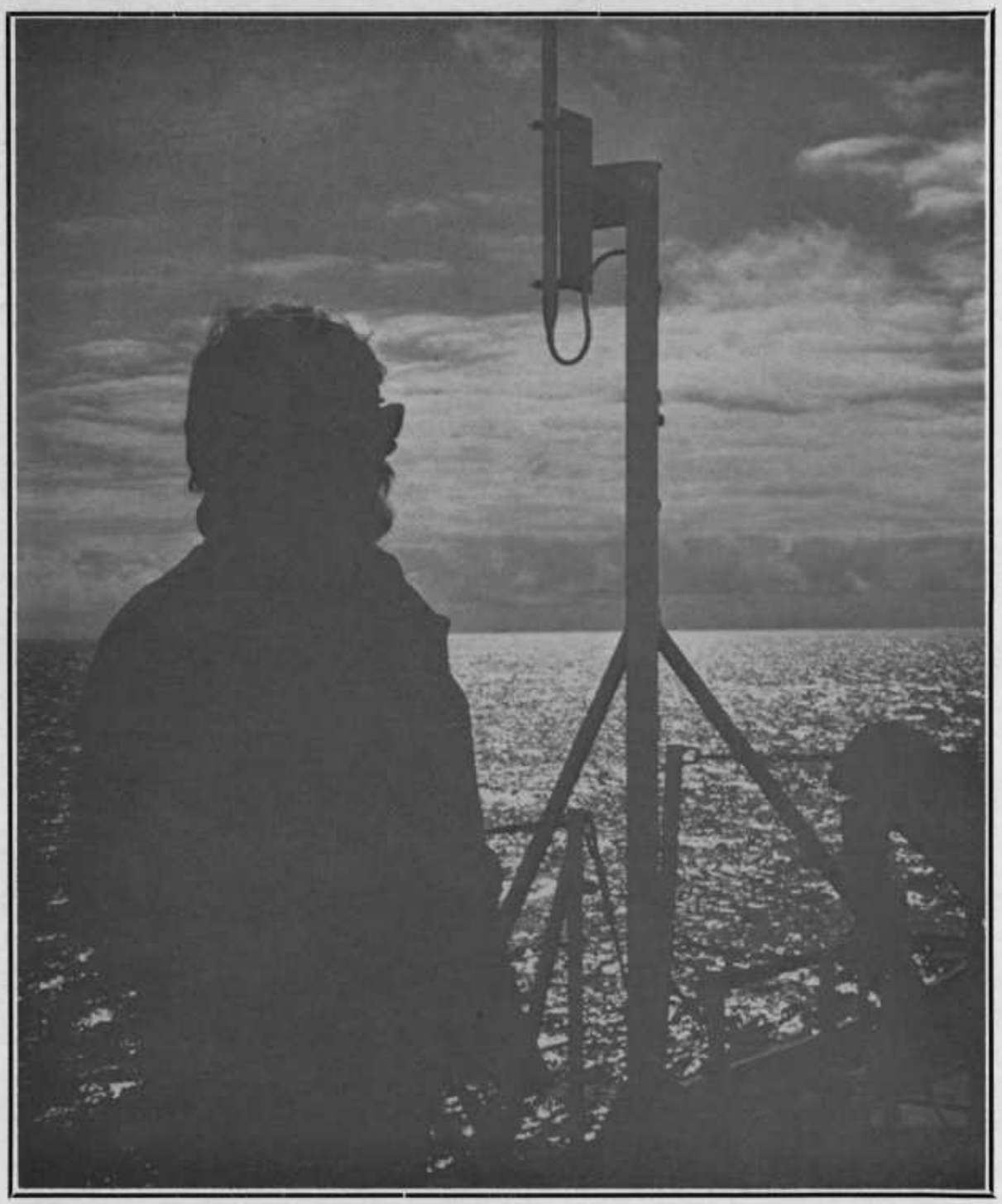
oregon's agricultural PROGRESS



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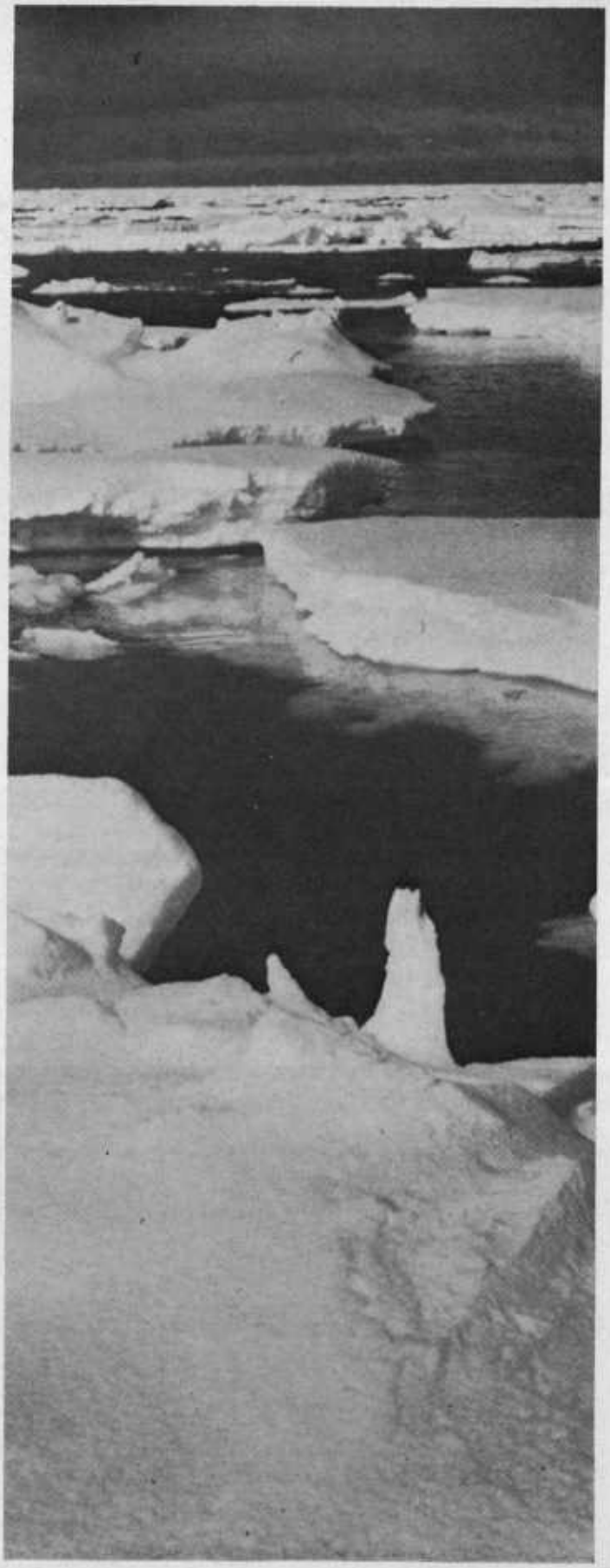
COVER: Aboard the Eltanin, OSU postdoctoral research associate Paul A. Gillespie watches for icebergs in the Antarctic. The research vessel left icy wake in summer sun (right). Story on page 3.



Basic research on cold-loving bacteria adds another link in understanding the fundamental processes of the sea

Answers in the Antarctic

PART OF THE OSU CAMPUS WENT south for the winter—to near the Antarctic Circle.

That's where a team of microbiologists, studying marine bacteria, collected specimens and data to determine the extent of bacterial activity in the cold Antarctic waters.

The path to the Antarctic began at Klamath Lake where OSU microbiologists have been studying the lake's natural enrichment processes for years. Under a major federal grant, they are finding some of the answers to why lakes live—and sometimes die—because of bacterial activity on nutrients.

In the ocean, the food chain depends on availability of primary nutrients such as phosphates, nitrates, ammonia, and sulfate. These primary nutrients in a natural situation, for the most part, are the result of microbial activity on organic matter.

Replenishment vital

The rates at which these processes take place, if at all, in an environment near freezing becomes an important fundamental question. So do the basic principles operating in the environment to allow this microbial activity to take place.

At OSU, Richard Y. Morita isolated the first obligately psychrophilic (cold-loving) bacteria 165 miles off the coast of Oregon in 1963. Prior to that time, such bacteria (which cannot survive at temperatures above 68° Fahrenheit) were thought not to exist. Since then, many investigators have begun to study these cold-loving organisms.

Bacterial activity in polar oceans is important, Morita points out, because the water, affected by salinity and low temperatures, submerges and eventually upwells in other areas of the world, causing tremendous increases in sea life. This upwelling water—it occurs off the Oregon coast, too—is rich in nutrients put there by the bacterial decomposition of organic materials.

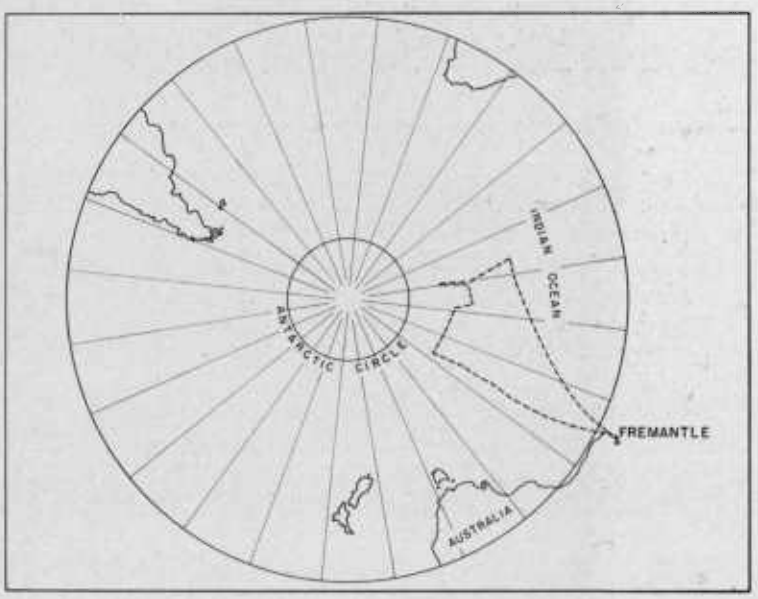
Knowing how the nutrients are regenerated and at what rate is a link in understanding the chain of replenishment vital to life cycles in the sea.

The importance of the activity of these cold-water bacteria is evident because about 90 per cent of the volume of the world's oceans is colder than 41° Fahrenheit.

Most work on cold-water bacteria has dealt solely with the types and numbers of organisms present. Because of this, there is nearly a void of knowledge concerning the nature of the nutrient regeneration processes which occur.

Under Morita's direction, the OSU Marine Microbiology Laboratory in the Departments of Microbiology and Oceanography has become the main

(*continued on page 16*)



Grass and legume seeds buried nine years showed a marked difference in viability and the potential of sending up unwelcome volunteer plants in other crops

Buried trouble: unwanted seed

VOLUNTEER PLANTS THAT GROW FROM buried seeds of previous crops often contaminate succeeding seed crops.

Buried seeds of grasses and legumes vary in viability, and to minimize contamination the Association of Official Seed Certifying Agencies prescribes a minimum number of years a field must be free of a species to produce Foundation, Registered, or Certified seed if the previous crop was of a different variety.

In addition, the Oregon certified seed standards require that field history must be adequate to insure species or varietal purity as determined by a seedling inspection. These rules, as shown in Table I, govern procedures in changing from one variety to another within the same species.

To test the adequacy of these rules, as they existed in 1961, OSU agronomists H. H. Rampton and Te May Ching buried 100 samples of 400 seeds each of nine grass and legume species at five different depths . . . 1, 2, 3, 5,

TABLE I. Number of years a field must be free of a species to produce Foundation, Registered, or Certified seed if the previous crop was of a different variety—1971 standards

Species	Foundation seed	Registered seed	Certified seed
	years	years	years
Annual ryegrass	5	5	5
Perennial ryegrass	5	5	5
Orchardgrass	5	2	2
Kentucky bluegrass	5	3	3
Tall fescue	5	2	2
Fine fescue	5	1½	1½
Highland bentgrass	5*	5	5
Crimson clover	5	3	2
Red clover	6**	–	3***

* Deep cultivation required 2 years.
** Cultivation required 3 years.
*** Two years if cultivated 1 year.

In 10-year project, forage seeds are buried in mesh to measure their ability to live. Mesh envelope keeps them from being lost.

and 7 inches . . . in the field. Samples were recovered each year for nine years and tested for germination and total viability.

Results:

Oregon annual ryegrass persisted longer than Linn perennial, and buried seeds of both ryegrasses persisted longer in poorly drained than in well drained soils. A few viable seeds of Oregon annual ryegrass were recovered in the ninth year. Linn perennial ryegrass was practically depleted in the third year, and no viable seeds were recovered after the fourth year.

These wide differences in viability indicate that Linn perennial ryegrass should have shorter field history requirements for certification than annual ryegrass, but that buried Oregon annual ryegrass seeds may render a field unsuitable for perennial ryegrass seed production for an extended period.

No live seeds of Danish commercial orchardgrass, Alta tall fescue, or chewings fescue were recovered from the soil in the third year. The short life of these species suggests changes in the field history requirements for Foundation seed production.

Persistence with depth

Buried seeds of Newport Kentucky bluegrass showed no viability after the second year until the eighth year when a trace of viability appeared and was carried over into the ninth year.

Highland bentgrass seeds were more persistent in the soil than any of the other grasses. After nine years the recovered seeds averaged 9.5 per cent viable and ranged from 0.5 per cent at the 1-inch depth to 16.8 per cent at 7 inches. Again, this suggests changes in field history requirements for certification.

Dixie crimson clover seed followed a pattern of increasing viability and persistence with increasing burial depth. No live seeds were recovered in the ninth year at the 1-inch depth but 7.4 per cent were recovered at 7 inches. Similarly, persistence of Pennscott red clover increased with depth of burial, reaching 41.7 per cent viability at 7 inches. Adequacy of current field history requirements for certification is questionable for both clovers.

Through this type of long-term study, information will be developed to provide scientifically based field history rules for seed certification.

In farming practice, extended seed viability in the soil contributes to the persistence of hard-seeded legumes and of grasses such as annual ryegrass and Highland bentgrass. By frequent plowing and tillage, deeply buried seeds are brought to the surface where breaking of dormancy and increased germination occur, thus hastening depletion of buried seeds preparatory to making new plantings.

New resource from the sea:

Hake passes taste test

YOU MAY FIND A HOT HAKE ON YOUR table some day.

Considered a lowly fish by most sportsmen and commercial fishermen, the Pacific hake, plentiful off the Pacific coast, represents a large resource.

The recent development of an efficient midwater trawl makes landing hake economically attractive.

The large number of fish in relatively uniform sizes enhances the possibility of mechanized filleting.

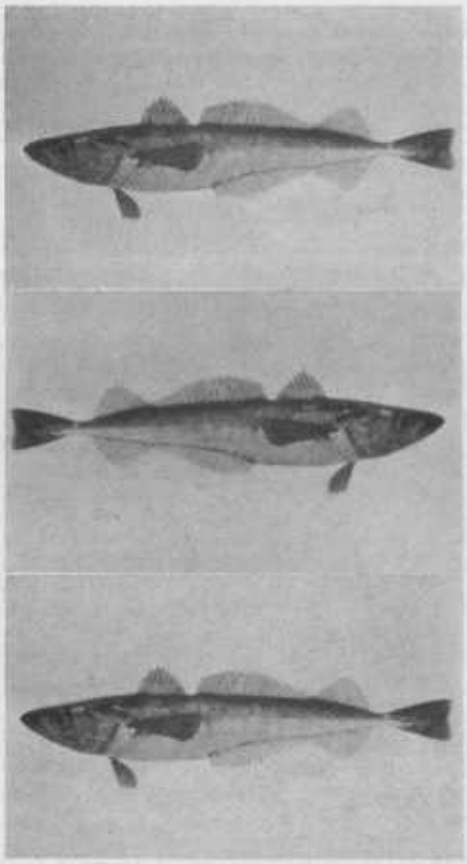
Hake for human food, particularly in frozen blocks, could provide a large market for the under-utilized species.

The big question: How about acceptance?

To answer it, David L. Crawford, director of the Seafoods Laboratory at Astoria, and a team tested hake and samples of ling cod, true cod, ocean perch, and flag rockfish on taste panel judges (staff members and graduate students of the Department of Food Science and Technology).

Also tested for taste acceptance was coarse ground hake from a skinning and deboning machine.

Texture, juiciness, degree of off-flavor and desirability were measured.



Equal to ling cod

In comparison with the species now utilized commercially, the Pacific hake was scored as satisfactory by the panel and two samples were judged equal to ling cod and ocean perch. However, hake scored lower over-all than ling cod, true cod, ocean perch, and flag rockfish.

Portions prepared from ground hake generally received lower scores than portions prepared from blocks of intact fish. So did the other species samples.

Machines up yield

However, panel scores for ground portions were good—and highly acceptable for all species evaluated except two sole species with skin separation problems. Desirability and degree of off-flavor of fish portions prepared from ground portions were judged to be equal for all species evaluated.

The degree of acceptance of ground fish portions was high enough to indicate they could have good consumer acceptance. Deboning and skinning machines, which produce the ground fish, can increase flesh production up to 101 per cent over hand filleting.

In taste tests, portions prepared from fillets contained slightly higher levels of moisture and significantly lower fat content than portions of ground fish. Exceptions were Dover sole and true cod.

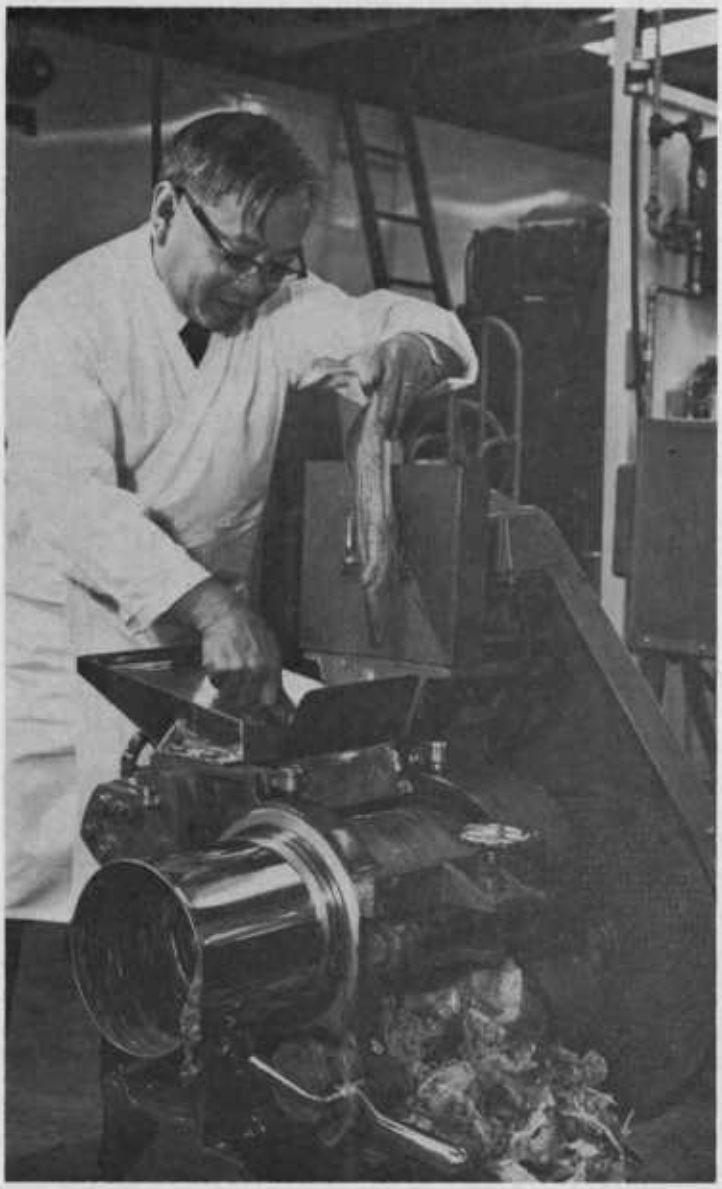
The Seafoods Laboratory, seeking a better way to use fillet waste from bottom food fish—sole, cod, ling cod, and rockfishes now used for mink and pet food and crab bait—found that deboning and skinning lower the ash content, improve protein quality, and yield a more favorable mineral composition which adds up to considerable nutritional upgrading of carcass scrap.

The team's research indicates greater marketing opportunities are waiting.

Pacific hake's acceptance as food, increased yield of several under-utilized species by using machine deboning and skinning, and the fact that portions of ground fish apparently will be accepted by consumers could open the kitchen door for a number of fish.

Hake, anyone?

A large number of fish in relatively uniform sizes enhances the possibility of mechanized filleting



Deboning machines add efficiency and nutrition to carcass scrap from bottom food fish for varied uses.

OSU Sea Grant Photo

Friend, Robert L. Goulding

For pet animals, a new leash on life

In 1963, OSU scientist Robert L. Goulding and a team taped a fly strip (the kind hung from the ceiling and called spaghetti) around a dog collar... it released chemicals which killed fleas

A DOG'S BEST FRIEND—AND A CAT'S, too?

It may well be OSU entomologist Robert L. Goulding. Because of him, many of the nation's 25 million dogs and 30 million cats are free from fleas and ticks.

They wear a plastic collar imbedded with Vapona, an organophosphate insecticide, usually effective for three months. Since 1964, when the "flea collar" was made available to the public, more than 70 million have been used on dogs and cats.

Goulding did the initial work at OSU in developing the use of a plastic formulation as a collar pest control system and much of the work leading to its registration.

First, a fly strip

In 1963, he and his team of scientists took a fly strip (the kind hung from the ceiling and called spaghetti) and taped it around a dog collar. The spaghetti strip released chemicals which killed fleas. The bigger the strip, the bigger the chemical output.

Working with dogs and then cats, Goulding found the system currently available unsatisfactory because the chemical release rate was too high. After determining the efficiency and limits of safety—vital because release of the chemicals depends on temperature of the animal and the air—the team established a safe concentration in plastic for Vapona, a vinylphosphorus pesticide which breaks down rapidly.

Today the collars are made of polyvinyl chloride resin with Vapona mixed in during formulation of the plastic. The material is extruded or injection molded as a strip.

The collar releases Vapona at a fairly regular rate. It is picked up in the animal's hair coat in the vicinity of the collar, and since fleas and other body insects move a great deal they are continually exposed. The insecticide also is distributed by the collar rubbing against the animal's body.

Lice affected, too

The insecticide affects the nervous system of fleas and ticks and kills them. The flea population drops sharply in the first 24 hours. There also is a marked effect against lice, usually not a major pet problem.

Collars for cats are similar, with potency of the insecticide release halved. But it works the same.

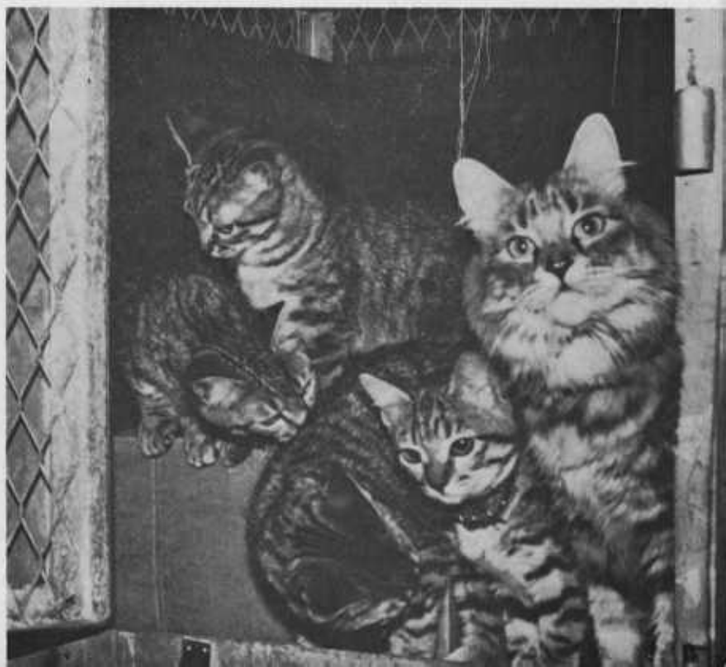
The research team has developed a mathematical model to provide a pesticide resin formulation for a particular release rate which could vary from animal or climate. It could be used for both pesticides and attractants, the latter to draw the housefly, cockroach, fruitfly, yellow jacket, termite, and other pests to traps where pesticides could be used, another safeguard for humans since it helps control the amount of chemicals released in the air.

Goulding and other scientists are finding out more about attractants and how to use them, but there is no product like the flea collar yet on the market for humans. However, in the Southwest United States, scientists are working on ankle strips which would protect against a tiny red scourge, the mighty chigger.

Goulding is continuing work to broaden the use of pesticides and attractants in plastic. The target—agricultural, industrial, and structural pests. In addition to his team of scientists, he has several other helpers—laboratory dogs and cats who test collars with new shapes and capabilities.

There also is a unique maternity section on campus. In a small room, its temperature and moisture carefully controlled, a vital link in Goulding's research is produced.

The room hatches fleas.



Cats, too, wear some of the 70 million 'flea collars' sold since 1964 to protect them from fleas and other pests.

Fertilizer makes hay --with help

SPRING FORECAST FOR EASTERN Oregon: Wet. Good.

Heavy snow accumulation is expected to flood the native meadows—whose hay keys the area's beef cattle operation—for longer periods and with more water than usual. Ranchers have been using the natural system of irrigation for years, waiting for the water to run off so their hay crops can get underway.

The water determines the ratio of vegetative composition of the meadows—basically rushes, sedges, and grasses. Without fertilization, the meadows average about a ton of harvested hay.

Extra ton added

Hay yields usually can be increased by adding nitrogen fertilizer. On an average, 80 to 100 pounds of nitrogen per acre produces an additional ton of hay at a cost of less than $10 an acre.

Squaw Butte Experiment Station studies over several years show ammonium nitrate, urea, and anhydrous ammonia can be used with equal success.

Ammonium sulphate is recommended when sulphur might be limiting, but otherwise the choice of nitrogen source should be based on the applied cost per pound of available nitrogen.

Station Superintendent R. J. Raleigh recommends that nitrogen be applied in the spring to avoid leaching. Some experiments show slightly higher yields over fall application, and by spring the availability of irrigation water can be more accurately determined.

Quality not improved

Quality of the meadow hay is not appreciably improved by nitrogen fertilization. It has some effect on the botanical composition, and the year the nitrogen is applied there will be an increased grass content. But if nitrogen fertilization is not continued on a yearly basis, meadows revert to the same balance of grass, rushes, and sedges.

The nitrogen content of hay is not necessarily increased with nitrogen fertilization unless the hay is harvested at an immature stage of growth which usually means a reduced yield.

Nitrogen (crude protein) content of meadow hay forages starts out high in the spring and drops with maturity. By July 1, they contain about 9 per cent crude protein and shortly reach a peak in total dry matter production and total protein or nitrogen production. This is the time to harvest.

Low in phosphorus

If it is delayed, crude protein content drops about 1 per cent a week. The energy quality drops accordingly.

Most meadow soils test low in phosphorus, but applying it will usually not increase yield under wet meadow conditions. If meadows contain appreciable quantities of clover, they may respond to phosphorus with an increase in yield and an increase in the quality of the forage.

Phosphorus fertilization does increase the phosphorus content of hay. However, it is impractical to fertilize with phosphorus just to increase the phosphorus content of the hay for animal utilization. To justify its cost, there must be a simultaneous increase in yield and quality as measured by other nutrients.

Phosphorus can better be supplied directly to the livestock as a supplement rather than using phosphorus fertilization on the hay merely to meet the animal requirement for phosphorus.

Two major assets

Station studies show there are no other elements which seem to limit production of grass. Adding iron, copper, manganese, zinc, or boron was found to have no significant effect on hay yields in the Experiment Station area.

Fertilization has two major assets. It gives the rancher an alternative to acquiring additional land to get increased forage. It also adds an element of control in producing hay for beef cattle, something missing this spring as the rancher waits to see how much water the mountain snows send.

Fertilization gives the rancher an alternative to acquiring additional land to get increased forage

A matter of pull:

Pill to replace sheep shearing?

Most wool comes off easily and if pulled 10 days after treatment leaves animal bare, one of the drawbacks.

SHEEP SHEARING MAY BE ON THE way out.

Replaced by a pill.

Two weeks after getting a dose of CPA (cyclophosphamide), a sheep is ready to be defleeced. The wool pulls off with ease and without any shearing.

Wool quality is better because short fibers from second cuts with shearing instruments are eliminated.

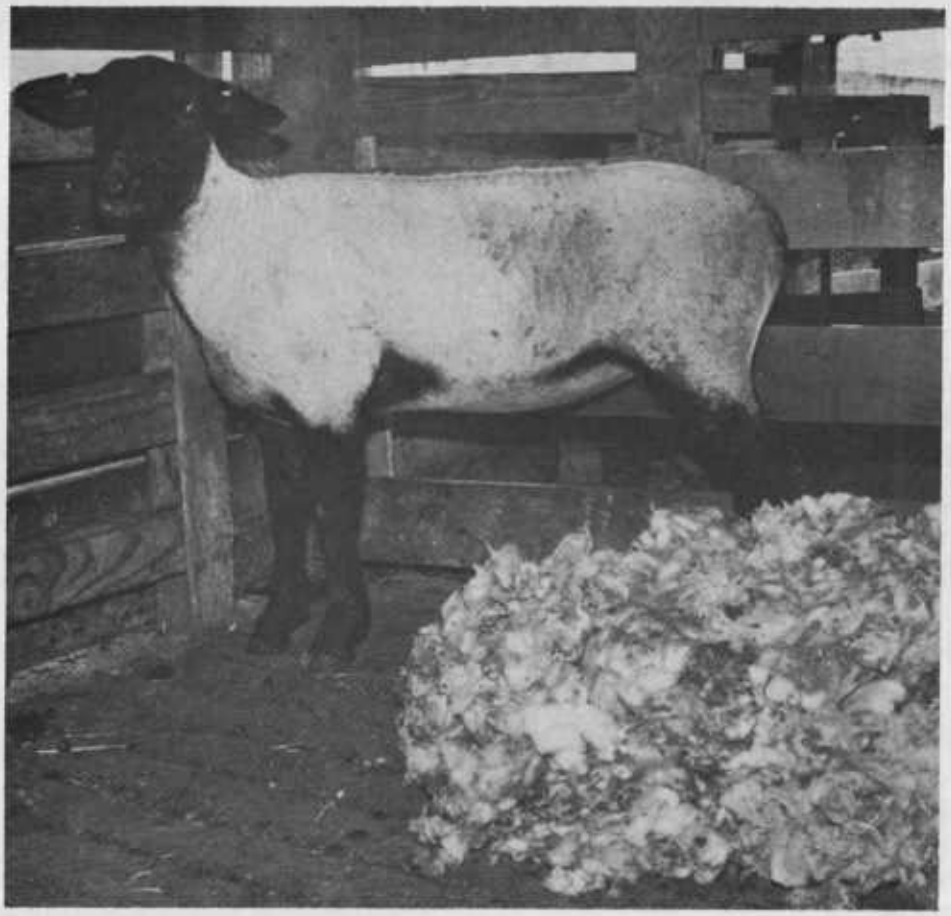
Some drawbacks

There are some drawbacks to CPA but its use, now experimental, sounds promising, particularly for owners of small flocks who have trouble finding sheep shearers or cannot afford them, said animal scientist William D. Hohenboken.

He is conducting the only experimental studies in Oregon to find out how practical CPA can be.

First used as a possible drug for leukemia, bone marrow cancer, CPA in large doses caused patients to lose all their hair. USDA scientists at Beltsville, Md., wondered if it would work on sheep wool. They tried it. It did.

In little pockets under the skin surface where wool fibers grow in a follicle, cells divide and wool is pushed out



A few minutes later, ewe looks surprised to find herself facing a chilly spring without a coat.

toward the skin surface as it grows.

CPA temporarily stops cell division, causing a constriction in the wool fiber. When the constriction reaches the skin surface, the fleece can be pulled off by hand, pretty much in one piece.

Cell division stopped

The time for defleecing after the animal takes the pill varies and depends on how well the animal is fed, how fast the wool is growing, and size of the dosage. Usually on a high dosage (25 milligrams per kilo of body weight), the wool can be pulled in about 10 days.

USDA scientists at Beltsville, experimenting with CPA since June, 1968, found no differences in giving the chemical by intravenous injection or oral drench. Last year, their studies showed that four ewes treated in the latter third of pregnancy lambed without complication. The lambs were normal and so was their wool development.

At OSU, Hohenboken is working to determine dosing conditions to provide ideal constriction of the wool fiber and to identify additional operational problems and side effects, if any.

Trials are being conducted on 130 sheep.

There are drawbacks to CPA, Hohenboken points out. Unlike shearing which leaves a light cover on the animal, the wool pull, if done 10 days after treatment, leaves the animal bare, presenting an exposure problem until wool grows back.

Animal left bare

Variability between sheep as to when they can be defleeced after dosing is a major problem. So is the variability on when different parts of the same fleece are ready for pulling. Since britch, head and belly hold wool longer, they could mean a second handling.

However, the drawbacks do not seem insoluble and Hohenboken and scientists in other states are expected to come up with more precise answers on dosage of CPA and its full effects as a chemical company seeks its clearance by the Federal Food and Drug Administration.

research briefs

Misuse of herbicides can cause damage blamed on disease

MISUSE OF HERBICIDES CAN INJURE. During 1970 about half the vegetable "disease" specimens received by the OSU Plant Clinic or brought to the attention of the Department of Plant Pathology by growers, fieldmen, and County Extension Agents were diagnosed as herbicide injury.

Herbicides stay in soil

Almost none resulted from proper use of chemicals on the affected crop.

More than half apparently were caused by herbicides which persisted too long in the soil after being properly applied on a previous crop. Some injuries were caused by inadvertent use of the wrong chemical or use of the right chemical but at too high a rate. Others were caused by the drift of herbicides applied by the grower or by someone else on a different crop and frequently at some distance from the affected crop.

Vegetable crops are sensitive to injury by certain herbicides and many injuries can be diagnosed by the grower himself, points out Edward K. Vaughan, OSU plant pathologist. He said that whenever a considerable number of plants in a field fail to grow or grow abnormally, one of the first questions the grower should ask himself is "What herbicides have been applied on this field in the last 2 or 3 years?"

If he cannot account for the injury in this manner, particularly if the plants

Numbered cherries pitted against shaker in census count

Rhododendron (left) shows growth controlled by chemical

are twisted or malformed, he should consider carefully what he (or his neighbor) has applied on other crops, fence rows, driveways.

If the grower cannot account for the injury from any of these sources, he might then consider the possibility that the crop is affected by disease, said Vaughan.

Cherry tree census stems from research on crop harvesters

HOW MANY CHERRIES ON A HEALTHY tree?

Agricultural Engineer Don Backus knows. He counted them, marked each cherry, and later profiled the tree's crop on a map.

His goal: To find out how to best prune a cherry tree for mechanical harvesting. Mechanical shaker harvesters are used successfully in states where cherries are produced for canning and the presence of stems is discouraged.

Keeping stems important

But the major portion of Oregon's crop is used for cocktail cherries and the stems are required. Since the mechanical harvester appeared significantly on the commercial cherry scene in Oregon three years ago, problems of stemlessness and physical injury have caused alarm among processors and growers.

The Agricultural Engineering Department study in 1970 centered on finding the effect of location and resulting action on quality of mechanically harvested fruit. Each cherry on selected limbs was marked with a nylon-tip pen for identification. Large-scale maps of five trees were drawn on butcher paper and the location of all cherries marked on the maps. Four shakers were used. They either shake trunks or limbs with big cushioned jaws.

Film records action

During harvest, a movie camera recorded the action of limbs. The pictures were studied to determine the space and time limits or vibration characteristics of limbs and cherries.

After Oregon's cherries are shaken from the tree, they are immediately placed in brine for preservation. Cherries in the study were evaluated for damage and presence of stems after brining three weeks.

Results were presented graphically on the tree maps so areas could be observed for damage, stems and fruit remaining on the tree. The maps were then photographed and prints used to identify specific limbs and cherry clumps in the motion pictures. Action was correlated with cherry quality.

Shaking action affected

The study indicates that limbs which contact the catching frame—a supported canvas which cushions fall of cherries and funnels them onto a conveyor to the brining bin—do not shake well.

Slender limbs heavily loaded at the ends droop and shaking action is not effective. Backus also found that orientation of limbs to direction of shaking action is important to efficiency.

As part of the study this year, Backus will work on frequencies of shaking and amplitudes (limit of shake), using tree maps again.

Limb count

And how many cherries are there on a tree?

Royal Anne and Corum trees studied by Backus were 10 to 60 years old. Their cherry count ran from 1,000 to 1,500 per limb.

Rhododendrons going to pot--for beauty that's portable

OREGON'S RHODODENDRONS, NOTED for their beauty, are developing a new characteristic.

They're becoming portable.

Horticulturist Robert L. Ticknor used chemicals to control varieties at the North Willamette Experiment Station. A more compact size and more flower buds means the plants can live in containers, spending part of the winter inside to add color where needed.

Plants ready all year

Nationally, horticulturists are studying container plants because of the growing demand for land. Chemical controls make container plants possible and make them available all year to the general buying public. Slow release fertilizers and soil-less media are being refined.

Ticknor used Cycocel (2 chloroethyltrimethyl ammonium chloride) in 4000 parts per million to spray Sappho rhododendron in 1969 and 1970. Average measurements this spring were 12.2 inches tall and 18.9 inches wide. Control plants were 23.4 inches tall and 23.3 inches wide.

Controls did not bud

Fifty per cent of the plants sprayed with Cycocel were budded with an average of 2.7 flower buds per plant. The controls had one flower bud on one of 16 plants.

In lesser amounts, Cycocel increased flower bud formation in Elizabeth Hobbie, Pink Pearl, and White Pearl with only a slight reduction in growth. Roseum Elegans responded in this 3-year field trial with more compact growth but a slight reduction in flowering.

(*continued from page 3*)

laboratory in the United States working on cold-loving marine bacteria.

Two of Morita's students, Paul A. Gillespie, a postdoctoral research associate, and graduate student Larry P. Jones, returned February 1 from a 61-day expedition to the Antarctic aboard the USNS Eltanin, Naval research vessel.

Various depths sampled

From Fremantle, Australia, the Eltanin sailed due south to the ice shelf and then turned west, taking stations (stopping for biological sampling) on the way. It was the Antarctic summer, the only time when the massive ice shelf breaks up and recedes far enough to allow a ship to penetrate. Air and surface water temperatures remained fairly constant in the vicinity of the pack ice, about 30° Fahrenheit.

Under the constant Antarctic sun, which never dipped below the horizon, Gillespie and Jones took samples from various depths, the deepest at the ocean's floor, nearly two and a half miles beneath the surface.

As the Eltanin nudged its way through the melting pack ice to within 30 miles of the Antarctic Circle, the team was compiling data to answer their questions.

The bacteria, they found, were there in abundance and the cold temperatures did not seem to diminish their rate of nutrient regeneration. By using radioactive tracers it was shown that the mineralization and assimilation of organic materials were quite significant.

Using knowledge and techniques gained partly during a three-year study of bacterial nutrient regeneration in Klamath Lake, the team became the first to attempt such a study in the Antarctic. The installation of a scintillation counter (to measure radioactivity) aboard the ship made possible precise measurement of the assimilation and respiration of the bacterial population.

During the expedition, Gillespie and Jones cultured 48 bacterial isolates, maintaining them at low temperatures to prevent their destruction. The bacteria, hand carried back to OSU in ice chests, are being classified and studied for their unique abilities to function at low temperatures.

This fall, two more young scientists will leave OSU for a second expedition to the Antarctic, this time to determine the extent of bacterial activity in the Ross Sea area, both in water and sediments.

In Oregon, Morita and his associates will continue studies at Klamath Lake, seeking to better characterize the bacterial contributions to the process of eutrophication (the natural cycle of nutrient enrichment of a lake).

Research being conducted at Klamath Lake, a naturally eutrophic lake, includes a study of the number and types of bacteria present, the role of bacteria in the cycling of phosphate, the role of vitamin B_{12}, and the rate of bacterial mineralization of organic materials.

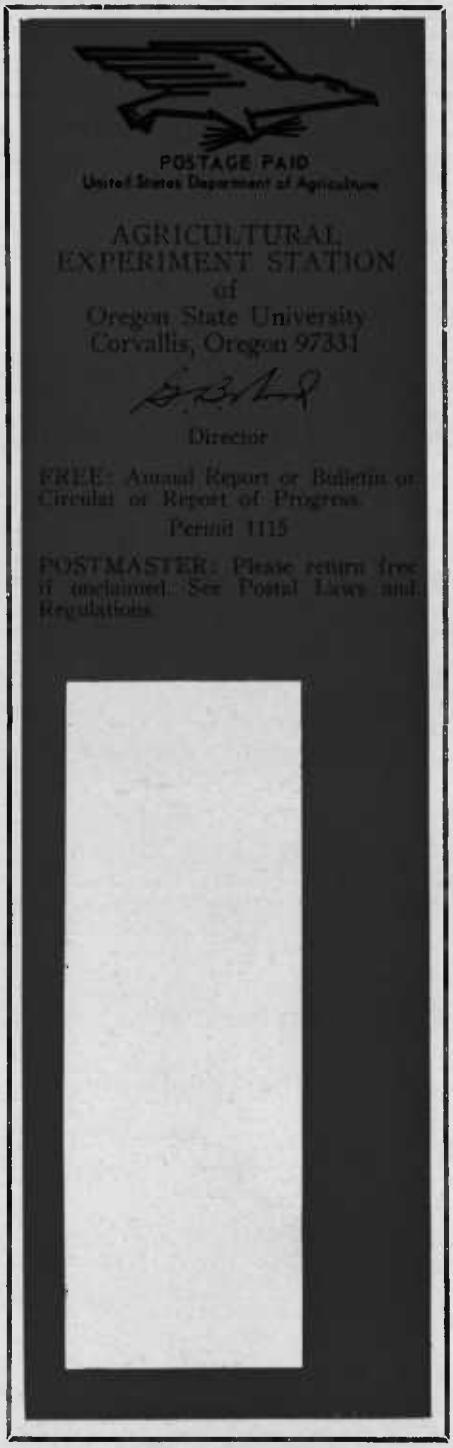
Klamath studies go on

In studying the relationship of microbial activity in water and sediment to the eutrophication processes of Klamath Lake, Morita will try to establish general concepts about the eutrophication process in more concrete terms.

He is hopeful that the knowledge gained will be useful in controlling the cultural (man-induced) acceleration of this process which threatens the nation's water resources.

For basic knowledge concerning a natural situation is the prerequisite to understanding the reasons why cultural eutrophication usually leads to the establishment of systems that are undesirable—economically, esthetically, and ecologically.

"...useful in controlling... acceleration of this process which threatens . . . water resources."



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