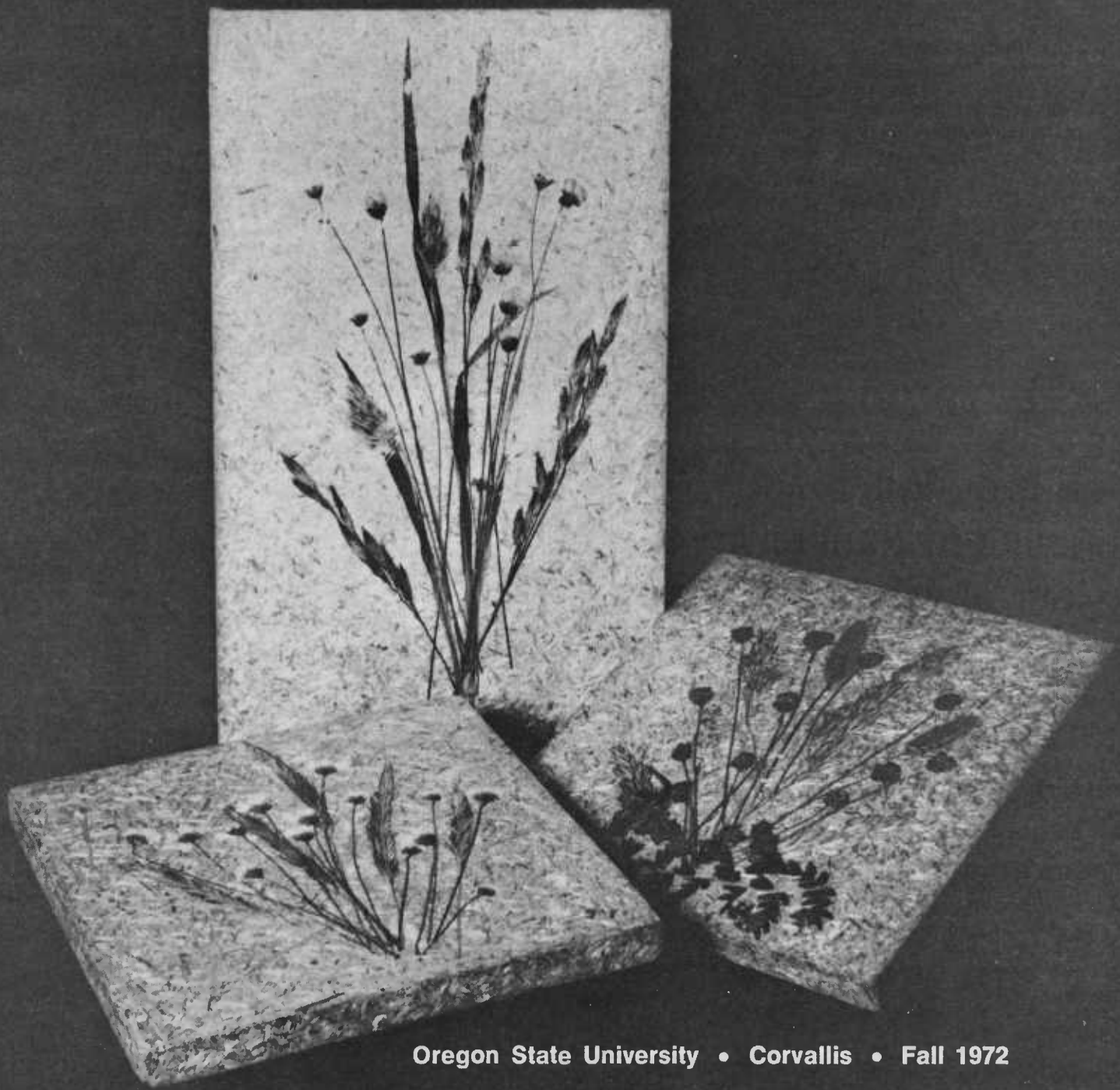
OREGON'S AGRICULTURAL PROGRESS



Oregon State University • Corvallis • Fall 1972

Contents

Cover

Add a touch of imagination to straw particleboard developed by OSU research and you have an ecological decoupage. The plaques, 4½ inches square or a rectangular 4½ x 7 inches, are designed and marketed at various locations throughout the Willamette Valley by Women for Agriculture.

Vol. 19, No. 2. Oregon's Agricultural Progress, a quarterly research report published by the Oregon Agricultural Experiment Station, G. Burton Wood, director, is sent free to Oregon residents. Address requests to Editor, AdS 416R, Oregon State University, Corvallis, Oregon 97331, or see your County Extension Agent.

Burning question

Oregon is trying to kick the smoking habit.

The problem: An estimated one million tons of grass straw—a byproduct of Oregon's $28 million grass seed industry—that goes up in smoke each summer.

Open field burning is a popular way to dispose of straw because it is inexpensive and, at the same time, sanitizes the fields, killing disease spores that might jeopardize next year's crop. However, open field burning during the summer months contributes to the air pollution problem in the poorly ventilated Willamette Valley where some 280,000 acres are burned annually, influencing the disposition of some valley residents, particularly in the more populated areas.

Resulting public pressure led to the birth and passage of legislation by the 1971 legislature banning open field burning beginning January 1, 1975. In the interim, a complicated quota system has been established allowing burning only in certain locations when weather conditions are favorable to moving the smoke away from populated areas. Research involving Oregon State University, several private firms and the Oregon Seed Council is underway to help growers develop alternatives to open field burning by the 1975 cutoff date.

The most pursued alternative is that of finding a use for the straw on the theory that if you use it you don't have to burn it. A profitable market for the straw would also help offset some of the costs for field sanitation which has to be done regardless of whether the straw is removed. In perennial seed crops, sanitation is necessary to control diseases, weeds and improve yields. In annual seed crops, field sanitation is essential for economical production of high-quality seed.

Several uses for straw are technically feasible. Yeast, plastics, paper, particleboard, decorative plaques, jewelry boxes, feed, insulation and fuel are some of the varied products that can be made from straw. The stumbling point is that most of these uses are not yet economically lucrative, even if the straw is available at no cost.

The straw is bulky, making it costly to handle and transport. And for many of the uses for which it is suited, it is in direct competition with low cost wood byproducts from Oregon's timber industry.

(Cont. on p. 5)

OSU straw studies

Yeast

Microbiologists have mastered techniques for hydrolyzing straw cellulose and using it to produce a high-protein yeast that can be used in human or animal foods. Some 150 to 170 pounds of yeast can be produced with a ton of straw. The projected cost for this type of yeast production—about 20 to 25 cents a pound—is competitive with other yeast-producing systems, but the yeast must compete with soybean meal as a protein source (which costs approximately 10 cents a pound). If funding were available, the next step would be to build a pilot plant as a forerunner to commercial production of yeast from straw.

Densification

Getting bulky straw into a form which can be transported easily and economically is a problem that must be solved regardless of eventual use. Agricultural engineers have worked with several methods for densifying straw, with most effort given to making cubes. They have identified maximum and minimum straw moisture content for cubing and concentrations of binding agents to hold the cubes together.

It was found that annual ryegrass cubes better than the fine fescues or orchardgrass and that lignin sulphonate, a byproduct of the paper industry, is a good binding agent. Some straw cubes are being produced commercially and shipped to Japan for livestock roughage.

Two other forms of densification—high-density bales and firelogs—also were investigated. The "super bales," about four times as big and four times as dense as a normal bale and weighing some 1,600 pounds are being produced commercially on a test basis. The firelogs produced a lot of ashes when burned, leaving little hope for competition with firelogs from wood wastes.

Paper

Utilization of annual ryegrass straw to produce a fine bleached paper newsprint and a corrugating medium for shipping containers was investigated in the Forest Research Laboratory.

Production of a corrugating medium emerged as the most likely use for straw in the paper industry. However, the first pilot plant trial showed that the corrugating medium made from straw was a little weaker than that made from wood pulp. Some production changes are being made in the straw paper in an attempt to increase its strength, and another series of tests will be run.

Since the United States produces about 3½ million tons of corrugating medium a year, this use for straw has good potential, but the problem is familiar—the paper industry is geared to using wood and today there is still plenty of wood to use.

Feed

Animal scientists are improving digestibility of straw by using hydroxides to break down the lignin, making it more usable for ruminants. Tests with treated pelleted straw show that, although an acceptable feed from the standpoint of animal performance, the costs of treating, drying and pelleting are too great to be competitive. Initial tests with straw silage show that this form of feed is more promising because there are no drying and pelleting costs and natural fermentation in the ensiling process buffers the hydroxide.

Silage additives and their amounts are being determined. Digestion trials with sheep are underway and will be followed with feeding trials on beef heifers. The goal is to put 1½ pounds a day on a 500-pound heifer. If successful, the researchers think straw silage will compare favorably with alfalfa hay on a cost-gain basis.

Particleboard

Agricultural chemists have developed techniques for making a straw particle-board similar to particleboard made from wood chips. It has potential for use as wallboard and paneling and in construction of furniture. Like the research with yeast production, the particleboard research has progressed to where additional funding for operation of a pilot plant to more closely simulate commercial production conditions would be the next logical step. Estimates put costs for initial commercial production of straw particleboard considerably higher than for wood particleboard.

Sanitizer

Agricultural engineering involvement with development of a mobile field sanitizer has moved into the testing phase, with most of this season's efforts devoted to determining effects of different burning temperatures and dates on seed yields the following year. Agronomists suspect that the right combination might increase yields, a factor that would help the grower absorb the cost of field sanitation.

Three years of preliminary design and experimentation with a field sanitizer prototype have led to commercial development of two models undergoing field tests this year.

To date, the mobile sanitizer, which can operate with or without straw residue on the field, holds the best promise as an alternative to open field burning. Looking like a large firebox on wheels, it travels between one and two miles an hour, burning residue and sanitizing the field with little smoke.

Economics

In a study on the economic feasibility of possible uses for straw, particleboard and corrugating paper appear to be the most promising. Uncertainty about the future of the grass seed industry and the easily available supply of wood residues cast doubt that these two uses will get a share of the market soon, however.

A study showing that 15 to 18 percent of the grass seed farmers are in economic trouble regardless of the field burning problems, is being followed with a study projecting how farms might adjust under alternative smoke control policies. Use of the mobile field sanitizer, costing $9 to $17 per acre compared to one or two dollars per acre for open field burning, appears to be the economical alternative. Alternatives involving residue utilization face serious market competition.

Two other studies will be completed by the end of the year. One will determine the economic feasibility of shipping grass resiude in various forms from the field to dockside Japan for a possible Japanese livestock feeding market. The other will determine what internal costs can be borne by the Willamette Valley grass seed industry before it looses its competitive advantage with other grass seed producing areas of the world.

(Cont. from p. 3)

Oregon State University researchers, with support from the State Legislature, Oregon Seed Council and U.S. Environmental Protection Agency, are attempting to overcome some of the drawbacks that put straw at a competitive disadvantage with other sources of raw materials for certain products. They have densified it, hydrolyzed it, fed it, shipped it and pulped it. Some of the results have been promising, but there are no significant breakthroughs offering a quick, easy solution to the straw disposal problem.

The picture has brightened somewhat with potential development of a sizeable Japanese market resulting from exploratory contacts initiated by Governor Tom McCall's trade mission to Japan earlier this year. A Japanese dairy cooperative has agreed to take several thousand tons of straw cubes that will be fed as roughage to their cows.

OSU research on the grass disposal problem began in 1965 with climatological studies to determine favorable and unfavorable conditions for dispersing smoke from concentrated burning. The early studies also identified the influence of residue levels, moisture content, and timing of burning on emissions from each of the several grass species subjected to burning. Much of the smoke management program now in effect is based on this research.

In 1970, an Environmental Protection Agency grant was awarded to OSU to evaluate possible uses for straw. Included were methods of handling, transporting and densifying straw and an economic analysis of some of the alternatives. Although not part of the EPA grant, the Department of Animal Science also has maintained research investigating methods for making straw an acceptable livestock feed and agricultural engineers have developed a prototype mobile field sanitizer for burning and sanitizing grass fields with little smoke emission. The agricultural engineers and agronomic crop scientists are testing effect of the sanitizer on the different grass crops.

The EPA grant, scheduled to end last June 30, has been extended for six months, without additional funding, to complete work in progress. No additional EPA funding is anticipated for further straw utilization research. However, research funded from other sources is expected to continue. This includes development of alternative cropping systems for land now supporting grasses, agronomic tests related to field sanitation, and utilization of straw for livestock feed.

What will happen in 1975 if a satisfactory alternative to open field burning is not found? Perhaps the growers will be able to borrow some additional time through an extension of the burning deadline. Perhaps they will switch to other crops, but much of the land that now supports excellent grass stands is too poorly drained for most other uses. Perhaps they will be forced out of farming.

Time is running out, but the many avenues of research still offer hope.

Shadowed by the problem research is trying to eliminate, a scaled-down version of the OSU field sanitizer undergoes tests to correlate its performance with that of the larger model. Easier and more economical to operate, the plot sanitizer will be the focal point of agronomic tests checking grass response to combinations of burning dates and temperatures.

BUGGING THE BUGS

Chirp of the bark beetle may be fatal—to the beetle.

OSU entomologist Julius A. Rudinsky has linked sound with activities of bark beetles, putting another tool in the hands of researchers trying to control the devastating insects that destroy millions of dollars worth of timber annually. Scientists previously thought the beetles communicated only by emitting attracting and repelling odors.

The female beetle, once she invades a suitable log and sets up housekeeping, emits a powerful attracting odor that brings swarms of males to her door. Then, to keep things from getting out of hand, she mysteriously "turns off" the odor—and prospective suitors—by releasing another chemical that masks the attractant.

Entomologists thought that mating had to take place before the masking chemical was released, but Rudinsky found that it is the chirping of the male that triggers the mask.

Tests with Douglas fir beetles by Rudinsky and electrical engineer. R. R. Michael show that playback of recordings of male beetle's chirping has the same effect on the female as presence of a male and that male beetles with stridulatory (chirping) organs removed do not cause the female to mask her attractant. The female attractant triggers the male chirping that, in turn, tells the female it is time for her to mask the attractant. Male beetles exposed to synnthetic female attractants use the same chirping signal they use when approaching live females.

The most destructive bark beetles—Douglas fir beetle, western pine beetle, and mountain pine beetle—have a specific sound for responding to the females' chemical attractant.

This relationship between sonic and chemical behavior in bark beetles may solve certain physiological puzzles facing researchers who have attempted to explain beetle behavior solely on the basis of chemical communication.

Although acoustic signals in forest terrain are short-range signals, they are effective in aggregated populations where control of attractants and repellants occurs.

Rudinsky is now testing synthetic chemicals to determine properties of the female masking agent, with hope that a combination of sound and sex may someday lead the beetle to his doom.

For more than 60 years, bark beetles, particularly the Douglas fir beetle, have plagued Northwest forests. Even in normal years, Oregon timber losses caused by Douglas fir beetles reach into millions of dollars. In favorable beetle conditions following severe storms or fires that leave many downed and weakened trees, losses can reach epidemic proportions.

The 1962 Columbus Day storm that hit Oregon provided such conditions and within the next two years the beetles destroyed enough timber to build three cities the size of Portland. One-third of the trees in some areas were destroyed. A blight on beauty of the environment and increased fire danger from dead or dying trees accompanied the economic losses caused by the beetles.

Bark beetles get their start in downed trees that attract flying females. Once 10 or 20 pioneer females reach the downed log and bore into the bark, they release their own attractant that brings thousands of beetles into the area, usually within half a day. Each female then skillfully masks the attractant once a male comes chirping near her door. But by this time it is too late to stop mating and expansion of the population.

After mating, the female tunnels along the log between the bark and wood, depositing eggs as she goes. Each female can produce approximately 100 offspring. As the larvae develop, they eat their way around the log, emerging in the spring and becoming adults in mid-summer.

The beetles prefer downed trees, but population pressure eventually forces them to living trees. The female beetle alone does not cause enough damage to kill the tree, but the larvae girdle the tissue layer under the bark preventing essential flow of nutrients from the tree crown to its roots. The beetles also allow entry of a fungus that helps kill the tree.

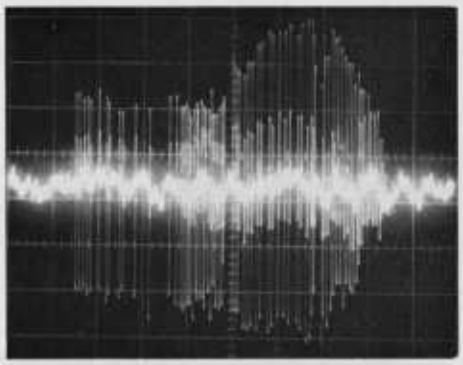
Nature does not allow the beetles to spread indefinitely, but they can destroy up to 400 trees in a cluster before less favorable conditions in living trees cause the population to decline and wait for another disaster that leaves a large number of fallen trees.

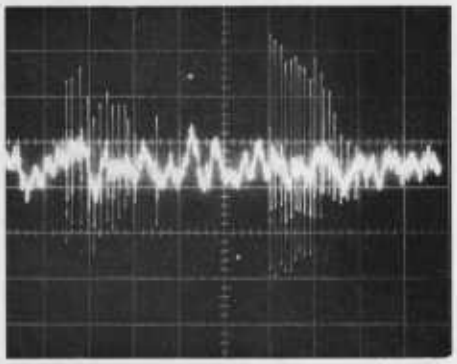
Controls for the insect are limited. This lack has led to intensified effort by entomologists to understand the physiology of the beetle, hoping to turn its sex life or some other vital habit against it.

Presently, best control is removal of fallen trees to deprive the beetle of a starting point for expansion of its population, but this is impractical in vast acreages of forests. Such an effort made the year after the Columbus Day storm reduced the number of downed trees by approximately six percent. To effectively control the succeeding beetle outbreak, at least 98 percent would have had to have been removed.

Insecticides have been ruled out because aerial application—the only practical way to cover large areas—cannot penetrate the forest canopy and, even if it did, would not penetrate the bark where the damage was being done.

Rudinsky thinks eventual control of the bark beetle will have to depend on knowledge about the chemistry, function, and triggering mechanisms of natural attractants and repellants and use of this knowledge to confuse the beetles in some manner that will prevent mating.





OSU electrical engineer R. R. Michael eavesdrops on the Douglas-fir bark beetle. When subjected to danger, the male beetle's chirp produces a full, uninterrupted pattern on the oscilloscope (upper left), but when responding to the female attractant the male beetle produces an interrupted chirp that serves as a signal for the female to mask the attractant.

Pear study goal: eliminate temperature as production variable

Temperature influences pollen tube growth in d'Anjou pears and has a definite effect on initial fruit development, but shows no consistent relationship to fruit size at the time of harvest.

Although seasonal temperature cannot be controlled, the pollen tube growth study by Mid-Columbia Experiment Station horticulturalists W. M. Mellenthin and C. Y. Wang show rapid pollen tube growth is important to insure good cross-pollination and fruit set. The heavy fruit drop characteristic of d'Anjou pears results from poor pollination, as the dropped fruit is generally seedless.

The study indicates that 10 degrees centigrade approaches the minimum day temperature necessary during anthesis (full bloom) for adequate pollination and fertilization. Limbs on pear trees were caged in thermostatically controlled portable limb cages seven days prior to full bloom until 14 days after hand pollination.

At 21.1 degrees centigrade, pollen tube growth was completed within 24 hours. At 1.5 degrees it took 72 hours and, at 10 degrees, it took 120 hours.

The 10-year average maximum temperature for the 10-day period following full bloom at the Station, located in the heart of the Hood River d'Anjou pear-growing area, is 14.37 degrees centigrade, with a low of 10.9 degrees in 1972 and a high of 18.8 degrees in 1971. Twelve percent of the daily maximums during this 10-year period were below the 10-degree Centigrade lower limit necessary for adequate fruit set.

While temperatures during anthesis are not related to fruit size at harvest, they greatly influence initial development during the pollination-fertilization process (see table). Data from station plots show there is a linear relationship between the post bloom temperatures and yield of d'Anjou pears.

A temperature-controlled limb cage goes into position at the Mid-Columbia Experiment Station. The cages, developed at the Station, have made a variety of temperature-related experiments possible.

Relationship of temperature to fruit weight and size

Cage Temp (c)	Two weeks after full bloom		Harvest
	Wt (g)	Diam (mm)	Diam (mm)
11.7	.79	12.0	60.2
14.4	1.26	14.5	64.8
16.7	2.15	17.8	62.7
17.3	2.25	18.0	63.8
18.4	2.56	18.8	68.7
20.5	2.99	20.0	63.9
23.3	5.01	24.0	62.4

Next step in the research now that critical temperatures for adequate fruit set have been established is to develop methods for improving pollination and fruit set. Use of growth regulating chemicals and a search for pollinators that will germinate and have rapid pollen tube growth at lower temperatures are two possibilities being pursued.

The goal: to have consistent production, regardless of temperature during bloom.

Peas please

Agronomist F. V. Pumphrey checks irrigated peas in experimental plots near Pendleton.

Sprinkler irrigation has improved consistency of pea production in Northeastern Oregon and reduced grower dependence on weather.

Pea irrigation, initiated in Union County nearly 10 years ago to increase yields by removing the hazard of unpredictable dry years, and to make more efficient use of expensive sprinkler systems, has expanded to several thousand acres in Union and Umatilla counties.

Irrigating peas, as initially practiced, produced several undesirable effects. Some of these undesirable features were excessive vine growth, lack of pea uniformity in size and maturity, and peas without their characteristic bright green color so essential to frozen peas. It soon became evident that the timing and quantity of water applied to peas was important, contrasted with the common practice of keeping peas moist from prebloom until harvest.

In 1969, Pendleton Experiment Station agronomist Roland Schwanke began seeking ways water could be used more efficiently to improve pea production. In the last three years, station agronomist Vance Pumphrey has followed up on the work initiated by Schwanke.

Irrigation treatments based both on stage of peavine development and amount of moisture in the soil have led to several refinements in the procedure for irrigating peas.

Data show the most important time to irrigate is during the pod-filling stage. Irrigation at this stage of growth gives more yield increase in marketable peas per inch of water applied than irrigation at any other stage of growth. Also, excessive vine growth is avoided, and uniformity of pod maturity is not drastically affected. With less vine growth, fewer discolored peas occur. Yield increase is obtained from more pods per vine and more marketable peas per pod.

In dry years, irrigation during bloom is recommended in addition to irrigation during pod filling in Umatilla County. In Union County, because of later planting and later harvesting, irrigation from blooming to harvest is needed for optimum production. Enough water should be applied to wet at least the top one foot of soil. Too much moisture encourages disease problems. Irrigation delays pea maturity and harvesting three to seven days beyond what it would normally be under dryland conditions.

Pumphrey emphasized that irrigation is not the only factor influencing pea production. Other important considerations are establishment of good stands, adequate soil fertility, and the control of insects and diseases.

Trout: cancer fighters

There is something fishy going on in cancer research —but the rats don't mind. Neither does OSU food scientist R. O. Sinnhuber.

Sinnhuber heads a team of researchers investigating toxic compounds produced by molds and operates the only laboratory in the world using fish as a test animal for cancer research. His work began 10 years ago when rainbow trout in hatcheries throughout the Northwest began dying from liver cancer. He traced cause of the cancer to a toxic compound, aflatoxin, produced by a common mold in cottonseed meal used in the fish diet.

Since the discovery of aflatoxin — the strongest cancer-causing compound known—Sinnhuber has been directing research on mycotoxins (mold-produced poisons) from all parts of the world. And the OSU Food Toxicology and Nutrition Laboratory near Corvallis was built to take advantage of the rainbow trout's accidentally-discovered sensitivity to certain mycotoxins. The lab has 100 tanks containing 80 to 100 fish each that are used in experiments. Brood fish are maintained to produce the large numbers needed for experiments, which usually begin when the offspring are about one month old.

The mycotoxins are mixed with a standard fish diet made at the lab and fed to the fish for at least a year with some of the fish being sacrificed every four months for liver samples. Most cancer-causing mycotoxins usually cause malignant liver cells by the end of the first four months.

Approximately 10,000 fish are used for each experiment. Standard concentration of mycotoxin added to the diet is four parts per billion, although some mycotoxins, such as aflatoxin, cause liver cancer in concentrations less than one part per billion.

Studies with the fish show that aflatoxin also can be present in peanuts and peanut butter and that cows fed cottonseed meal containing aflatoxin pass the toxic compound to their milk.

Although effect of aflatoxin on man is not known, work by the OSU food scientists has led to efforts by the cottonseed industry to eliminate aflatoxin from their product, with promising results. Other food industries where cancer-causing mycotoxins have been found are doing the same.

A treatment with a combination of heat and ammonia gas appears to effectively eliminate aflatoxin. The OSU researchers are involved in tests to see if the treatment is doing the job. Milk and meat from livestock fed treated cottonseed meal are being added to the diet of test fish. If the sensitive fish do not develop cancer within a year, the substance being checked is considered free of cancer-causing mycotoxins.

In addition to identifying cancer-causing compounds, clues are being sought about how the compounds cause cancer. Some mycotoxins are selective. Aflatoxin causes cancer in both rainbow trout and rats, but it does not affect salmon or mice.

What does one species have that the other does not have to prevent cancer from aflatoxin?

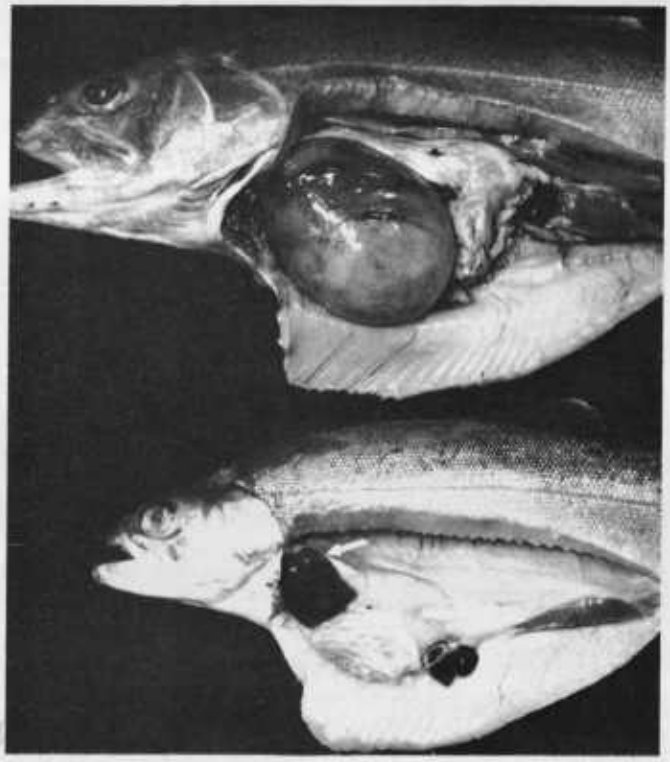
Sinnhuber and his co-workers are working to find the answer. They also hope to add new dimensions to cancer research by taking advantage of controls over fish that are not possible with other laboratory animals. Rainbow trout can go up to two months without food, their metabolism rate can be changed by varying water temperature, and oxygen levels can be altered. Manipulation of these variables may make it possible to determine their effect on cancer development.

The lab also is used for nutrition research involving fat and protein requirements of fish. The researchers found that fish in laboratories and hatcheries often lack certain fatty acids in their diet and that this deficiency can be corrected with the addition of fish oil.

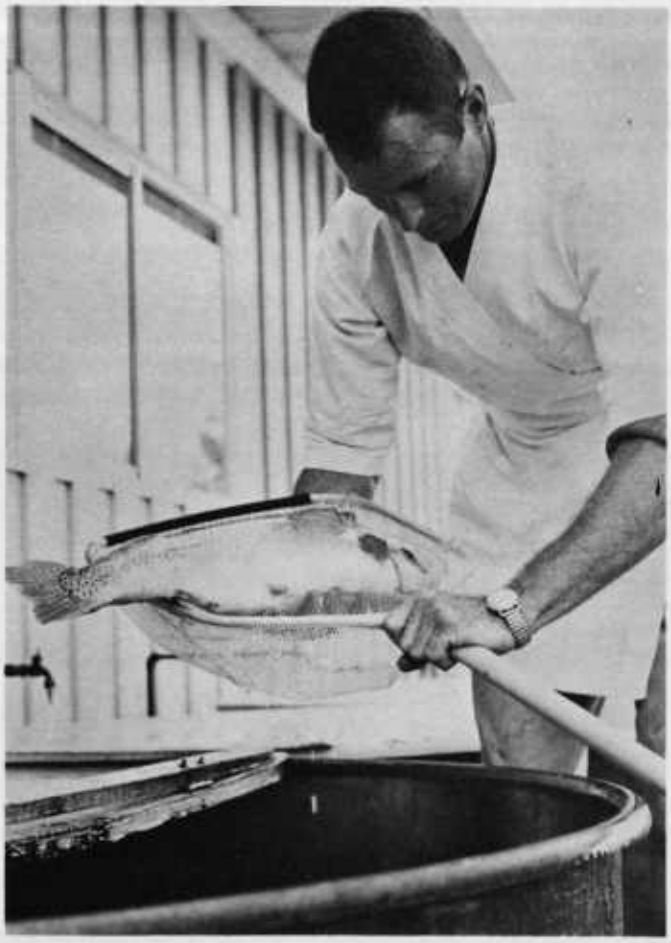
This work has had implications for the fish food business, aiding in perfecting the Oregon Moist Pellet used throughout the world as commercial fish food. It has raised questions about validity of results from previous nutrition experiments using fish suffering from the fatty acid deficiency. And it has provided a market for surplus fish oil.

Success of both the mycotoxin and nutrition research has Sinnhuber convinced that fish are better test animals than rats. In addition to being more sensitive to cancer-causing mycotoxins and offering more research variables, fish are easier to manage and are relatively disease free.

And who would want to feed 10,000 rats for a year?



Aflatoxin-induced cancer is just beginning to appear as a small blemish (arrow) on the liver of the smaller rainbow trout. The cancer on the other fish is more advanced.



Tanks containing 80 to 100 fish each make a variety of large-scale feeding experiments possible at the OSU Food Toxicology and Nutrition Laboratory. Outside the lab, brood fish are maintained to produce the thousands of young trout needed for the research.

A new range management philosophy is being tested in the foothills of Eastern Oregon. Called "ice cream" area management, the practice involves developing desirable (ice cream) grazing areas to control the movement of livestock in larger surrounding areas.

Oregon State University range management graduate student Rick Miller has initiated a two-year study working with the Eastern Oregon Agricultural Experiment Station, Union, under the direction of animal scientist and station superintendent J. A. B. McArthur and W. C. Krueger, OSU assistant professor of range management.

"Fifty to 80 percent of most forested rangelands in the foothill areas of Eastern Oregon are not being utilized, greatly reducing the livestock carrying capacity and farmer income from these areas," said McArthur.

The reason the land is not being efficiently utilized is because cattle tend to congregate in easy-to-graze areas, refusing to move out where forage is harder to find. The result is overgrazing and damage to the preferred area unless herd size is reduced only to what the area will handle.

Fencing large range areas to force livestock grazing on unused sections is considered too expensive and driving cattle to unused areas usually results in their returning to the original location within a few days, said McArthur.

The ice cream alternative being tested by Miller involves developing and using key grazing areas as a method for controlling rather than hindering livestock movement. A similar type of grazing management has been successfully used in some areas of Canada.

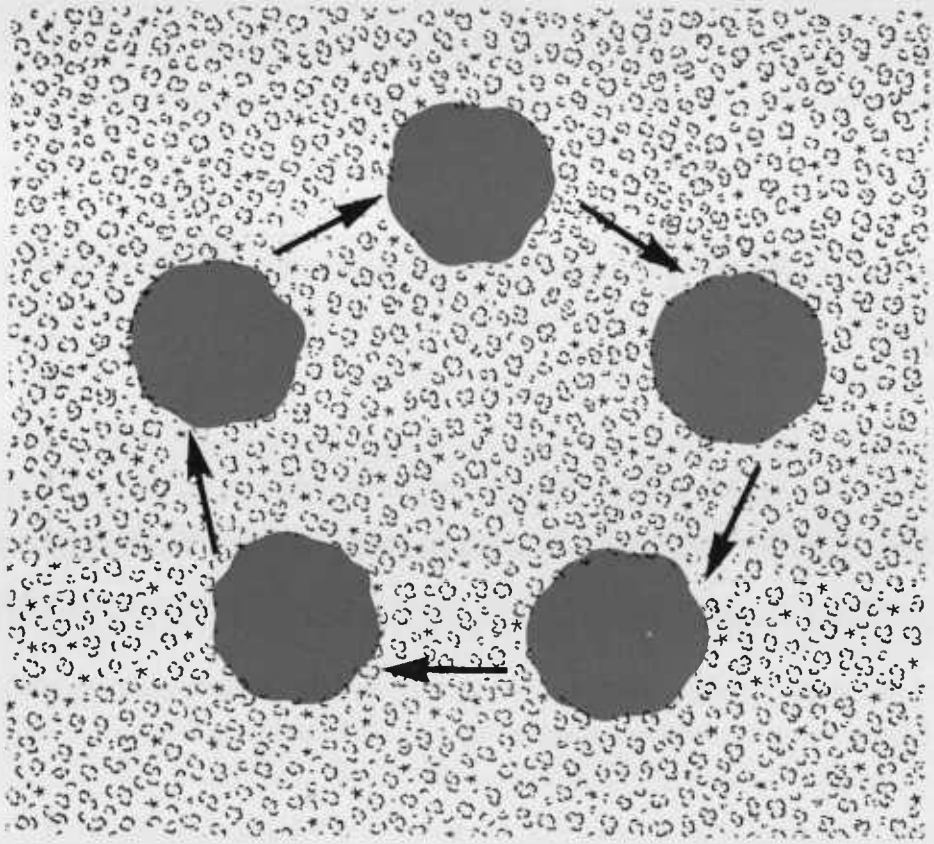
The procedure involves developing a patchwork of clearcut areas in stands of old-growth grand fir that have developed into a diseased and stagnated condition with poor timber, grazing, wildlife and recreational values and seeding these areas to suitable grasses such as timothy, tall oat and orchard grass.

Once the grass stand is established, animals are brought in to graze each of the areas in succession. When one area is grazed to approximately 50 percent of its capacity, the animals are moved to the next area where the same procedure is followed until all the clearcut areas have been grazed. Then the cycle is repeated, but by this time the grass has gone dormant and cannot be harmed by overgrazing. So once the available forage has been utilized in the key area, the cattle are forced to utilize the surrounding area that would otherwise be neglected. When the surrounding area has been fully grazed, the cattle are again moved to another ice cream area and the process is repeated until the entire range area has been efficiently grazed.

"We think the ice cream area needs to be about 10 percent of the total area to be grazed," said McArthur.

The study is being conducted on the Eastern Oregon Experiment Station's 2,000-acre Hall Ranch in the foothills of the Wallowa Mountains 12 miles southeast of Union.

A 55-acre area on the ranch was clearcut in 1969 and burned and seeded to grass in 1970. The area was lightly grazed in the fall of 1971. The first major grazing was done by cow-calf pairs in June, 1972, as the initial phase of Miller's study. When the area was approximately 50 percent grazed, the animals were removed. Cows will be returned to the area without their calves in September



Proper rotation of livestock in a series of clearcut areas that have been burned and seeded to grasses prevents damage to the area and also forces animals to utilize forage available in the surrounding forest.

A 55-acre clearcut on the Eastern Oregon Experiment Station's Hall Ranch is being used to test the "ice cream management" concept. Researchers believe the area can be used to control grazing in the surrounding 500 acres of forest.

after the grass has gone dormant. Miller is taking forage utilization samples of the clearcut area and surrounding 500 acres to see how well the practice works. Next year the clearcut will be grazed only in the fall to simulate conditions on ice cream areas grazed toward the end of the rotation.

"Because we're talking about forest sites, we have to keep in mind that their main purpose is producing trees," said McArthur.

The ability of trees to reestablish themselves on the clearcut demonstration area through natural reseeding is being monitored.

"If the clearcut areas are limited to a maximum width of one-quarter of a mile, hand seeding of new trees shouldn't be necessary," said McArthur.

"Perhaps the greatest advantage of grazing the clearcut area is to prolong the period of secondary succession when big game habitat is maintained at a high level of productivity," he added.

Previous station studies show that some browse species grow out of reach of deer and elk in four to six years if cattle are not used to hold down annual growth. Proper management of livestock, which also tend to feed on and "prune" the browse, will extend usefulness of the sites to big game up to 20 years instead of only five to eight years, said McArthur.

"This type of management has potential use on thousands of acres of private forests in Eastern Oregon. It improves forest quality, is beneficial to big game and, at the same time, provides an income for the landowner," concluded McArthur.

Spray speeds filbert fall

The growth-regulating chemical ethephon is being put to work in Oregon filbert orchards to accelerate nut drop, making it possible to advance the harvesting of filberts as much as three weeks.

This allows harvesting to be completed in mid-September instead of the usual mid-October completion date. Biggest advantage of the earlier harvesting is that it allows growers a better chance of getting their filberts picked before the rainy season begins.

Applied as a foliage spray, ethephon releases ethylene gas to plant tissue as it breaks down. The gas, a natural plant hormone responsible for a variety of physiological effects, influences maturation of the filbert husk.

Four years of tests by USDA horticulturalist Harry Lagerstedt show that best results are obtained if ethephon application is made when the first few nuts separate from the base of the husk. Although varying with seasonal conditions, this stage of nut maturation is usually reached during the third or fourth week of August.

At least 90 percent nut drop occurs about 21 days following ethephon treatment, making it possible to predict harvest time within a few days.

Concentrations of ethephon ranging from 100 to 1,000 parts per million were tested, with a concentration of 1,000 ppm being most consistent for producing satisfactory results. Lower concentrations take too long to produce the desired effect and excessively high concentrations may cause early defoliation or injury to the tree.

This year, ethephon was applied on one-acre plots at locations throughout the Willamette Valley to give growers and processors some experience with the chemical. It is also being tried on varieties other than the common Barcelona and Daviana varieties.

Growth promoter may replace DES

Diethylstilbesterol (DES), recently banned by the Food and Drug Administration as a livestock feed additive to produce faster weight gains, may be replaced by Ralgro, a new growth-promoting compound.

Ralgro does not appear to have the hormonal side effects sometimes attributed to DES and has received FDA approval for use with livestock. However, it is more expensive than DES, costing about 85 cents for a recommended 36 mg implant compared to 13 cents for a recommended 12 mg implant of DES.

DES, which still can be administered legally to feedlot cattle in pellets implanted under the skin of the ear, became available to livestock producers in 1954. Extensive tests show that the compound increases rate of gain in cattle by 10 to 15 percent. This, combined with an eight to 10 percent decrease in the amount of feed required to produce a pound of gain, makes use of DES an economical practice for producers.

Comparison of Ralgro and DES implants to control animals

	Treatment	Average daily gains (lbs.)	% over control
Experiment I (weaner steers)	Ralgro-36 mg	1.25	60
	DES-12 mg	1.25	60
	Control	.78	----
Experiment II (finishing steers)	DES-24 mg	2.11	27.7
	Ralgro-36 mg	1.76	6.0
	Control	1.66	----

But large doses of the compound administered over extended periods have caused cancer in laboratory animals. Misuse by some producers, causing illegal residuals in liver tissue of slaughtered animals, has led to banning DES as a feed additive. Although ear implants apparently do not create a residue problem and are still acceptable to the FDA, they, too, may be banned as pressure grows to discontinue all use of the compound.

Tests by animal scientist Dr. Larry Foster at the Squaw Butte Experiment Station show that Ralgro generally does as well as DES in stimulating growth.

Two experiments were conducted at the Station comparing Ralgro and DES implants to control animals. The first experiment involved 60 head of weaner steers on a growing ration for 112 days. Initial weight averaged 528 pounds. The second experiment involved 45 head of finishing steers on a high grain ration for 152 days. These steers averaged 811 pounds initially.

All the animals failed to gain as hoped, but the implants outperformed the controls on both experiments and the percent increase in gain over control animals was generally higher than normal (see table).

It appears that cattle should be implanted in a growing stage as well as during the finishing period. There does not appear to be a distinct advantage to either Ralgro or DES during the growing period. Side effects sometimes occur on cattle implanted with DES that do not have adequate grass to support good gains. Side effects are not a problem with Ralgro under the same conditions.

Unfortunately, buyers often discriminate against implanted calves because they feel that growing cattle implanted with a growth promotant will not respond to additional use of the promotant in the feedlot.

Approximately five years of data compiled by the Nevada Experiment Station from studies in which cattle have been implanted with DES during the growing stage and then reimplanted in the feedlot indicate that feedlot response to DES is not hindered under these conditions.

Plants stimulated --by herbicides

Sub-lethal doses of herbicides can stimulate plant growth.

The hypothesis that poisons are stimulatory in small quantities is not new and various research reports have given it support. OSU crop scientist Arnold P. Appleby and Steve Wiedman, a graduate student, have added more evidence in favor of the hypothesis, showing that hormesis—the term describing the stimulating effect of toxic substances on organisms—is common among several major classes of hebicides.

Pre-emergence application of 11 herbicides at sublethal doses stimulated root or shoot growth of oats in greenhouse studies. Two additional herbicides also stimulated root growth in cucumbers. Only three herbicides tested showed no stimulatory effect on either the oats or cucumbers, but even these three have stimulated plant growth in other studies.

In every case, treatments producing stimulation caused higher total plant dry weight than non-stimulatory treatments, indicating that the herbicides increased ability of the plants to produce living tissue rather than simply redistributing plant resources to roots or shoots.

Although the research was unable to define mechanisms responsible for the stimulatory effect of the herbicide applications, it suggests that hormesis is a widespread biological phenomenon and counters the belief that any poison is harmful, regardless of dosage.

The concept that some chemicals are poisonous at high concentrations, but may produce beneficial effects at low concentrations should be considered in making legislative and regulatory decisions regarding use of these chemicals, said Appleby.

Economists cast eye at fishing

How much is Oregon's salmon and steelhead sports fishing industry worth?

Oregon State University agricultural economists, directed by William G. Brown, are refining estimates of its economic value in a study sponsored by the National Oceanic and Atmospheric Administration.

First attempt at evaluating the intangible recreational aspects of sport fishing was made 10 years ago. Economists then determined that the recreational value of salmon and steelhead sport fishing in Oregon was approximately $3.1 million annually. However, they realized that the techniques used to determine this value produced only a rough—and probably low—estimate.

Refined estimation techniques, developed through further research and applied to the early data, produced what the economists think is still a tentative but more reliable annual value ranging from $8.5 to $8.8 million. This means that if a private operator had a monopoly on the recreational value of Oregon salmon and steelhead sport fishing, demand would allow him to charge each fisherman a maximum of $20 for a day's worth of fishing.

Brown said that a comprehensive survey and analysis of the Pacific Northwest sport fishery is needed to obtain new data that can be analyzed with the new techniques. The result would be a reliable estimate that will help planners establish priorities for public spending to preserve or enhance fish production, predicts Brown.

The information also would help compare fishing with alternative uses of water resources such as dam building for power, help determine allocation of fish stocks for sport and commercial use, and will help with management and production decisions such as best species for hatchery output, said Brown.

Basic difference between the 1962 study and the new study is increased efficiency of demand estimation by analyzing data from survey participants individually rather than grouping them into zones and developing averages for the groupings, said Brown.

Also, the analysis of the 1962 data concluded that family income was insignificant in estimating demand for salmon and steelhead fishing. Brown suspects income cannot be overlooked because it is highly related to expenditures for durable equipment such as boats and campers, a factor that probably encourages high-income families to spend more days fishing when they go on a fishing trip.

Another factor that probably has changed since the earlier study is the preference pattern of sport fishermen, said Brown.

There also is a need to develop a range of values that reflect quality differences in sport fishing, avoiding use of a single value to represent an activity that has such a wide range of diverse characteristics, he added.

Alfalfa cocktail next for swine?

Utilization of freeze-dried alfalfa or a protein concentrate from alfalfa juice are two possible methods for making alfalfa—a high-protein animal food—more suitable for use in pig rations.

Oregon State University animal nutritionist Peter R. Cheeke is trying to make alfalfa contribute more to the protein requirements of swine and possibly replace protein supplements such as soybean meal or fish meal in swine feed.

"Yield of protein from alfalfa is higher than from any other crop, even soybeans. And it has an amino acid composition quite favorable to what is required by swine," said Cheeke.

These factors give alfalfa potential for becoming a source of cheap, high-quality protein for swine, particularly in the Northwest where much alfalfa is produced. The problem is that pigs do not particularly like alfalfa and will reject any feed having more than 30 or 40 percent alfalfa mixed with it.

Cheeke traced the palatability problem to a "browning reaction" between certain sugars and amino acids when alfalfa is subjected to heat during drying.

"It is much like the process bread goes through when you toast it," said Cheeke.

In addition to giving alfalfa a bitter taste, the browning reaction ties up certain amino acids, particularly lysine, in a form that cannot be utilized by swine. One way to eliminate the browning reaction is to freeze-dry alfalfa —a process where alfalfa is frozen and water removed in a vaccuum.

Preliminary tests with rates indicate that freeze-dried alfalfa is tastier, but economics have dampened Cheeke's hopes that freeze-dried alfalfa will ever become available commercially as a swine feed.

"It works out to a cost of approximately $800 a ton," said Cheeke.

However, Cheeke said the research has been beneficial:

"Main advantage of our research has been to indicate what alfalfa can be like without the browning reaction, and we are continuing to look at freeze-dried alfalfa in terms of vitamin content, digestibility and other factors in hope that there may be more economical ways to achieve the same results. One possibility is development of browning inhibitors."

Major thrust of Cheeke's alfalfa research has turned to another form of alfalfa that is economically feasible to produce—a high-protein concentrate made from alfalfa juice. A California firm is already producing some 4,000 tons of bright-green powdered concentrate annually, primarily for use in poultry feeding to give a desirable yellow pigmentation to egg yolks and meat.

"We want to uncover the major advantages and disadvantages of using the concentrate in swine rations," said Cheeke, who plans to begin feeding trials with the alfalfa concentrate this fall.

Fan-cy

Fanning interest of plant breeders is a different shape for experimental plots. Horticulturalist Harry Mack checks beans planted in shape of a fan, a pattern developed by an English scientist. Compared to the conventional rows-in-a-square, the plots provide variable spacing from 3 x 3 inches up to 10 x 10 inches, save space by eliminating buffer plants and make available a wide range of populations. The beans were planted by Jack R. Stang, graduate student, who is conducting nitrogen tests at the Vegetable Research Farm.

AGRICULTURAL EXPERIMENT STATION
of
Oregon State University
Corvallis, Oregon 97331

Director

FREE: Annual Report or Bulletin or Circular or Report of Progress.

Permit 1115

POSTAGE PAID
U.S. DEPARTMENT OF AGRICULTURE
AGR 101

U.S.MAIL