pollutants from wastewater.

Wastewater from the primary clarifier is aerated before going into the secondary clarifier.

Laboratory rat inspects dried sludge mixed with rations for dietary protein.

Wastewater treatment facilities have disposal problems, too.

Modern tertiary (three-stage) waste-processing plants can make wastewater 95 percent pollution-free, but the process produces activated sludge —itself a disposal problem. The sludge results from the growth of microorganisms on the soluble part of wastewater. Efforts to find a use for the dark, syrupy sludge have ranged from incorporating it into the soil as fertilizer to using it as a source of vitamin B_{12}.

Now OSU animal nutritionist Peter R. Cheeke and graduate student Robert Meyer believe dried sludge, containing approximately 35 percent crude protein, would make an acceptable additive for livestock feed. The researchers base their conclusion on several experiments where they evaluated the growth performance of rats having sludge, produced by the tertiary water treatment plant in Cottage Grove, mixed with their diets.

The first series of feeding trials revealed that the sludge had only limited value when used as the sole source of supplementary protein. Later trials identified the limiting factors and found that they could be easily overcome by adding a small amount of a high-quality supplement such as fishmeal to the sludge.

A corn-based ration with sludge as the protein supplement produced average daily gains in the rats of 3.8 grams, compared to average daily gains of 6.1 grams with a soybean meal additive, 5.7 grams with a fishmeal additive, and 4.3 grams with a cottonseed meal additive.

Three amino acids—lysine, methionine, and tryptophan—were found to be the limiting ingredients.

When the sludge is mixed with wheat or barley-based feeds, the low tryptophan content is not important because these grains contain adequate tryptophan to compensate for that which is lacking in the sludge. Another source of tryptophan would have to be added to corn-based rations, however, because corn also is low on tryptophan.

High mineral ash content of the sludge does not appear to detract from its potential as a feed additive. In fact, the feeding trials indicated that the sludge contributes useful amounts of calcium and phosphorus to the diet.

Heat treating (autoclaving) the sludge substantially improved the performance of the rats having it in their feed. Cheeke suspects autoclaving either increases availability of the protein in the sludge or makes it more palatable. A corn-based ration with 20 percent autoclaved sludge added produced average daily gains of 5 grams. When lysine, methionine, and tryptophan were added to the corn-sludge ration, average daily gains jumped to 6.6 grams, exceeding the 6.1 gram average daily gains in the control group being fed a corn-based ration with soybean meal as the protein supplement.

Peter Horvath, superintendent of the Cottage Grove wastewater treatment plant, is confident that sludge can be commercially dried and marketed.

The Cottage Grove plant, serving a population base of 10,000, is capable of producing 1,000 pounds of dried sludge a day from a 1.5 million-gallon daily intake of sewage. Although many area residents welcome opportunity to take sludge to fertilize their gardens, the supply outstrips the demand.

In addition to the OSU research, Horvath has proved to himself that finely ground sludge makes good fish food. Goldfish and assorted tropical fish in aquariums in his office have thrived for years on a steady diet of the sludge.

Horvath believes main roadblock to large-scale commercial production of sludge is lack of adequate drying facilities. It presently is spread in large beds and air dried—a problem during long, wet Western Oregon winters. This slow drying process also is responsible for a strong odor in the sludge that Cheeke feels must be eliminated before most people would be willing to work with it as a feed additive.

The possibility of developing a drying plant to speed up drying and produce consistent volumes of dried sludge is being explored by Horvath. Success of such a venture could turn a handicap into a profit.

Although the sludge would not be a top-quality protein supplement for livestock feed, it would be utilized if it can be made available at a price giving it a competitive edge over other protein sources, said Cheeke.

Mike and Lynn Vaughan

Goat population not climbing

Winter high in Oregon's Wallowa Mountains can be rough.

Michael R. Vaughan, an Oregon State University graduate student in fisheries and wildlife, should know. He has been living in the Eagle Cap Wilderness area since June 1972. A 12- x 14-foot tent equipped with a bot-bellied stove protects him from temperatures that sometlmes drop to 25 degrees below zero. Two-way radio keeps him in touch wlth the outside world.

Vaughan is spending one year In the wilderness area compiling information about the number, distribution, movement, feeding habits, age, and sex of Oregon's mountain goats. The goats are descendants of six goats released on Chief Joseph Mountain by the Oregon Game Commlssion in 1950. Their number has never exceeded 40, and annual aerial counts started by the Oregon Game Commission in 1962 have fluctuated between 10 and 29 goats. The goats have never strayed more than five miles from the release site.

Mountain goats, native only to Western Canada, Alaska, Washington, Idaho, and Montana, have expanded much more rapidly in releases in other states.

In the Black Hills of South Dakota, six goats released in 1924 led to a population of more than 200 by 1942. By 1950, the population had leveled off to 300-400 goats. A Colorado release of eight goats in 1948 and six in 1950 developed into a herd of 250-300 anlmals within 20 years.

Vaughan hopes to reveal why the Oregon goat population has remained so small. His work Is under the direction of Charles Meslow, asslstant leader of the Oregon Cooperative Wildlife Research Unit at OSU.

Vaughan has found that the goats seem to take life rather easy—eating and sleeping mostly—but observing them takes energy and skill in outdoor survival.

"I've done a little camping before, but never anything like this," sald Vaughan, who is from North Carolina.

Two survival courses for himself and one for his wife, Lynn, who is with him much of the time, were a prerequisite for the year-long field study.

Vaughan is restricted from using power equipment in the wilderness area. Snowshoes are the main mode of winter transportation. The wood that fuels the pot-bellied stove in his tent is cut by hand.

During the summer, Vaughan backpacks from the base camp for three- and four-day stays at elevations exceeding 9,000 feet to observe the goats. Snow and thunderstorms are unpredictable at such heights and Vaughan has been caught in both.

"I never will get used to seeing lightning bounce off the rocks around me," said Vaughan.

A July snowstorm trapped him in his small backpacking tent for three days.

"I did a lot of reading—even the labels on my freeze-dried food packages," he said.

Several factors may be limiting the goat population, said Vaughan. He suspects that accidents—falls from cliffs and burial in avalanches—may be a source of mortality among the goats. A limited supply of short non-woody plants used for food by the goats might be another factor.

Vaughan also has noticed differences between goat habitats visited in other states and the habitat in the Wallowas. Feeding areas in the Wallowas are not as close to lofty cliffs the goats like. Also, major ridges in the other locations run east and west, giving the goats warmer southern slope exposure in the winter. In the Wallowas, the slopes run north and south.

Young goats are scarce in the herd. Vaughan has seen only three kids, although there are at least 10 adult females among the 26 goats under surveillance. He has observed the females being bred and thinks that lack of young may be the result of nutritional deficiencies in the diet of the mother.

Can the mountain goats predict weather?

Perhaps so.

"A certain wind-cloud combination moves the goats to lower elevations in anticipation of a storm and so far they've been right," said Vaughan.

A wilderness outpost . . .

with a pot-bellied stove for warmth . . .

makes year-long mountain goat study possible.

Potato recipe: water, fertilizer

Potato success: a matter of water and fertilizer.

A series of experiments by OSU soils scientists C. H. Ullery and T. L. Jackson are showing that improper use of either water or fertilizer can significantly reduce yield and quality of Russet Burbank potatoes.

The researchers are working with the sandy soils in the Hermiston area and the loamy soils in the Madras area, two major potato-producing regions in the state.

In the sandy soils, inadequate water causes stress that decreases yields, size, grade, and processing quality of potatoes. Too much water is a problem in the heavier loamy soils, causing rotting and reduced size.

Ullery is pinpointing the amount and timing of irrigation to produce the best crop. With the sandy soils, he is basing irrigation treatments on the amount of water lost from a standard evaporation pan placed in the field. Irrigating daily or every three days at 100 percent of the pan evaporation rate produced the best yields—31.1 tons per acre—when compared with other variations used in the trials.

A slightly higher percentage of No. 1 potatoes—81.1 percent compared to 77.7 percent—was obtained with daily irrigation. Irrigation every five days at 100 percent of the pan evaporation rate allowed the potatoes to get too dry, reducing yields to 29.1 tons per acre and reducing the percentage of No. 1 grade potatoes to 58.2 percent.

Most of the reduction in grade from less frequent irrigation was the result of misshapen tubers rather than smaller ones. Tuber size was affected by the amount of water applied each time rather than by varying the intervals between applications. Plots irrigated at 70 percent of the pan evaporation rate produced a larger percentage of undersized potatoes than plots irrigated at 100 percent of the pan evaporation rate.

In the Madras area, irrigation treatments were based on both pan evaporation rates and soil moisture tension, which indicates how reluctant soil is to give up available water. The drier the soil, the higher the soil moisture

Test plots near Madras (left) and Hermiston help determine fertilizer and water requirements of potatoes on sandy and loamy soils.

tension. Best yields—20.5 tons per acre—were obtained by irrigating when soil tension eight inches below the surface reached one atmosphere. This approximates applying 1.3 inches of water every four to six days, depending on weather.

Unlike the Hermiston results, irrigation frequency in the Madras trials influenced the size of tubers at harvest. Shortening the irrigation frequency increased the percentage of large tubers. More than 23 percent of the tubers weighed less than four ounces when the crop was irrigated at a soil tension of two atmospheres. When irrigated at 0.5 atmosphere, only 18 percent of the tubers were smaller than four ounces.

Jackson is refining nitrogen fertilizer recommendations for the Hermiston and Madras areas and is coordinating his research with the irrigation work.

He is finding that excessive use of nitrogen is as much or more of a problem than not using enough nitrogen. Too little nitrogen reduces yields. But there is a point where additional nitrogen has little influence on yields and has an adverse effect on processing quality and shape of tubers, particularly in the heavier soils.

In sandy soil, most of the excess nitrogen is leached out, making potential water pollution the main threat from overuse of nitrogen. Jackson found that, on sandy soil, yield and grade resulting from nitrogen applied at 260 pounds per acre to soil already containing 100 pounds of nitrogen per acre at planting were higher than those obtained when applying 340 pounds of nitrogen per acre. Best yields were obtained using 260 pounds of nitrogen per acre in combination with the irrigation schedule Ullery found most effective—100 percent of the pan evaporation rate at three-day intervals.

In the Madras area, 160 pounds of nitrogen per acre combined with irrigation when the soil tension reaches one atmosphere produced the best yields.

During the 1973 growing season, Ullery and Jackson hope to determine the effects of applying water-fertilizer combinations during portions of the growing season.

IRRIGATION TRIALS—HERMISTON (1972)

Rate—% of pan evaporation	Frequency	Water applied (inches/ season)	Yield (tons/acre)	% No. 1
70	daily	21.8	23.0	68.3
70	3 days	21.8	22.4	51.4
100	daily	31.1	31.1	81.1
100	3 days	31.1	31.1	77.7
100	5 days	31.1	29.1	58.2

IRRIGATION TRIALS—MADRAS (1972)

Rate—% of pan evaporation	Frequency	Water applied (inches/ season)	Yield (tons/acre)	% No. 1
100	2/wk	24.0	19.9	72.3
100	1/wk	23.8	19.4	73.1
—	0.5 atm	23.7	18.5	70.0
—	1.0 atm	22.1	20.5	74.1
—	2.0 atm	20.3	19.0	69.0

NITROGEN TRIALS—HERMISTON (1972)

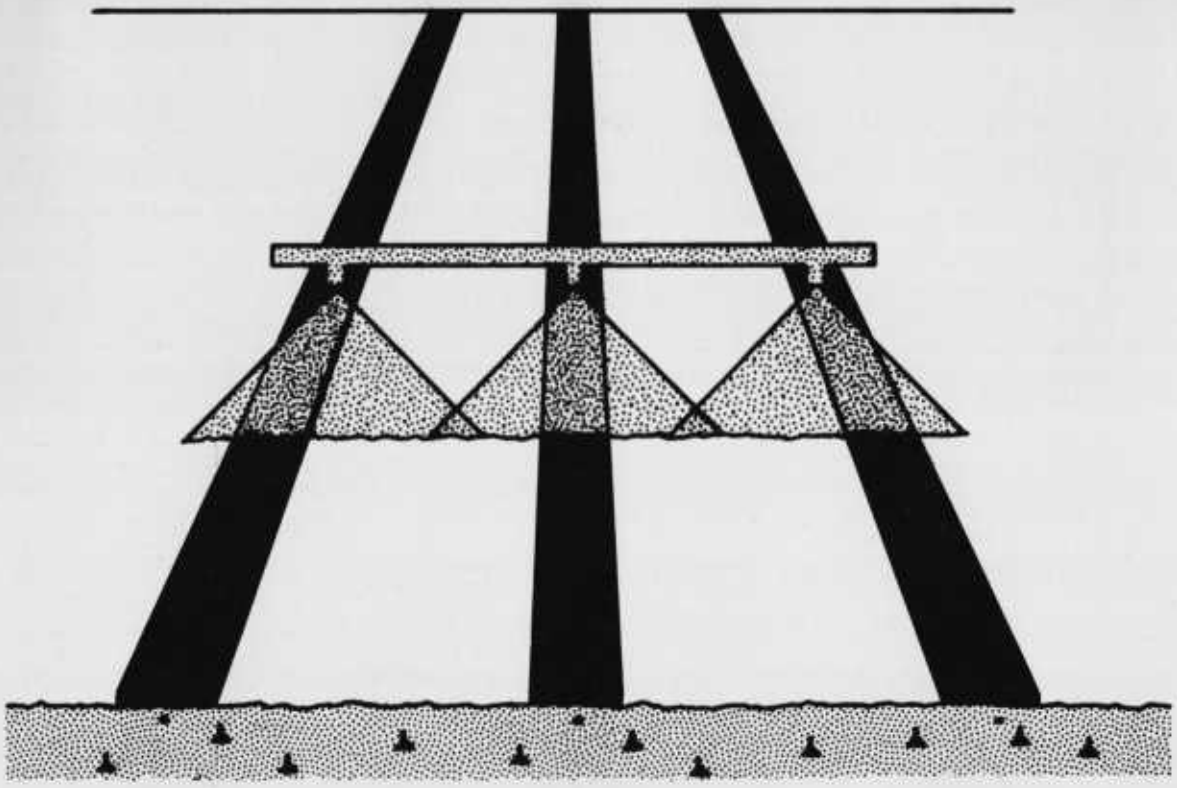
	Irrigation at 100% of pan evaporation					
	Daily		3-day intervals		5-day intervals	
N (lb/A)	Yield*	No. 1*	Yield	No.1	Yield	No.1
100	30.1	25.2	31.1	24.5	28.9	17.5
180	30.4	25.7	30.8	23.8	30.9	18.8
260	32.5	26.3	30.9	24.6	29.9	16.5
340	30.3	24.0	30.1	22.7	28.0	16.0

* Tons/acre

NITROGEN TRIALS—MADRAS (1972)

	Irrigation Treatments							
	100% of pan evaporation				Soil moisture tension			
	2/wk intervals		1/wk intervals		0.5 atm		1.0 atm	
N (lb/A)	Yield*	No. 1*	Yield	No. 1	Yield	No. 1	Yield	No. 1
0	18.3	13.1	17.6	12.9	16.5	12.3	17.7	13.1
80	19.6	14.0	19.4	14.3	18.2	13.0	20.7	15.2
160	18.6	12.6	21.4	15.6	18.6	12.8	22.6	16.9
240	21.8	16.9	20.0	14.7	20.3	14.0	21.5	16.3
320	21.8	15.7	20.0	14.5	18.6	12.3	20.8	15.4

* Tons/acre



Herbicides find a helper--antidotes

Antidotes are giving old herbicides new uses.

Successful use of herbicide antidotes—chemicals that increase the selectivity of herbicides by protecting the desired crop—offers potential for expanding the use for many commercial herbicides as an alternative to developing and testing new special-purpose herbicides.

Research by OSU agronomists Arnold P. Appleby, Donald Colbert and Philip Olson shows that hard-to-control weeds such as nutsedge, shattercane, and quackgrass can be eliminated in corn fields by protecting the corn with an antidote and then killing the weeds with herbicides that normally could not be used without injury to the corn.

The group began working with herbicide antidotes in greenhouse and field studies two years ago, checking corn response to the herbicide EPTC and an antidote produced by Stauffer Chemical Company. They found that as little as one-half pound per acre of the antidote mixed with six or twelve pound per acre rates of EPTC completely protected Golden Jubilee sweet corn, the most EPTC-sensitive of three varieties used in the trials. Both spray application of an herbicide-antidote mixture and antidote treatment of corn seeds before application of EPTC were effective in preventing herbicide damage to the corn. However, seed treatment with the antidote appeared to slightly reduce the height of plants.

Effectiveness of EPTC in controlling shattercane, wild oats, yellow and purple nutsedge, barnyard grass, and pigweed was not decreased with use of the antidote.

What worked with corn was not transferable to sorghum, though. Tests by graduate student Ercan Guneyli on three varieties of sorghum—Honey No. 3, Red Top Tenn., and Atlas Sorgo—showed the antidote was ineffective in protecting sorghum seedlings from EPTC.

In 1972, more field trials were conducted using various combinations of EPTC and the antidote used previously, as well as another herbicide, vernolate, and an additional potential antidote. Again, the objective was to see if the experimental chemicals increased sweet corn tolerance to the herbicides without reducing effect of the herbicides on weeds.

Weed control was excellent with all vernolate and EPTC treatments, but the herbicides caused substantial growth reduction and ear deformation in the corn when used without the antidotes.

Treatment with EPTC or vernolate plus either of the antidotes provided good protection for the corn. Severe growth reduction did not occur until the rate of EPTC reached twelve pounds per acre and the antidote treatment was reduced to one-sixteenth of a pound per acre or less. Ear deformation was moderately severe at an EPTC rate of eight pounds per acre. The eight and twelve pound per acre EPTC rates are well above the three to four pound rates needed to do an effective weed control job.

Although the concept of herbicide selectivity—the ability of a chemical to destroy one plant without harming another—is not new, the use of herbicide antidotes gives selectivity a new dimension and offers the farmer another weapon for weed control.

(Strawberry, continued)
breeding experiments still must maintain satisfactory color, firmness, flavor, acid, and sugar content and other biochemical characteristics that go into a top-quality processing strawberry. Disease resistance also is a major consideration. Selections that show low resistance to red stele have no chance of developing into a commercial variety, regardless of how promising their other characteristics appear.

First plantings selected specifically for mechanical harvesting in the breeding program were made in 1966. Developing strawberry varieties amenable to mechanical harvesting is the responsibility of F. J. Lawrence, USDA horticulturalist at OSU. Some 8,000 seedlings are planted yearly for evaluation. About 5,000 of these are planted at the North Willamette Branch Experiment Station, Aurora, where station superintendent and horticulturalist L. W. Martin grows the plants under virus-free conditions and assists with evaluating and screening the plantings. Remainder of the seedlings are planted at the Lewis Brown Horticultural Farm a few miles east of Corvallis.

About 98 percent of the seedlings are scrapped after the first year. The remaining 2 percent that show some promise of having the sought after characteristics are retained for further evaluation and as genetic material for making more new crosses. Even with the promising new selections, it takes several years before they reach the point where mass plantings can be made so they can be evaluated under conditions simulating commercial production. The 1972 season marked the first time selections made from the 1966 plantings were available in sufficient quantity for such evaluation.

Most progress has been in selecting for crop concentration. Many selections are approaching three tons per acre yields in a single harvest, with 70 to 80 percent of the fruit ripe at one time. Selections that cap easily, a job done by hand pickers but not mechanical harvesters, have been developed but their fruit is considerably smaller than that of the commonly grown Northwest and Hood varieties.

G. W. Varseveld and R. F. Cain in the Department of Food Science and Technology have been evaluating the processing quality of many of the newer selections after they have been machine harvested. During the 1972 season, 21 new selections, as well as the Hood variety, were evaluated with respect to usable and non-usable fruit after being harvested and stemmed mechanically. After culling ripe fruit with mechanical damage, disease or other damage, and attached caps, usable ripe fruit ranged from 10.6 percent to 52.6 percent of the total fruit harvested. Two samples of the Hood strawberry subjected to the same analysis netted 30.5 percent and 29 percent usable ripe fruit. Total ripe fruit harvested ranged from lows of 67 percent and 71.9 percent for the Hood samples to 98.4 percent for one of the experimental sections. Mechanical damage to ripe fruit was relatively low —ranging from 1.3 percent to 16.7 percent—compared to the percentage of ripe fruit that had to be culled because caps were not removed. Percentage of ripe fruit with caps still attached after being run through a declustering device developed under the direction of agricultural engineer Dale Kirk, ranged from 17.6 percent to 61.6 percent.

Top: This experimental strawberry selection has a reflexed calyx, a trait that should make it easier to cap because rollers can grip the calyx and pull it from the berry. Bottom: Getting most of the fruit to mature at the same time as shown by this selection is another goal of the breeding program.

The declustering device, designed to stem, decluster, and cap the fruit, is one of several field-handling and processing changes made necessary by mechanical harvesting. To further increase the percentage of capped fruit, Kirk also has developed a rotary tumbler that shatters the caps on berries after they have been frozen to –30 degrees Fahrenheit. The tumbler has been successful with the hard-to-cap Hood and Northwest varieties.

To see if processing facilities could accommodate frozen fruit coming from the tumbler, Kirk and Cain held the berries below freezing and took them to two commercial food processing plants for slicing, filling, syruping, and refreezing on a commercial line. The results indicated that, with a few modifications, the frozen berries can be packed with existing plant equipment and methods. Plant personnel indicated that appearance of the sliced berries going into the package was equal or superior to those packed from fresh hand-picked fruit.

The samples checked by Varseveld and Cain for usable fruit also were processed and subjected to quality tests. Ripe berries that still had their caps were hand capped and included in the processing. Hand-picked samples of Hood and Northwest also were included for reference. A 10-member panel evaluated the samples for color, slice wholeness, texture, and flavor. Several selections were rated in the good category with the hand-picked Northwest reference sample. Several more, along with the hand-picked Hood samples, were rated average. The machine-harvested Hood samples were rated fair. None of the samples, hand-picked or machine-harvested, were rated excellent. Only one new selection was rated poor.

The research—from breeding through assuring quality in the final product—is helping assure that the strawberry in Oregon will survive, and survival will mean jobs for many Oregon workers.

A sound move: just one ear for sweet corn

One-eared corn?

A possibility that should be studied, suggests horticulturalist Harry J. Mack.

Four years of experiments by Mack show that the yield of sweet corn increases as planting density increases. But at the same time, ear-size and number of ears per stalk decrease. Smaller ears mean reduced processing efficiency, but adjusting the number and spacing of plants so each stalk produces only one acceptable ear of uniform size may offset any disadvantage of having smaller ears.

Although ear size decreased 10 to 15 percent, sweet corn yields increased 35 to 55 percent as the number of plants increased from 29,890 to 128,100 per hectar (2.471 acres) under irrigated conditions. Planting arrangement is not as important as plant density in obtaining increased yields, but narrow rows of 30 to 60 centimeters or equidistant spacings should be more advantageous over commonly used row spacings of 90 to 105 centimeters.

Some of the highest yields in Mack's trials were from 30 x 30 centimeter spacings in equilateral triangles. However, triangular spacing as close as 20 x 20 centimeters produced smaller ears, more culls, and lower yields. Most previous research on sweet corn spacing has been concerned with spacings varying from 75 to 105 centimeters.

High-density planting does not insure increased yields. Other factors such as suitable varieties, planting and harvesting equipment, adequate moisture and fertilizers, efficient handling and processing, and control of weeds, insects, and diseases must be considered also, said Mack.

Deer pick pellets in taste study

Pelleted grain gets a four-star rating, but whole grain is unacceptable.

That is the opinion of four black-tailed deer used in feeding trials to determine deer preference for various forms of grains and commercial concentrates.

Although they worked with captive deer, animal nutritionists D. C. Church and R. E. Dean were seeking insight to likes and dislikes of deer that might have implications for emergency winter feeding of wild deer in Oregon.

Oregon has a history of periodic winter starvation in some deer herds, reducing populations to levels lower than desired and taking several years for the herds to recover. Ingredients in rations for emergency winter feeding of deer vary throughout the nation and failure of deer to accept strange feeds is a problem in some Oregon areas. Deer without previous exposure to prepared feeds have starved to death even though feed was placed in their immediate area.

When given a choice, the captive deer chose pelleted barley, corn, and oats almost exclusively over rolled and whole forms of the same feeds. All oats eaten were pelleted, 79.6 percent of the barley intake was pelleted and 77.9 percent of the corn intake was pelleted. Remainder of the intake was rolled feed as all three grains in whole form were rejected. Although many studies have shown pelleted feeds to be most desirable among domestic livestock, this was the first scientific evidence that deer also find pelleted feed more palatable.

Deer preference among nine commercial concentrates commonly used as energy and protein sources in emergency deer rations also were tested. Consumption rates of the pelleted concentrates indicated that corn, wheat, and soybean meal are preferred. Barley and oats were selected in limited amounts. Beet pulp, cotton seed meal, linseed meal, and peas were consumed only when the deer had no other choice.

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