

OREGON'S AGRICULTURAL PROGRESS



Goal tending

Agricultural research helps everybody.

We in the Experiment Station have known that fact for a long time. Now, because of heightened awareness of food production brought about by recent threatened shortages, the consumer is learning it, too. There is new interest in agricultural research and in the role of the Experiment Station. More consumers are asking, "What do you do?"

So, what is our business?

The simple answer: We are in the knowledge business. We try to develop useful information through the application of science to provide knowledge so people can make better decisions.

This is certainly true in buying food, in balancing diets, in concern with food safety, in teaching students, in the wise use of our resources while protecting the quality of the environment. At the same time, we must help the business operator maintain a livelihood.

To work, our business, like everyone else's, must be adaptable, able to adjust to change or to take advantage of new challenges, keeping the best of the old and accommodating the best of the new. Part of this continuous process, of course, is making available knowledge, the product of the Experiment Station, which is done in many ways—news releases, through the Extension Service and meetings, public service.

Our goals—our work categories—can be divided into eight divisions. Their changing priorities reflect shifts as new problem areas appear.

Our targets:

Protection

- Natural resources.
- Crops.
- Animals.
- Consumer.
- Environment.

Development

- New products.
- Agricultural marketing.
- Community.

Because our goals are built on the goals of many agricultural and consumer groups in Oregon, we cannot always fully satisfy all our "clients." But we try, and from meetings, exchanges and deliberations comes another goal:

Decisions for the greatest benefits for the greatest number.

—G. Burton Wood
Director
Agricultural Experiment Station



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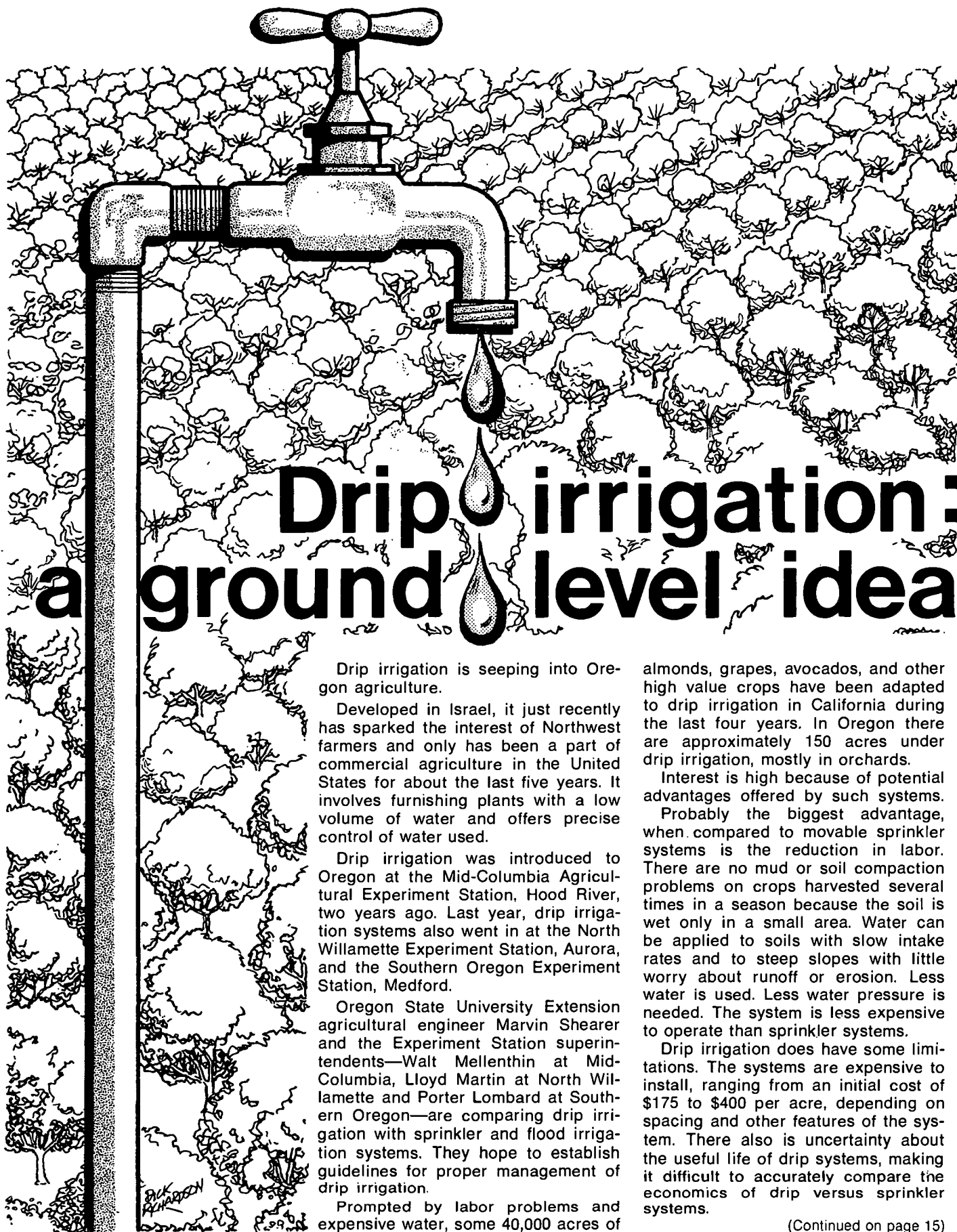
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Cover

Millions of dogs and cats have a friend at OSU. He is entomologist Robert L. Goulding who did much of the research leading to development of plastic flea collars introduced in 1964. Now, he has helped develop a new, better collar. Story on page 11.

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Drip irrigation is seeping into Oregon agriculture.

Developed in Israel, it just recently has sparked the interest of Northwest farmers and only has been a part of commercial agriculture in the United States for about the last five years. It involves furnishing plants with a low volume of water and offers precise control of water used.

Drip irrigation was introduced to Oregon at the Mid-Columbia Agricultural Experiment Station, Hood River, two years ago. Last year, drip irrigation systems also went in at the North Willamette Experiment Station, Aurora, and the Southern Oregon Experiment Station, Medford.

Oregon State University Extension agricultural engineer Marvin Shearer and the Experiment Station superintendents—Walt Mellenthin at Mid-Columbia, Lloyd Martin at North Willamette and Porter Lombard at Southern Oregon—are comparing drip irrigation with sprinkler and flood irrigation systems. They hope to establish guidelines for proper management of drip irrigation.

Prompted by labor problems and expensive water, some 40,000 acres of

almonds, grapes, avocados, and other high value crops have been adapted to drip irrigation in California during the last four years. In Oregon there are approximately 150 acres under drip irrigation, mostly in orchards.

Interest is high because of potential advantages offered by such systems.

Probably the biggest advantage, when compared to movable sprinkler systems is the reduction in labor. There are no mud or soil compaction problems on crops harvested several times in a season because the soil is wet only in a small area. Water can be applied to soils with slow intake rates and to steep slopes with little worry about runoff or erosion. Less water is used. Less water pressure is needed. The system is less expensive to operate than sprinkler systems.

Drip irrigation does have some limitations. The systems are expensive to install, ranging from an initial cost of \$175 to \$400 per acre, depending on spacing and other features of the system. There also is uncertainty about the useful life of drip systems, making it difficult to accurately compare the economics of drip versus sprinkler systems.

(Continued on page 15)

Alfalfa leaves: new pushers of protein

Ration composition and market hog performance from 90-210 lbs.

Ingredient (percent of ration)	Treatment					
	#1	#2	#3	#4	#5	#6
Alfalfa concentrate	-----	5.0	10.0	15.0	20.0	24.0
Soybean meal	10.0	8.0	5.0	-----	-----	-----
Meat and bone meal	7.5	5.5	5.0	5.5	2.5	-----
Barley	80.8	79.8	78.3	77.9	75.9	74.4
Tricalcium phosphate	0.2	0.2	0.2	0.2	0.3	0.3
Salt (trace mineralized)	0.5	0.5	0.5	0.4	0.3	0.3
Bentonite	1.0	1.0	1.0	1.0	1.0	1.0
Average daily gain (lbs.)	2.2	2.1	2.2	2.1	2.0	2.2
lb. feed/lb. gain	3.41	2.96	3.16	3.42	3.29	3.47

Each ration was supplemented (per ton) with 120,000 IU Vitamin D, 1,200,000 IU Vitamin A, 230 grams zinc sulfate and 2 pounds Aureo-Sp-250.

Ration composition and young pig performance from 38 to 100 lbs.

Ingredient (percent of ration)	Treatment					
	#1	#2	#3	#4	#5	#6
Alfalfa concentrate	-----	-----	7.5	12.5	20.0	20.0
Soybean meal	10.0	9.0	5.0	2.0	-----	-----
Herring meal	2.5	2.5	2.5	2.5	2.5	2.5
Meat and bone meal	5.0	5.0	5.0	5.0	1.0	1.0
Barley	79.0	72.5	76.5	74.8	73.0	73.0
Ground Alfalfa	-----	7.5	-----	-----	-----	-----
Molasses	1.0	1.0	1.0	1.0	1.0	1.0
Salt (trace-mineralized)	0.5	0.5	0.5	0.4	0.3	-----
Dicalcium phosphate	1.0	1.0	1.0	0.8	1.2	1.2
Bentonite	1.0	1.0	1.0	1.0	1.0	1.0
Average daily gain (lbs.)	1.50	1.45	1.55	1.46	1.33	1.34

Each diet was supplemented (per ton) with 3 pounds Aureo-SP-250, ½ pound zinc sulfate and 200,000 IU Vitamin D. Ration 1 was supplemented with 1,500,000 IU Vitamin A per ton.

Ration composition and creep and starter fed pig performance

Ingredient (percent of ration)	Treatment		
	#1	#2	#3
Wheat	66.0	64.5	63.25
Alfalfa meal (sun dried)	5.0	5.0	5.0
Soybean meal	10.0	5.0	-----
Herring meal	5.0	5.0	5.0
Dried buttermilk	6.0	6.0	6.0
Dried whey	2.0	2.0	2.0
Ground limestone	0.5	0.5	0.5
Salt (trace mineralized)	0.5	0.5	0.25
Molasses	5.0	5.0	5.0
Alfalfa concentrate	-----	6.5	13.0
Average daily gain (lbs.) (pre-weaning)	0.45	0.47	0.40
Average daily gain (lbs.) (post-weaning)	1.01	0.99	0.93

Each ration was supplemented (per ton) with 5 pounds Aureo-Sp-250, 340 grams zinc sulfate, and 180,000 IU Vitamin D.

Alfalfa may become the Pacific Northwest's first major home-grown source of supplementary protein for swine and poultry rations.

Grown and utilized extensively in the Northwest as a feed source for ruminants, alfalfa has had little value for simple-stomached animals because of its high fiber content, the large volume needed to fulfill dietary protein needs and an undesirable taste.

Now a special process that extracts juice and coagulates and dries protein from alfalfa leaves produces a high-protein concentrate that overcomes these problems. Oregon State University animal nutritionist Peter R. Cheeke has found the concentrate to be a good substitute for soybean meal as a protein supplement in barley-based swine rations.

The protein concentration process, Pro-Xan (standing for Protein-Xanthophyll), was developed by USDA researchers at the Western Regional Research Laboratory, Albany, California. It has been adapted to commercial production by a California company. The plant, operating at full capacity, is producing about 4,000 tons of the concentrate annually. It is being marketed primarily for poultry feed.

Cheeke, the only researcher investigating feasibility of the concentrate as a swine protein supplement, sees great potential for the product in the Northwest if a processing facility can be established in the region and operate with economics similar to the one in California. The concentrate sells for \$250 a ton in California, making it competitive with other protein supplements.

"Pressure on soybean meal prices and competition with other uses are making this protein source less available for animal feeding. Alfalfa grows well in the Northwest and produces twice as much protein per acre as soybeans," said Cheeke.

Swine performance on the concentrate was evaluated by Cheeke during three growth stages ranging from pre-weaning to market weight hogs. The research indicates that the concentrate can be the sole protein supplement for market hogs and produce

gains equal to those produced by hogs using a soybean meal supplement. The hogs were started on the ration at 90 pounds and carried through to market weight of approximately 210 pounds.

A second feeding trial with smaller pigs—started at 38 pounds and fed until they reached 100 pounds—indicated that the concentrate also could be used with the younger pigs. However, best performance for the smaller pigs came when it was mixed with other protein sources. Average daily gains were reduced when it was used as the sole source of protein supplementation.

Cheeke also experimented with incorporating the concentrate into creep and starter rations, feeding pigs from a pre-weaning weight of about 11 pounds until they reached a post-weaning weight of more than 60 pounds. He found that rations having some of the protein furnished by 6.5 percent or 13.5 percent alfalfa concentrate produced no significant difference in gain when compared to a ration containing other protein supplements.

The USDA researchers in California found that the concentrate works equally well in poultry rations.

The concentrate is about 40 percent protein and has only two percent fiber. It has a high ash content (19.2 percent), but did not cause scouring in swine, a problem sometimes associated with feed having high ash levels. In addition to high quality protein, the concentrate was shown to be a good source of needed calcium, phosphorus and certain trace minerals.

Human as well as animal consumption of the concentrate is a possibility. The researchers who developed the Pro-Xan method are working to improve the flavor and color of the concentrate and have succeeded in changing it from a green color, believed objectionable to consumers, to white. They think it can be developed into a highly nutritious snack food.

"The leaves of green plants are the largest source of untapped protein in the world and the method used to extract the alfalfa protein is the first successful commercial attempt to utilize this source. Its adaptation to other plants could have world-wide significance in easing the current protein shortage," said Cheeke.



Ability to isolate individual plants is one of the main features of a new isolation chamber designed by plant pathologist Duane Coyier.

A spore chamber for fungus sex studies

Studying the sex life of a fungus requires an uncontaminated environment and Duane Coyier, USDA plant pathologist at Oregon State University, has developed a low cost, portable plant isolation chamber for maintaining such an environment.

Coyier designed the chambers for powdery mildew mating studies when it was necessary to isolate individual spores on host plants, but the chambers can be adapted for use with any plant disease when isolation from other diseases or insects is desirable.

Construction of a chamber requires nothing more than a transparent plastic bag, a styrofoam cup and a plywood disc. The disc is sealed to the plant container with florist's clay, and the plastic is at-

tached and sealed around the disc. Detachable tubes for water and air are accommodated by small openings in the disc and run from a common line that can serve several chambers.

A slightly higher air pressure is maintained around the plant than outside the chamber to keep the plastic top inflated and prevent entry of contaminants. Inoculation with desired spores is accomplished through a small hole punched in the top of each chamber.

The chambers allow flexibility in size and shape of plants that can be used and allow individual plants to be moved readily for inoculation or observation. They also are effective barriers to infestation by insects and mites.

Cadmium may explain hypertension

A group of hypertensive rats is helping researchers at Oregon State University learn about a metal in our environment that may affect human health.

The rats are being fed cadmium to see if low exposure to the metal over a long period causes high blood pressure.

Cadmium is present in the environment from a variety of sources including water and air, with the air around large industrialized cities containing more of the metal than rural areas. It also is associated with several occupational tasks, including soldering, electroplating, welding, mining and refining of zinc ore and the manufacture of nickel-cadmium batteries.

The metal accumulates in body tissue in much the same manner as lead, meaning that individuals with greater exposure to it build up greater concentrations in their bodies during a lifetime.

Whether cadmium is actually bad for health has not been established, but OSU researchers under the project leadership of agricultural chemist P. D. Whanger have been working with it for the last five years, seeking clues to its action and effect on certain life processes. Their involvement with cadmium came about partially as a result of previous work with zinc, which is similar to cadmium in many ways, and partially as a follow-up on scattered scientific reports suggesting that cadmium creates high blood pressure, a factor that might be important to several Oregon industries that expose workers to cadmium.

The researchers have analyzed cadmium in hair samples, blood samples, water supplies and in a special kidney protein, metallothionein, that they suspect of being a heavy metal scavenger. A study to learn more about the properties of this protein was initiated this fall.

Research with the rats is to see if cadmium really is a factor in creating hypertension. A previous short-term experiment adding high amounts of cadmium (150 parts per million) to the diet created only a temporary blood pressure rise that dropped to normal once the high cadmium diet was removed. Now the researchers want to see if long term exposure to smaller amounts of the metal, more like human exposure, causes hypertension.

The rats are being fed cadmium at rates of 10 ppm and 20 ppm for 18 months. The scientists say that one

year in the life of a rat is equivalent to 30 years in the life of a human.

One of the biggest problems they've had to overcome is determining how to measure a rat's blood pressure accurately. A special machine that takes readings from the rat's tail has been found to work satisfactorily. They also found that warm rats produce easier blood pressure readings than cold rats, so the animals are preheated under a 250-watt infra-red lamp for three minutes before blood pressure readings are taken. The heat is dissipated through the tail, producing a measurable pulse.

Measurements, taken monthly, are averaging about six millimeters of mercury higher for the cadmium-fed rats than for the control group. Average blood pressure for a rat is 140 millimeters of mercury. For humans, aver-



Rats are warmed under an infra-red lamp before blood pressure is measured.

age systolic blood pressure is 120-130 millimeters of mercury.

Other OSU probes into the action of cadmium in the bodies of rats have revealed that Vitamin C or increased iron in the diet decrease cadmium accumulation in body tissue.

The researchers also have checked cadmium levels in blood samples from hypertensive patients in the Veterans Administration Hospital, Portland, in an attempt to link cadmium with hypertension. Cadmium levels in these samples averaged considerably higher than those found in blood samples collected in cooperation with the American Red Cross throughout Oregon. The higher cadmium levels in the veterans' blood may be due to a higher average age of the veterans because they have had more years in which to accumulate cadmium compared to the

Red Cross donors. A check of blood samples from people without high blood pressure but of similar age to the Veterans Hospital patients revealed cadmium levels similar to those of the patients.

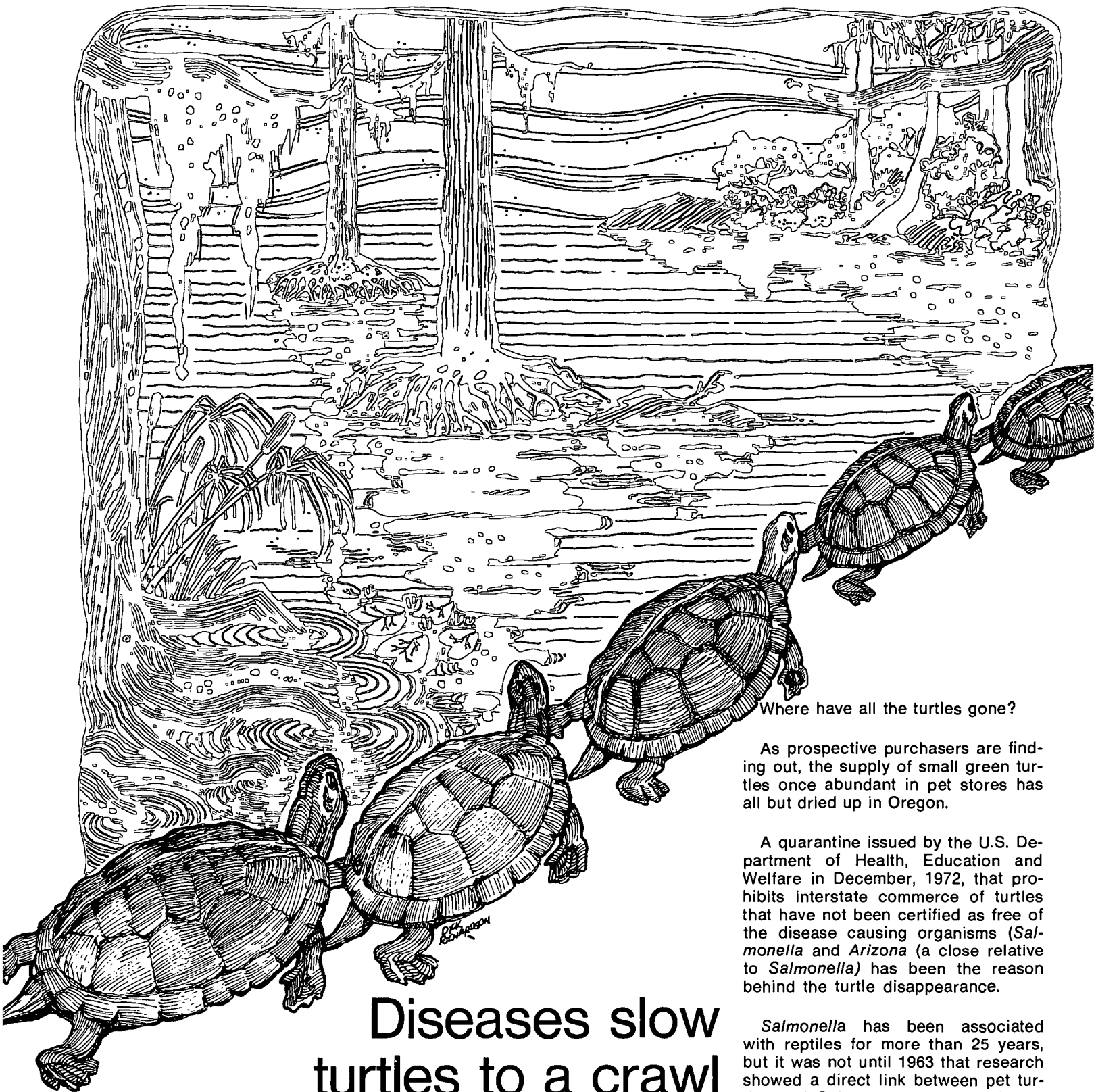
Other information was gleaned from the cooperative work with the Red Cross, particularly where hair samples were taken as well as blood samples. The researchers found that smokers had higher levels of cadmium in their hair than non-smokers, although there was no difference in blood cadmium levels between smokers and non-smokers. No relationship was found between blood cadmium levels and occupation of the blood donor, but metal workers (welding, sheet metal, electroplating, etc.) had higher hair cadmium levels than office workers or laborers who did not use any metals

in their occupations. This indicates that hair might be a more sensitive check for cadmium than blood, said Whanger.

He added that the things being learned about cadmium will have more significance as research puts them together into an overall picture of their effect on man and his environment.



Blood pressure readings are taken from the tail.



Diseases slow turtles to a crawl

Where have all the turtles gone?

As prospective purchasers are finding out, the supply of small green turtles once abundant in pet stores has all but dried up in Oregon.

A quarantine issued by the U.S. Department of Health, Education and Welfare in December, 1972, that prohibits interstate commerce of turtles that have not been certified as free of the disease causing organisms (*Salmonella* and *Arizona* (a close relative to *Salmonella*)) has been the reason behind the turtle disappearance.

Salmonella has been associated with reptiles for more than 25 years, but it was not until 1963 that research showed a direct link between pet turtles and *Salmonella* poisoning. In the mid-1960s, researchers produced consistent evidence that the turtles, indeed, were often responsible for the ills of their owners and laid the groundwork for the quarantine restrictions.

At its peak in the late 1960s and early 1970s, the sale of pet turtles was

a \$15 million business annually in the United States. There was approximately one turtle for every 25 homes and some 300,000 *Salmonella* poisonings a year were attributed to the turtles.

Most of the poisonings, characterized by nausea, vomiting and diarrhea, hit children under seven years of age, mainly because the younger children lacked understanding about the proper relationship with their pets. They drank aquarium water, put contaminated rocks and pebbles and sometimes even the turtles themselves into their mouths.

In 1971, Oregon State University microbiologist Ramon J. Seidler and Ph.D. candidate R. H. McCoy became involved with the problem of turtle diseases. Their work indicated for the first time that turtle owners had more than *Salmonella* and *Arizona* infections to worry about.

The discovery was not exactly planned. The microbiologists were investigating a relatively little studied organism, *Aeromonas*, that is primarily a fish and reptile disease organism, but had been found capable of causing infections in humans.

While collecting *Aeromonas* samples from reptiles, lakes and medical sources to learn more about its presence in nature and bacterial classification, Seidler and McCoy received some fecal samples from a doctor treating a child with chronic diarrhea. *Aeromonas* discovered in the sample was traced to a turtle aquarium.

Was this an accident? To find out, the researchers collected turtles from pet supply sources throughout Oregon and California. They kept the turtles isolated, sterilized the aquaria and water and then took a look at the bacteria produced by the turtles. They found *Salmonella* in 20 percent of the samples, but more surprising was the presence of *Aeromonas* in 63 percent of the samples. The number of *Aeromonas* in each sample also was considerably larger than the number of

Salmonella organisms, ranging from 100,000 to 1,000,000 per milliliter of water.

Four other potential human pathogens carried by the turtles were also found by the OSU researchers. The result influenced strengthening of the quarantine in California where the state decreed that turtle shipments into the state must not only be free of *Salmonella* and *Arizona*, but also must be free of "all other pathogens."

The California and HEW quarantines have practically eliminated the shipping and selling of pet turtles, raised primarily in the southeastern United States. The only exceptions to the quarantines are shipments of less than seven turtles and bulk shipments to colleges and universities for research purposes.

There are ways the problem may be cleaned up.

"Turtle farms have traditionally fed the cheapest food available. Carcass remains from slaughterhouses are sometimes thrown directly into ponds as feed for the turtles and become a source for *Salmonella* contamination among the feeding turtles," said Seidler.

Although costs would increase, improved sanitation when raising the turtles for large scale shipment to retail outlets would help growers establish and maintain stock free of *Salmonella* and other disease organisms, said Seidler.

Chemicals and antibiotics have been tested but have been unsuccessful in eliminating the problem.

The OSU microbiologists have attempted biological control by introducing a parasitic bacterium to feed on the disease causing bacteria. They were able to reduce the concentration of disease organisms but were not able to eliminate the unwanted bacteria.

Seidler and graduate student Carol Brown are continuing research on dis-

ease organisms in the environment, but their emphasis has shifted from *Aeromonas* and turtles to plants and a different group of bacteria, *Klebsiella pneumoniae*.

K. pneumoniae, a nitrogen-fixing bacterium, was discovered when Seidler was helping OSU plant pathologist Harold Evans and U.S. Forest Service pathologist Paul Aho identify bacteria from decaying trees. Approximately five percent of the bacteria found, including *K. pneumoniae*, were already known to be capable of causing disease problems in animals and humans.

If they existed in trees, what about other plants, particularly those eaten by humans?

Research by Seidler and Brown to isolate and check the frequency of *K. pneumoniae* on vegetables revealed that about 50 percent of the vegetables examined contained high concentrations (several thousand per gram of peeling) of the bacterium.

"Most people don't have any reason to worry about *K. pneumoniae* when they eat fresh vegetables because the organism is primarily associated with infections secondary to some other health problem. *K. pneumoniae* is responsible for 10 to 20 percent of the infections acquired by patients while they are in the hospital and is most infamous for kidney and bladder (urinary tract) infections and occasional infections in burn patients," said Seidler.

He suspects that these hospital acquired infections might be transmitted to the patients from fresh vegetables and salads served in hospitals, but this link has not yet been proven.

"The organisms must multiply on the surface of fresh vegetables to be present in such large numbers," said Seidler.

A study of the growth of *K. pneumoniae* on vegetables was initiated this fall by Chris Eby, an undergraduate student in the Department of Microbiology.

Quail eggs withstand "shelling" by DDT

Some pesticides may have been unjustly accused of decreasing egg shell thickness in certain avian species.

A study by the Oregon State University Departments of Poultry Science and Agricultural Chemistry revealed that long term exposure to DDT and its breakdown component DDE had no adverse effect on egg shell thickness of Japanese quail or fertilizing capacity of adult male White Leghorn chickens. The work was done by master's degree candidate W. A. Robson, G. H. Arscott, head of the Department of Poultry Science, and agricultural chemist I. J. Tinsley.

Groups of quail had 0, 100 or 300 ppm (parts per million) of DDE or 100 ppm of DDT added to their diets. Half the quail in each group also were fed diets with either 3.0 or 0.5 percent calcium.

The results through five, 28-day production periods indicated that specific gravity of eggs (a measure of egg shell thickness) and the number of cracked eggs were not influenced by pesticide treatment. However, quail fed the lower calcium level produced significantly more thin-shelled eggs and had more cracked eggs. Fertility and hatchability of eggs were reduced with the lower calcium diet but not the pesticide treatments.

The researchers found no calcium-pesticide interaction. DDT previously has been linked to a decrease in the ability of birds to secrete calcium necessary for strong-shelled eggs. Egg

production, feed consumption, egg weight and female body weight were not affected by the treatments. The pesticides also had no significant effect on the hatchability of fertile eggs or survival of the chicks.

The pesticides did produce some effects not directly related to reproductive performance of the quail. Male body weight was reduced considerably with the addition of 300 ppm of DDE to the diet and both sexes had more deaths at this pesticide level.

Female body weight was not affected by the high pesticide rate because hens were presumably able to eliminate the pesticide buildup through egg laying, said Arscott.

The work with White Leghorn chickens was restricted to males because the effects of such pesticides on hens had been studied and reported previously.

The White Leghorns were fed DDE at a concentration of 100 ppm for 16 weeks. The concentration then was doubled to 200 ppm for another 16 weeks. Another group received 100 ppm of DDT in their diet for the entire 32 weeks.

Reproductive performance of the males was checked by measuring semen volume, sperm concentration and fertility. Fertility and hatchability were checked by inseminating hens with semen from the males and incubating all eggs produced.

These measurements revealed no significant effect on reproductive per-

formance from either DDE or DDT. The White Leghorns also had a significant weight loss resulting from the diet contaminated with DDT but not from the DDE diet. At the end of the 32 weeks, DDT-fed males weighed about 23 percent less than those in the control group.

During the experiment, only one death was attributed to pesticide consumption. The death came 31 weeks into the experiment, with the bird showing tremors associated with DDT toxicity.

Although the research with the Japanese quail and White Leghorn chickens shows that DDT and DDE did not influence reproductivity and that the adult male chicken is relatively resistant to long-term feeding of moderate levels of the pesticides, Arscott cautions that this might not be true for all species of birds. He said that birds of prey might be affected more than other species because they are at the high end of the food chain and studies have shown they can accumulate extremely high levels of the pesticides. Also, information on calcium needs of these species is not known.

The OSU research is part of an overall series of experiments initiated through the Environmental Health Science Center and funded by the National Institute of Environmental Health Sciences to determine the effect of pesticides found in the environment on various species, including man.

Dwarf hens react normally to molting

What happens when dwarf White Leghorn hens are force molted?

To find out, OSU poultry scientists George H. Arscott, Paul E. Bernier and Robert W. Dorminey, who are interested in the dwarf hen as an economic unit, conducted a series of molting studies of the normal-sized White Leghorn and the dwarf.

Chickens molt naturally in the fall, as day length decreases, dropping their feathers, noticeably those

on the wings. To force molt, producers withdraw feed and water and decrease light for varying periods.

Force molting is used when a hen has been laying 8 to 12 months (or as egg production declines) and egg shells get thinner and crack more easily and interior quality of the egg deteriorates.

When regular feeding is resumed after the inactive period, the hen's feathers grow and egg production

and quality return to normal.

In the molting studies, 90 normal-size pullets and 116 dwarfs were penned, force molted and studied for four 28-day periods.

The results showed that the dwarf White Leghorn not only produces eggs competitively with the normal-size hen but also reacts to force molting the same way: Egg production and feed conversion improve. Egg shell thickness and quality of the egg's interior tend to improve.

Science collars safety for pets

Pet owners are getting a new jump on the flea and other pests.

Oregon State University entomologist Robert L. Goulding also has some good news for the nation's 1.1-plus million dogs and the 25 (or so) million cats. Their improved flea collars not only will be safer but also can be worn longer with the same effectiveness.

The flea collar, introduced in 1964 after research by Goulding and OSU colleagues, has topped sales of 100 million. Goulding did the initial work in developing the use of a plastic formulation as a collar pest control system and much of the work leading to its registration.

The first collars, made of polyvinyl chloride resin with Vapona mixed in during formulation of the plastic, released Vapona, a vinyl phosphate insecticide, at a fairly regular rate which was picked up in the animal's hair coat and exposed fleas and other insects continuously.

The insecticide, which affects the nervous system of fleas and ticks, kills them. The flea population drops sharply in the first 24 hours. The collar was equally effective for cats, with the insecticide total halved during formulation. Collars for both were effective for three months.

The improved collar is effective for four months. It uses Dibrom, a vinyl phosphate insecticide closely related to Vapona which has a lower mammalian toxicity rate and a more favorable emission rate in the plastic system, making it safer.

Because the materials used volatilize off the pet's collar into the hair, continuing at an ever-decreasing rate, there can be a surplus of the insecticide released. The new collar gives a



Robert L. Goulding tests the improved flea collar on laboratory dogs.

much steadier release. The initial flea kill is not as great as with Vapona, taking four to five days for the average pet.

The flea collar is effective principally in the neck area because the flea, never still, heads there looking for the warmest place on the pet's body. The flea has a good reason: he cannot regulate his own body temperature.

In scratching or grooming its own body, the pet passes the insecticide collar over nearly all its body, effec-

tively exposing the pests to the insecticide.

Like any other chemical, the collar insecticide in the first collar caused some negative reactions in some pets, mostly skin irritation associated with too tight collars. A few animals showed signs of pesticide poisoning, symptoms which disappeared when the collar was removed.

Tests with the new collar have turned up no cases of irritation or any ill effects, Goulding said.

As a result of the flea collar work, scientists have learned how to combine volatile materials in plastic with a controlled release which not only works on pets but also on insect attractants.

Goulding said the flea collar research probably will not be extended beyond the limits of the new improved collar. But he and other scientists are looking at different insecticide and plastics for fly strips.

And one of their objectives is a yoyo insecticide, a plastic strip which would kill mosquitoes underwater and when water dried up would become inactive until the rains came and then be ready to combat the mosquito again.

Ways with holly not folly

If you're worried about when to cut holly for best storage you've been needlessly concerned.

Procedures commonly used by commercial holly producers and florists to extend the useful life of the cut product appear to be as good as any. This includes cutting holly when the berries reach desired color without respect to any specific physiological condition of the holly spray, dipping it in a 100 ppm solution of naphthalene acetic acid (NAA) and storing it at 32 degrees Fahrenheit.

Variations of this procedure were evaluated by horticulture student Raymond F. Gray under the direction of L. H. Fuchigami, assistant professor of horticulture. Gray evaluated the storage and vase life of holly sprays

cut in mid-October and mid-November, thinking that the different harvest dates might affect storage quality because they would reflect different stages of berry maturity. He found no such change.

Gray also varied storage temperature—evaluating storage at 32 degrees and 40 degrees—and the NAA dip concentrations, trying concentrations ranging from zero to 200 ppm of NAA. He found that storage at 32 degrees combined with a NAA dip provided the best results. With this combination, sprays of Oregon Select, Rederly and Silvary holly remained in good condition all 12 weeks of the experiment. A level of 20 percent leaf or berry drop was set as the point where the spray was no longer commercially acceptable.

Some rams would rather fight

Sex or Violence?

That was the choice facing five ram lambs in an animal science study by Oregon State University animal scientist W. D. Hohenboken and graduate student Carol Shreffler.

The study confirmed that competing rams establish a dominance/subordination relationship, a common type of social organization among cattle, pigs, sheep and goats.

The study also showed a surprise: Evidence that the amount of mating activity is not closely associated with dominance order. Two rams low and intermediate in dominance were high

in mating activity while the two highly ranked dominant rams were near average in activity.

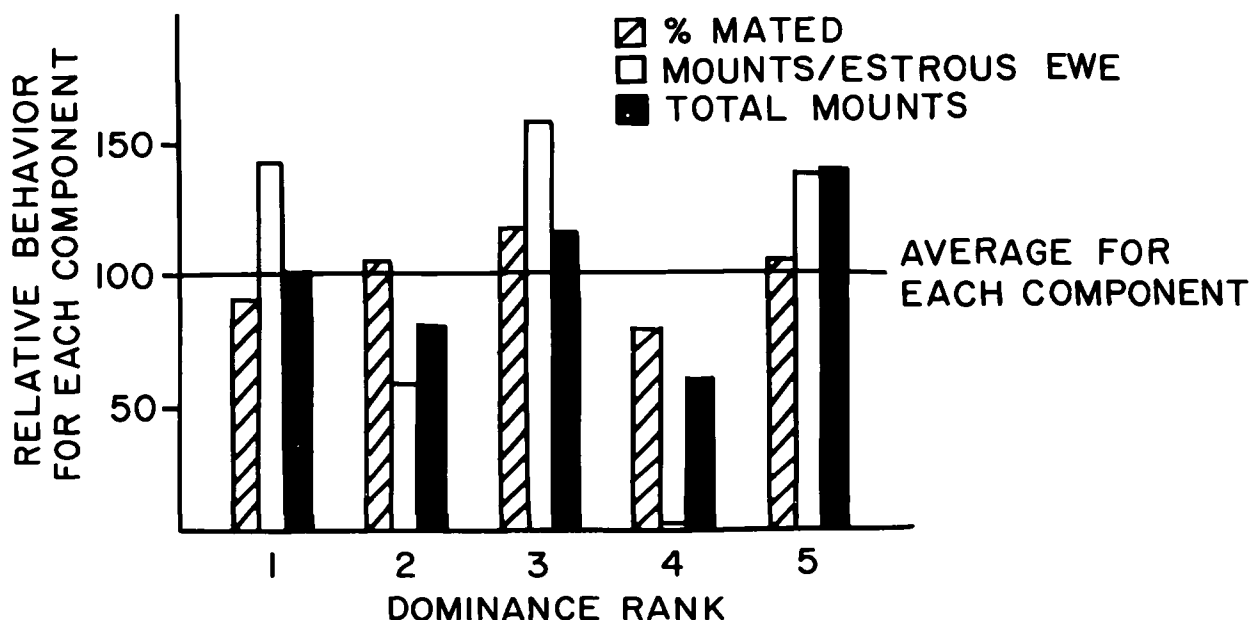
Reproductivity is a critical factor in livestock profitability. Animal health, nutrition, breeding and management are all recognized factors influencing reproductivity, but little research has been done on the effect animal behavior has on reproductivity. A better understanding of the social-mating relationship could lead to improved management practices.

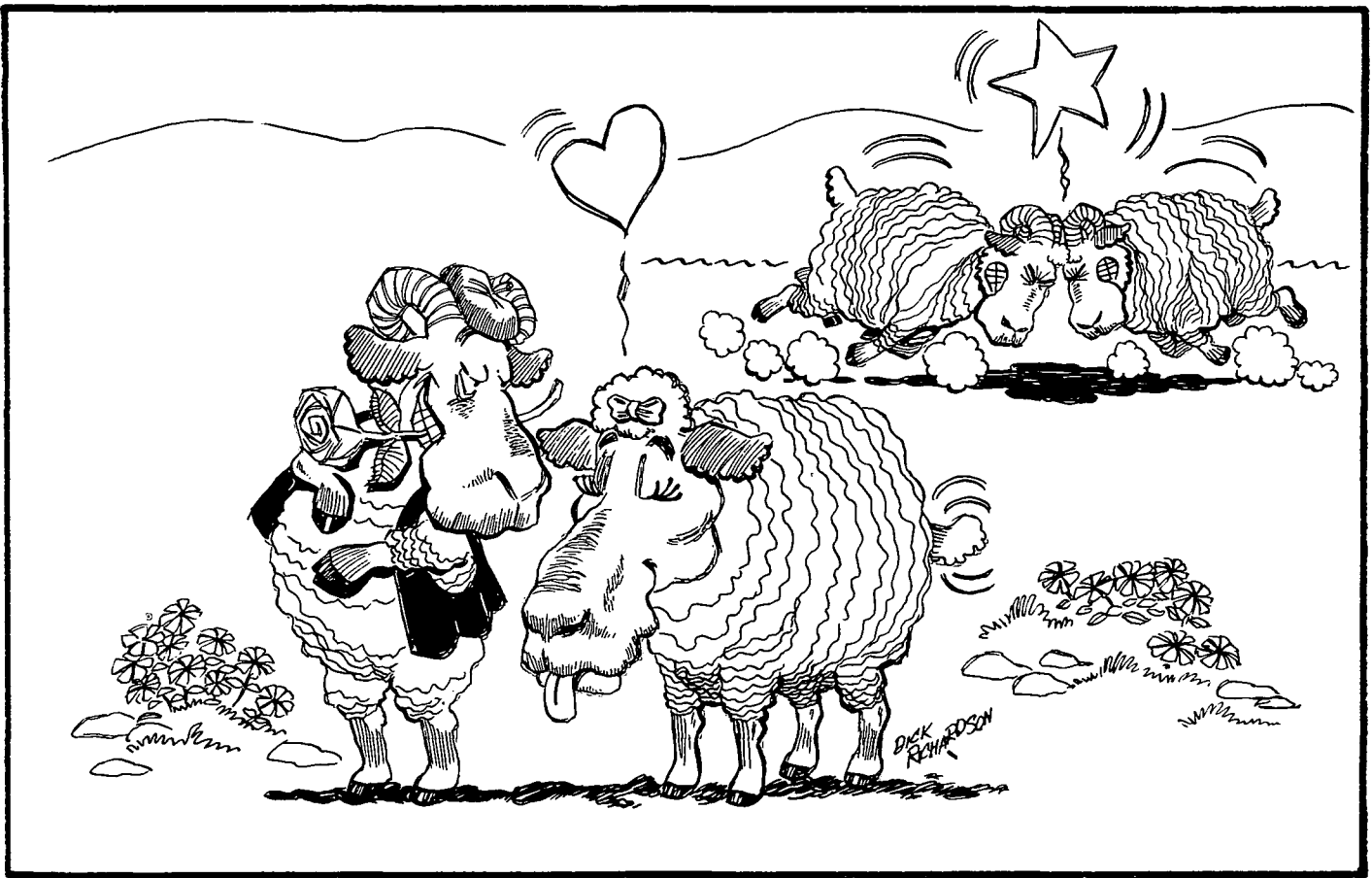
To study dominance relationships in rams, the animal scientists chose five Suffolk ram lambs without knowl-

edge of their dominance relationships. Each of 10 possible two- and three-ram combinations was randomly assigned to one of 20 consecutive testing days.

Each day, the chosen combination was introduced into a flock of 38 closely confined crossbred ewe lambs who were estrous cycling normally. Two 90-minute observation periods for each ram combination began at 6 a.m. and 6 p.m. The rams were returned to the ram group at the end of each observation period.

When the five were held without contact with estrous ewes, no overt





aggressive acts were noted. The dominance order could not be determined unless rams were stimulated by the competition for estrous ewes.

During observation, mating behavior and fighting behavior were recorded. Threats, pushes, chases and bunts were considered aggressive acts and mounts by rams on receptive ewes were counted.

When two rams were in the observation area, one was consistently the aggressor or dominant ram and the other was the subordinate, confirming the "pecking order" social organization.

Earlier studies had established that dominance in cattle was associated with size, age and longevity in the herd and that in sheep, mature rams tended to dominate yearling rams. In goats, relative age, size and strength were correlated with dominance order.

No such relationships were found in this study, but the rams were all fairly uniform in these characteristics.

The scientists did find that increasing the number of estrous ewes from one to two increased aggression more markedly than increasing the number from two to three or from three to four. The time of observation was found to be without effect. Increasing the number of estrous ewes also increased the total amount of mating activity, but decreased the number of mounts per estrous ewe.

There was significantly more aggression in two-ram combinations than in three-ram combinations. In the three-ram combinations, the dominant ram was more aggressive toward the higher ranking subordinate than to the lower one and aggression between the two subordinates was suppressed.

The three rams in the middle of the dominance order—those ranking 2, 3, 4—had an opportunity to assume both dominant and subordinate roles. No. 2 was both the most aggressive and the object of most aggression.

The amount of mating behavior was influenced by the number of ewes in

estrus. Hohenboken and Shreffler also reported that increased mating activity by a ram's competitors stimulated an increase in his mating as well. There were large individual differences between rams in sexual activity.

The two higher ranking rams were near average in mating activity. They were easily dissuaded from mating by the mating activity of a competitor. A common response was to abandon the ewe they were courting to pursue and punish the upstart competitor.

Some subordinate rams were above average in mating behaviors, probably because they were less successful in completing mating and had to be more persistent.

The fourth ranked ram lamb typified the "born loser" syndrome. He had little interest in violence and even less in sex.

Sex or violence? The answer seems to be both for dominant rams, while most subordinates show a decided preference for the former.

Now it's SUPERWEEDS

A strain of super weeds resistant to herbicides may be developing from prolonged use of the chemicals.

Entomologists have known for years that continued use of certain insecticides leads to insect resistance, but agronomists have just recently become suspicious that the same thing might be happening in weed control.

These suspicions, scientifically documented only in a few instances, have been confirmed by former Oregon State University graduate student S. R. Radosevich, now an Extension specialist at the University of California, Davis, and OSU agronomist Arnold P. Appleby.

The OSU researchers studied the effect of atrazine and simazine on

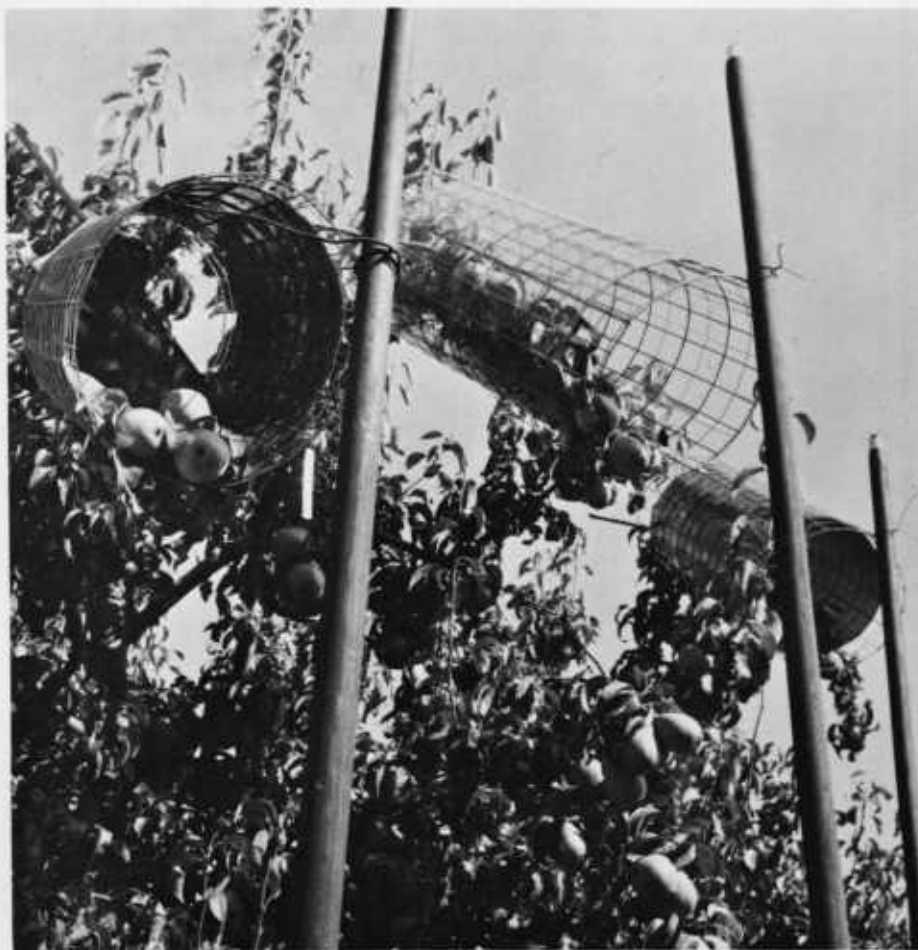
common groundsel previously reported resistant to the herbicides and on the same weed species from an area where the herbicides had not been used. Plants from the area of nonherbicide use were effectively controlled by atrazine and simazine concentrations as low as 0.5 ppm in nutrient solution, but simazine concentrations as high as 4 ppm and atrazine concentrations up to 30 ppm failed to adequately control the plants that had developed resistance to the chemicals.

The resistance apparently is limited to the triazine group of herbicides. Other researchers have found no increased resistance of this groundsel type to several other herbicides. And, unlike insecticides, which can be classified into only a few chemical groups,

herbicide chemistry is so diverse that resistance to any one group should be easier to overcome than in the case of insecticides.

Development of groundsel resistance to triazine herbicides was probably caused by long term selection of a small percentage of individuals in the groundsel population whose physiology made them resistant to the chemicals. The researchers do not feel that the herbicides have caused any change in the physiology of the groundsel to make it resistant.

The research also suggests a need to register more than one herbicide for a particular crop and points out the importance of herbicide rotation, using herbicides from different groups, for effective weed control programs.



Station pear trees 'going Hollywood'

Large filters used to produce special lighting effects in Hollywood's cinema world have moved from the studio to pear trees at the Mid-Columbia Experiment Station, Hood River.

Station superintendent Walt Mellenthin is using the filters to control the quality of light reaching the fruit, a factor he believes influences many physiological disorders in pears. One of these disorders is cork spot, and Mellenthin is using seven different filters to see which light spectrum is related to the problem. The filters were put on the tree for six weeks immediately before harvest. Although conditions establishing the problem may originate sooner, Mellenthin sees the period immediately before harvest as one that can be influenced to overcome or minimize the problem.

Cloud cover, dust and elevation are some of the natural factors influencing light quality that in turn may be causing some of the pear disorders.

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"The cost can be as little as \$100 an acre if the grower is willing to install the system himself but the engineering of such systems is critical to proper operation, making self-installation unadvisable. Low annual cost of operating the system once it is in should be considered as well as the initial investment when deciding whether to install drip irrigation," said Shearer.

Drip irrigation is not yet well adapted to forage or field crops where plants cover most of the surface. On annual crops the system must be removed or destroyed when the crop is harvested. Unlike sprinkler systems, drip irrigation cannot be used for temperature control. If fertilizer is to be applied during the growing season it must be applied through the drip system or water will not reach it to wash it into the soil.

Drip irrigation systems plug up unless the water source is adequately filtered, making clean water the primary key to successful drip irrigation.

The main problems that Shearer and the Experiment Station researchers are trying to solve include developing dependable filtering systems, determining proper emitter spacings for different crops and developing methods for determining how much water should be applied and when.

"The switch from sprinkler to drip irrigation requires a rethinking on the part of the grower regarding water application. Moisture levels will not be constant throughout the root zone and a system scheduling the amount of water needed for best plant performance is critical," said Shearer.

It will probably take three to five years of research to obtain some of the information necessary for optimum management of drip irrigation.

At the Mid-Columbia Experiment Station, Mellenthin is comparing drip and sprinkler irrigation systems on the performance of established blocks of mature Bartlett and D'Anjou pears.

The ideal way to begin drip irrigation is on new blocks of trees. The big challenge is to determine methods for supplying mature trees with adequate moisture so yields, quality and size are not low while the plants are going through the transition from sprinkler to drip irrigation.

During the first year, drip irrigated blocks at the Experiment Station had eight percent fewer #1 grade Bartlett pears than sprinkler irrigated blocks. Two drip emitters were used per tree, compared to three and four emitters



Drip emitters undergo evaluation at the Mid-Columbia Experiment Station.

used this year. This year's data have not been evaluated yet.

"If we start drip irrigating early enough in the season and maintain soil moisture capacity, I feel we can obtain adequate fruit size with drip irrigation," said Mellenthin.

Class A evaporation pans, measured daily, were used to determine water application rates. An attempt was made to replace the water which had evaporated the previous day.

In addition to determining water needs for acceptable grade and yields, filtering suspended silt and clay particles common to glacial runoff water supplying the Hood River Valley was a major challenge. A unique filter using a 200-mesh stainless steel screen washed by high pressure jets has been developed. It is working satisfactorily but is not completely trouble free.

Several drip emitter designs also are being tested at the Mid-Columbia Station. So far they all look good. The main concern with emitter design is even distribution of water pressure. About 15 pounds per square inch of pressure should be maintained at each emitter. This is done by adjusting lateral tubing size, by using microtubing for emitters so pressure can be controlled by adjusting length of the tubing, by using emitters with threaded walls of different sizes, by using emit-

ters with varying numbers of small openings and by using emitters with adjustable diaphragms.

At the North Willamette Experiment Station, drip irrigation was installed primarily to see if it would reduce mold on Oregon Evergreen blackberries. A low incidence of mold in all test plots during the dry 1973 season prevented such comparisons.

However, water use, yield and fruit size were measured. Yields were down on the drip irrigated plots. They averaged 3.91 tons per acre compared to 4.99 tons per acre from the sprinkler irrigated plots. The berries also were smaller. Average berry weight for the drip irrigated plots was 2.8 grams per berry, compared to 3.4 grams per berry for the sprinkler irrigated plots.

Martin suspects the differences are the result of incorrectly judging the amount of water needed with the drip irrigation system. The drip emitters were spaced one to a plant and water application was based on a 100 percent replacement of pan evaporation for a 10-square-foot area around each plant.

Soil moisture tension checks showed that this application rate was adequate until mid-summer. After that time, irrigation water added did not keep up with crop use. The average amount of

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water delivered to each plant during the growing season was 159.2 gallons for drip application and 691.5 for sprinkler application. A change in irrigation scheduling is planned for next year.

At the Southern Oregon Station, drip irrigation was compared with furrow irrigation on 35-year-old Bartlett and Bosc pear trees spaced 25 x 25 feet apart on clay adobe soil. Four emitters, each capable of delivering one gallon of water per hour, were ringed around each tree. The drip system ran 21½ to 23 hours a day during the driest part of the season. Other times it was on 11 to 14 hours a day. Furrow irrigation followed normal practice and was done approximately every three or four weeks. Tree response to each irrigation system was determined by measuring the rate of fruit growth. Preliminary observations indicate a slightly greater average growth rate produced by the drip irrigation system.

Immediately after irrigation, growth rate was greater for the furrow irrigated plots. Seven to ten days later the growth rate dropped below that of the drip irrigated plots.

The researchers expect that continued use of drip irrigation will eventually lead to concentration of most of a plant's roots in the area watered, improving efficiency of the system.

As the young research program shows, there are still a lot of unanswered questions about drip irrigation in Oregon agriculture, but the promise of drip has created a flood of interest and hope for a better way of watering thirsty crops. Design criteria and management techniques are being developed at the experiment stations to help growers avoid costly mistakes.

Size of earstones helps identify young trout

Juvenile steelhead trout or rainbow trout?

Few, if any, can differentiate between the two fish which are of the same species.

The steelhead goes to sea and returns two or three years later to spawn, his maturity marked by a silvery sheen. The rainbow stays at home.

To better manage the fish and streams like the Deschutes River, which is home to both fish, the Oregon State Game Commission and other agencies need to identify the young steelhead and rainbow.

Comparing scales or the horny rays of the fin—common ways to identify juvenile fish—does not work with steelhead and rainbow because there are no known differences.

Identification is complicated further because young rainbow, if released in a coastal stream, may migrate and become, in essence, steelhead. Young steelhead, if taken to a land-locked water area, act like rainbow trout.

In the Deschutes River, this interchangeability is probably slight since the rainbow prefers the upper reaches and the steelhead prefers the lower part of the famed fishing river. But in the overlap area, the Game Commission finds that the lack of identification of the juveniles adds to management problems.

James Rybock, graduate student working under the guidance of Howard F. Horton in the Department of Fisheries and Wildlife, found a way to differentiate between the young steel-

head and rainbow. He does it by measuring their otoliths, or ear stones.

A pair of otoliths, heart-shaped bony structures about 2/10 of an inch long, rests in hair-lined cavities below the brain. Easily accessible, they apparently have two functions: to sense certain low frequencies of sound and to maintain equilibrium. Man, too, has otoliths. They are small crystals that are part of the series of auditory canals, the organs of equilibrium.

Sampling adult fish from the Deschutes, Rybock found the steelhead has a larger otolith nucleus (the center portion of the otolith) than the rainbow. Differences in size of the otolith nucleus are enough to identify the steelhead and rainbow, even at an early age. Rybock also found that the otolith nucleus does not change with growth of the fish.

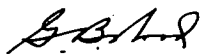
The size of the otolith nucleus appears to be directly related to egg size, since this portion of the otolith is formed when nutrition comes from the egg yolk. Eggs of steelhead are larger than those of rainbow.

Otoliths can be removed quickly from dead fish, using a tool developed during a previous study at the OSU Department of Fisheries and Wildlife.

"The otolith does not deteriorate rapidly so it can be removed from fish heads obtained from fishermen," said Rybock.

"Until we come up with a simpler method that does not require the sacrifice of fish, its measurement gives us a way to differentiate between young rainbow and steelhead."

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