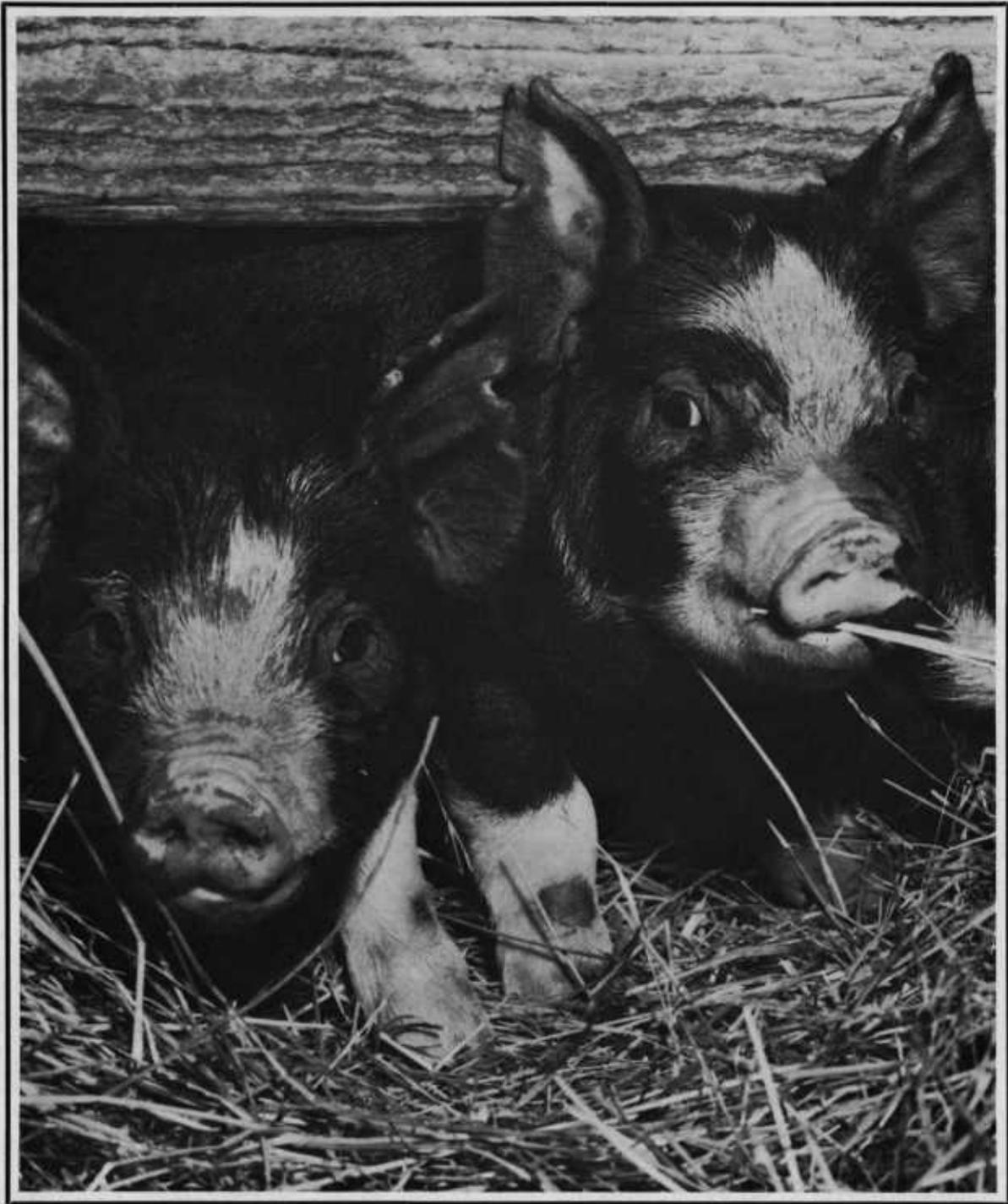


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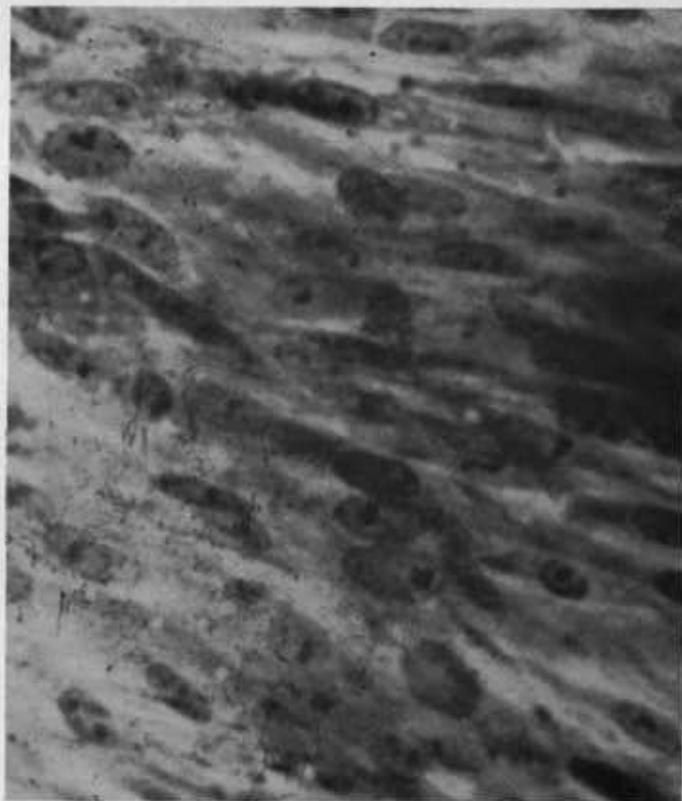
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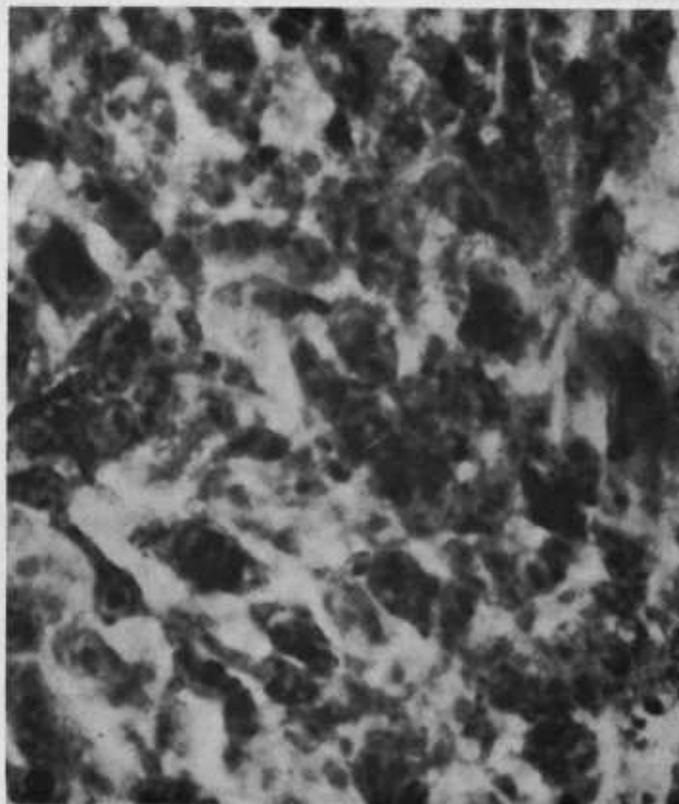
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COVER: OSU researchers have developed several management practices for increasing survival of baby pigs like these Berkshires. Story on page 8.



Potency of a virus' effect on cells is shown in normal cells from chicken (above) and transformed cells (below). Normal cells are long, spindle shaped and in a uniform pattern. Cells transformed by a virus in culture have lost their contact inhibition and have piled up in disorder.



Cancer

Agricultural biochemists study virus-induced leukemia in chicks, seeking answers to what makes cells malignant--an age-old problem of man

IN CANCER RESEARCH THE BIG QUESTION remains: Is human cancer caused by virus?

Because most animal leukemias and tumors are caused by virus, a major part of the research of OSU agricultural biochemist George S. Beaudreau and his staff has been devoted to studying virus-induced leukemia in chicks and the transformation of cells in tissue culture from normal cells to malignant cells by virus.

Until recently, it was believed that a

virus contained either deoxyribonucleic acid (DNA) molecules or ribonucleic acid (RNA) molecules—the genetic material in all living things—held together by a coat of protein.

Research in Prague

In Prague last year, Beaudreau, working with Josef Riman, observed DNA in an RNA-tumor virus, essentially the leukemia virus. Other laboratories including those of Baylor's M. Benyesh Melnick and San Francisco's

W. Levinson also have found DNA in RNA-tumor viruses.

Beaudreau and his staff, trying to pin down the properties of DNA in virus particles, hope to shed light on the function of these molecules which may transform benign cells into malignant ones.

They found the virus that causes leukemia in chicks has both DNA and RNA. Potentially both these molecules can carry instructions for the normal cell to change to a malignant cell. Studying physical and biological properties of these molecules, the researchers are trying to relate these characteristics to information accumulated on similar molecules in normal cells by many scientists working on life processes of cells.

Besides RNA and DNA, the OSU scientists have found tumor-causing viruses contain a special RNA that is concerned, in the normal cell, with the process of translating genetic information of the cell. They are also studying an enzyme—DNA polymerase—contained in the tumor virus that may be the key molecule for introducing new viral instructions into the cell because the enzyme can transcribe RNA instructions into DNA.

The cell, a factory

DNA (deoxyribonucleic acid), a molecule housed in the cell's nucleus, looks like a tiny frayed thread and is a complex arrangement of chemicals. It is the cell's manager, designing products, dictating how they are to be manufactured and when delivered.

Manufactured by DNA, *RNA (ribonucleic acid)* gets genetic information into use by passing out of the nucleus into the cytoplasm. Wrapping itself around another molecule, RNA becomes a mold to align amino acids for welding into proteins. From many pro-

teins are built the cytoplasm and membranes of other cells and chemicals which regulate cell functions.

Enzymes, one of the most important classes of proteins, control virtually all actions within the cell and apparently play the key role in determining what part of the body a cell becomes—bone, blood, vessel, nerve.

In brief, DNA makes RNA which makes enzymes which organize the cells and protein production.

(Continued on page 16)



SANITIZER: An alternative to field burning

AFTER JAN. 1, 1975—WHEN OPEN field burning is scheduled to be banned in Oregon—what will grass seed growers do?

Important to the economy of the Willamette Valley, an estimated 1,000 to 1,500 farms generate \$24 million from grass seed production, 18 percent of the region's crop income. Seed processing and sales add \$3.7 million.

Growers have several alternatives, a study by OSU agricultural economist Frank S. Conklin shows: other crops, soil incorporation of residues for annual ryegrass, mobile field sanitizer, mechanical removal of residues, livestock alternatives.

Prospects bright for sanitizer

Economically, the mobile field sanitizer appears to have the brightest prospects. It becomes a particularly attractive choice with annual ryegrass, orchard grass and perennial ryegrass, all having high residues and low returns per acre.

But Conklin points out that the sanitizer cannot be viewed as a practical operational choice for several years because commercially available production units have not been developed although several companies appear interested. OSU agricultural engineers, testing a second experimental model this summer, are still making modifications.

The problem of grass seed growers is novel. In the past, nearly all farm cultural practices died only because of market forces. Practices which did the job more efficiently at lower costs simply were substituted.

Until recently, field burning substitutes were not considered because they were more expensive than open field burning which removed residue and sanitized for disease control and better yield for \$1 to \$2 an acre. The issue of field burning extends beyond the realm of the market place. The negative effects of smoke emission, a contributor to air pollution, are not automatically priced by the market system.

Land reclamation costly

Few field crops will tolerate wetland conditions on the Valley's "whiteland" soils without land reclamation. These include pasture for livestock, spring sown oats, alsike clover and vetch. Historically, grass production has held a comparative advantage or profit margin over these crops. Limiting factors in choosing these crop alternatives are cultural practice difficulties and markets.

Intensive crops such as sweet corn and bush beans can be grown on "whiteland" soils when reclaimed by drainage and summer irrigation for an investment of \$310 to \$620 per acre. However, contracts provide the only access to market for these crops. Large stocks of these frozen vegetables and availability of considerable acreage of other soils now growing less intensive crops preclude short-run prospects for widespread "whiteland" reclamation. The prospect of limited ground water supplies casts doubt upon expanding wells for summer irrigation, another factor.

Soil incorporation of residue, technically feasible only for annual ryegrass, has not been used because of high cost and because the high water table of "whiteland" soils restricts bacterial action necessary for soil decomposition. Exclusive of unknown costs on herbicide control and unknown yield effects, an annual plowdown program is estimated to increase annual costs on annual ryegrass \$21 to \$26 per acre.

Residue removal expensive

Technically feasible, mechanical removal of grass residue (1.5 to 6 tons an acre) is expensive unless the residue itself commands a satisfactory market price. Today, no active market exists for grass residue.

The cheapest way to remove it from the field involves bunch and field bucking (estimated \$9 to \$16 an acre) or using a stack former and mover (\$11 to \$25 an acre). The cost range, de-

termined by residue yield per acre and machine use, includes an \$8 an acre charge for field sanitation.

As part of the removal process, chopper-blower, baling or field cubing—all involving densification of residue and hauling—must be considered high cost operations. The range is from \$16 to \$68 an acre, depending upon residue yield and machine use levels, and include the field sanitation charge. They become practical only if a positive market exists for the residue.

Experiment Station scientists are trying to find out if an economically feasible means can be developed to break down the undigestible cellulose and lignin content of residues to provide a livestock feed. They also are looking for ways to determine the technical and economic prospects for using grass residues as a wood-grass blend in both domestic and international paper-making markets.

Livestock create pollution

Livestock appears to offer no general solution for grass growers in the Valley. While eliminating smoke emission problems, the animals ability to create pollution problems of their own plus a change in management requirements, labor, machine use and price risks add up to negative components for profits. In some cases, returns from livestock have been equal or superior to grass production but high price risks and high capital investments were also encountered.

Although no commercial units of the mobile field sanitizer are available, current data, Conklin said, indicate that the cost may run from \$10,000 to \$14,000 for the machine which will be able to burn all residue or burn grass stubble after most of the residue is removed mechanically.

At this price, custom rates for use of the sanitizer might range from \$5 to \$10 an acre, thus providing the lowest cost choice of the alternatives now available for open field burning, assuming technical difficulties in use of the sanitizer are solved.

Fish, too, get an oral vaccine

WHEN ODDS ARE TEN TO ONE AGAINST survival you need all the friends you can get.

Pacific salmon and steelhead trout in saltwater rearing impoundments on the Oregon coast may have found such a friend. He is OSU microbiologist John L. Fryer who is developing an oral vaccine to protect disease-plagued fish in the experimental rearing efforts.

Successful rearing of the fish in the brackish water of inlets and sloughs along the coast could mark the beginning of a new industry for Oregon. In addition to supplementing fresh water hatcheries, it might be possible to commercially rear and harvest the fish without ever releasing them. Such a venture is currently being undertaken in Puget Sound where coho salmon are being pen reared and marketed for the restaurant trade.

Young fish killed

Efforts at saltwater rearing in Oregon, however, have met with high mortality rates among the stock fish. The villain is the bacterium *Vibrio anguillarum*, an infectious disease that attacks and kills up to 90 percent of the young fish, often within 20 days following their release into brackish water. The disease creates large hemorrhagic lesions on the sides of the fish.

Fryer has been working on a vaccine that would immunize fish to the disease. After running several tests he has been able to effectively eliminate the mortality rate from vibriosis when working with small groups of fish under laboratory conditions. This is the first fish vaccine tested by Fryer that has proven successful. He is also developing vaccines for calumnaris and frunculosis which are also diseases that attack fish.

The vibriosis vaccine is produced by culturing vibrio cells and cracking them with high frequency sound. They are then dried and ground into a powder that is placed into the diet of the fish.

Several different diets have been used to administer the vaccine, including the commonly used Oregon moist pellet diet developed at OSU.

Initial experiment with the vaccine involved subjecting 200 chinook salmon to a diet designed to allow each fish to consume approximately 300 micrograms of the vaccine over a 14-day period. Twenty days after the vaccination period the fish were transferred from the OSU Fish Disease Laboratory to the Lint Slough salt water rearing facility near Waldport.

Mortality rate among the vaccinated fish was 45 percent, compared to a 98 percent mortality rate among a control group which did not receive the vaccine. A later experiment effectively reduced this mortality rate to zero by giving a group of salmon the vaccine in a concentration of 1,000 micrograms per fish over a 28-day period.

The biggest variable in administering the vaccine seemed to be the number of days it was included in the diet. The 28-day feeding provided more opportunity for each fish to consume at least a minimum dosage of the vaccine required for immunization than did the 14-day feeding period.

Work is currently progressing on attempts to duplicate the experimental success on a production basis. Best results so far have been to reduce the mortality rate to 55 percent, which represents a substantial improvement over the situation existing prior to development of the vaccine.

Feeding period important

The biggest problem involved in making the transition from an experimental to a production basis involves administering the vaccine to large masses of fish in a manner that will allow them to consume relatively equal amounts of the immunizing vaccine.

Effective immunization can be obtained by injecting the fish with the vaccine, but this method is not practical with large numbers of fish.

Mint disease licked

THE MEN BEHIND YOUR CHEWING GUM have licked a sticky problem.

Verticillium wilt, a disease that has kept the mint industry on the move for 50 years, has been dealt a death blow with this year's release of a wilt-resistant variety.

Until recent years, the only way to evade the wilt disease was to leave infected fields and move to areas not yet exposed to the disease. Wilt appeared in Oregon's mint in 1951. During the next 10 years, approximately 12,000 acres of mint in the Willamette Valley, one of the nation's top producing areas, had to be removed from production.

Plants die gradually

Early stages of wilt curl and redden upper leaves on the mint plant and stunt its growth. As the disease progresses, it begins killing leaves at the bottom of the plant and gradually works up to the top. The process takes about four weeks. It is most prevalent just before harvest.

Seriousness of the situation led to a cooperative arrangement between industry and public institutions, including Oregon State University and Washington State University in the Pacific Northwest. Wilt-resistant strains developed by A.M. Todd Co., a major mint dealer, were field tested by the two universities.

Millions of plants tested

Plant pathologist C. E. Horner, in charge of the OSU field testing, said development of the new variety involved testing approximately six million plants representing 58,000 varieties.

Horner also tackled the wilt problem from another angle by experimenting with cultural practices that would reduce incidence of the disease. The most effective practice discovered was post harvest flammage that killed the verticillium spores without harming the rootstock. Annual losses were reduced as much as 50 percent to an average of five percent.



Willamette Valley farmer harvests mint near Junction City.

Use of the new wilt-resistant variety combined with flammage is expected to reduce the wilt losses to less than one percent, Horner said.

More than one-third of the nation's mint is produced in Oregon, representing a nine million dollar industry. Most of Oregon's production is peppermint oil. Madras and the Willamette Valley are the state's two major growing areas.

Largest users of mint oil are the chewing gum, toothpaste and mouthwash, and candy industries respectively. The candy industry is a relatively small user when compared to the two largest ones.

Exports also play an important role. About 28 percent of U.S. produced mint oil is exported. England, Japan, Canada, Australia and New Zealand are among the biggest customers.

Flavor critical

Since success of most products using mint oil is directly related to their taste, dealers are extremely quality conscious regarding flavor characteristics of the oil. Reproducing the acceptable flavor of the commonly used Mitcham variety was one of the biggest handicaps that had to be overcome in developing the wilt-resistant variety.

Oil in the mint plant is contained in small glands under the leaves.

Once the plant has been cut, partially dried and chopped, the oil is distilled by subjecting the leaves to pressurized steam. This changes the oil into gas form. The steam and oil vapor are then condensed and separated.

Average yield is 68 pounds of oil per acre. Normal storage for the oil is in 400-pound, 50-gallon drums. Each drum is worth from \$1,500 to \$3,000, depending on market conditions.

Survival - key to profit in pig litters

THERE IS MORE THAN ONE WAY TO save a baby pig.

OSU research has shown that under-sized newborn pigs can be an important part of the profit picture and that their performance, though somewhat delayed, is as good as larger littermates once they reach about eight pounds in weight. From this weight they grow as fast and produce carcasses equal to that of heavier littermates when they reach market weight at a slightly older age.

However, smaller pigs—particularly those weighing two pounds or less at birth—have a lower survival rate in the first week of life than their larger littermates.

OSU animal scientist Dave England has approached the survival problem by seeking ways to decrease the percentage of runty pigs at birth and by ex-

amining the influence of various natural birth conditions on survival of small pigs.

Chemical increases birthweight

Three years of research involving approximately 200 litters show that birthweight can be consistently increased by mixing dichlorvos, a worming chemical, with the diet of pregnant sows and gilts.

The experiment involved giving sows and gilts 800 milligrams of dichlorvos daily from the ninety-first day of gestation to farrowing. This dosage amounts to about 17 grams per head, or less than one twenty-sixth of a pound, for the total period.

Birthweight of baby pigs from dams receiving dichlorvos for the first time was one-fifth to one-fourth of a pound

higher than that of baby pigs from the control group not receiving dichlorvos.

Only eight percent of the pigs born in the treated group weighed two pounds or less, compared to 18 percent in the control group. In all weight categories above 2.5 pounds, baby pigs in the treated group outnumbered the control group.

Baby pigs from the dichlorvos-fed group also had a higher survival rate in all weight categories except one where the two groups were equal. Survival in the treated group averaged 7.5 percent higher than in the control group.

Strength and vigor improved

Sows receiving dichlorvos in their diet in succeeding gestation periods did not have an increase in litter birthweight. Their litters still had a 5.6 percent increase in survival, indicating that strength and vigor of the baby pigs was improved by treatment of the pregnant sows with dichlorvos.

Two conclusions can be drawn from the dichlorvos experiments. Feeding dichlorvos reduces the percentage of pigs in the low birthweight portion of the litter and increases the percentage in the high birthweight portion. Secondly, dichlorvos increases the capacity of baby pigs to survive regardless of birthweight.

Dichlorvos could open a new avenue for improvement of survival of baby pigs with a non-nutritive product, England said. However, dichlorvos is currently approved by the Federal Food and Drug Administration for use in swine only as a worm medication. It cannot presently be used commercially

Variation in birth size is evident in these one-day-old pigs from the same 12-pig litter born to a gilt.



as a feed additive for increasing birthweight.

Natural factors examined

In other experiments, the OSU researchers looked at the influence of several naturally occurring factors on baby pig survival. Among these were the relationships between percentage survival and number in litter, total farrowing time and length of time between births of individual pigs.

Results in the latter two areas provide only slight indication that longer farrowing time or a longer period between birth of individual pigs causes a decrease in survival rate.

Data on the relationship between litter size and survival discounts the commonly held philosophy that nine "good pigs" are better than 12 "little pigs." Percentage of survival varied little between large and small litter sizes. Large litters produced more small pigs at

birth; even more important, they also produced more large ones.

The number of pigs weaned per litter increased consistently with the number of pigs born alive per litter. (See table.)

Survival means profit

The economic advantage of increasing percent survival is easily deduced. Rule-of-thumb estimates are that six pigs weaned per litter pay costs. Average pigs weaned per litter is about eight; this provides two pigs for profit. An increase of one pig per litter weaned thus provides essentially three pigs for profit—an increase of 50 percent even though total production was increased by only 12½ percent. This increase in efficiency can permit continued production instead of economic failure in bad years, and increases overall supply of pork in all years with consequent advantages to consumers that result from plentiful supply.

Litter Size: Weight and Survival

Litter size	Av. birth weight (lbs.)	Av. no./litter 2 lbs. or less	Av. no./litter above 2 lbs.	Av. no. weaned/litter
1	3.35	0	1	1
2	3.39	0	2	1
3	3.25	0	3	2.4
4	3.31	.17	3.83	3.4
5	2.94	.65	4.35	4.6
6	2.99	.56	5.44	5.0
7	2.86	.78	6.22	6.1
8	2.87	.80	7.20	6.9
9	2.82	1.04	7.96	7.3
10	2.78	1.42	8.58	8.4
11	2.78	1.44	9.56	9.5
12	2.67	2.16	9.84	9.8
13	2.68	2.13	10.87	10.4
14	2.53	3.00	11.00	10.9
15	2.61	3.26	11.74	12.1
16	2.50	5.00	11.00	14.0
17	2.78	2.01	14.99	15.0

Science confuses transmitter of fruit tree diseases

Leafhoppers tricked by timing

LEAFHOPPERS REPRESENT THE KEY TO understanding and control of some disease epidemics that periodically plague Oregon's \$13.5 million sweet cherry industry.

OSU entomologist K. G. Swenson has devoted four years of research to the biology of leafhoppers and their role in transmitting fruit tree diseases.

Leafhoppers, usually brown or green, range from one-fourth to three-quarters of an inch in length. Some species carry viruses and mycoplasmas that infect fruit trees. Mycoplasmas are bacteria with thin, flexible cell walls that allow them to pass as a virus in many tests used to differentiate cells from viruses. Viruses have no cellular structure. Many diseases originally thought to be caused by viruses were actually caused by mycoplasmas.

Leafhoppers feeding on new green twigs transmit the virus or mycoplasma into the tree's sap stream where it moves into susceptible tree cells. Fruit yield and growth are reduced on infected trees.

Cherry trees threatened

Although leafhoppers can transmit diseases to different types of deciduous fruit trees, citrus trees and grapes, Swenson has been primarily interested in "little cherry" diseases that produce small, poorly colored fruit.

Several such diseases are transmitted by leafhoppers. They are always a potential threat to the cherry industry, Swenson said. Infected leafhoppers offer the only method for spreading these diseases from tree to tree.

Adult leafhoppers are extremely mobile. This, combined with the fact that a relatively few insects can infect a significant number of trees has made spraying with insecticides impractical for controlling the diseases.

Life cycle understanding necessary

Swenson hopes his work will open new avenues for control. He is extending a highly sophisticated understanding of insect diapause to species of disease-carrying leafhoppers.

Diapause is a type of insect dormancy much like bud dormancy in

woody plants. Insects enter diapause as a means of surviving periods of lack of food, intolerable heat or, most commonly, intolerably low temperatures. Diapause may occur in any stage of the insect life cycle, but it occurs in a given stage for a given species.

Diapause is not a response to direct stimuli such as cold weather or other adverse conditions, because insects must be in the diapause stage before adverse conditions arrive. Instead, diapause is triggered by token stimuli such as changes in day length. Insects respond to diapause-inducing stimuli regardless of whether a period of adverse conditions actually follows.

Swenson has found that some virus-transmitting leafhoppers in Oregon produce two generations a year. One stage winters in egg form. As days lengthen, these eggs hatch into larvae and develop into adults. The adults lay eggs that hatch in a short time, producing a second generation that matures in late summer during shorter days. Triggered by the short days, these adults lay the diapausing, cold-resistant eggs that survive the winter.

Controls possible

Inducing leafhoppers to enter or terminate diapause at the wrong time is one possible control that could develop from Swenson's work. Diapause has been terminated experimentally by application of synthetic insect hormones. Commercial interest in using hormones as an alternative to present insecticides for insect control has been increasing.

Understanding diapause is the key to understanding the field biology of leafhoppers. With this comes an understanding of when virus spread is most likely to occur, greatly improving chances for developing and applying control techniques, said Swenson.



*Biology of the leafhopper *Draculaccephala crassicornis*, shown in successive stages of development, is little understood. It can transmit two major viruses. One attacks grapes and the other infects peaches.*

Pear Prematurity Postponed

ANNUAL PRODUCTION OF BARTLETT pears with a constant grade of quality?

This goal is one step nearer reality as result of the Mid-Columbia Experiment Station's temperature control work on premature ripening of pears, a biochemical and physiological disorder that causes pears to advance in maturity while still on the tree and green.

The premature ripening problem is unique to Bartlett pears and has periodically plagued almost every growing area throughout the Northwest, causing multi-million dollar damage to the pear industry during bad years.

Symptoms appear too late

In its early stages, there is little outward appearance that the disorder is present.

The first symptom to appear in the premature ripening process is a pink coloration of the pear calyx, which is the bud end of the pear opposite the stem. This symptom is followed by a

Limb cages heat, refrigerate air surrounding fruit in pear study

change in skin color in the calyx area from green to yellow. Succeeding stages of premature ripening cause softening of the pear tissue in the calyx region and considerable dropping of the fruit prior to harvest. By the time these symptoms become apparent to the grower, it is usually too late for him to accelerate harvesting and prevent large losses to his crop.

As early as 1954, OSU horticulturists suspected that premature ripening was associated with temperature because the problem appeared only during years with unseasonably low temperatures preceding harvest.

Limb cages create symptoms

This observation led to the development of temperature control limb cages capable of experimentally reproducing the premature ripening symptoms. Each cage surrounds the limb of a pear tree and either refrigerates or heats the enclosed air to desired temperatures.

Work with the temperature control cages laid the groundwork for developing techniques to predict and control the disorder. For instance, it was found that cold weather has its critical effect on pears during a 30-day period prior to harvest.

Thirty hours of 45-degree nights or 90-100 hours of 50-degree nights during this period will produce the disorder. However, the symptoms cannot be reproduced when the temperature does not drop below 55 degrees during the 30-day period. Work is also being done on the effect of wide variations between nighttime and daytime temperatures.

Temperature monitored

Knowledge about the effect of temperature on the disorder means that its occurrence can be predicted by daily monitoring of orchard temperatures during the critical period. If temperatures indicate that premature ripening is likely to occur, pears can be harvested before normal maturity. How-

ever, early harvesting is undesirable because the fruit has not reached full size.

Recent research efforts have been directed toward chemically controlling the premature ripening, allowing the pears to remain on the tree until normal maturity is reached.

Premature ripening was experimentally induced by using the limb cages. The premature ripening symptoms were then successfully retarded by treating the fruit with the chemical growth regulators gibberellic acid and Alar. Gibberellic acid was applied at a concentration of 100 parts per million and Alar was applied at 1,000 ppm. Both chemicals were effective. Alar provided a beneficial side effect by greatly reducing fruit drop.

Research continues

Experiment Station superintendent W. M. Mellenthin and horticulturist C. Y. Wang are striving to refine chemical control of premature ripening by observing the effect of temperature variation on the physiology of pears.

Once the effects of temperature variation on firmness, ethylene production, respiration and changes in organic acids and soluble pectins in pears are fully understood, answers will be available regarding proper use of growth regulators.

Minimum dosage of growth regulators necessary to retard premature ripening at different temperatures, proper time for application of chemicals and frequency of application are some areas to be explored.

The temperature control limb cages are capable of reproducing temperature conditions of all Bartlett pear-growing sections of the Northwest.

In addition to its importance to the grower, understanding and control of the premature ripening disorder will aid in establishing an orderly marketing program, assuring the consumer quality fresh and processed pears throughout the season, Mellenthin said.

Clear-cut logging wins one

ADD ONE VOTE—QUALIFIED—FOR clear-cut logging and slash burning.

The combination may be the most effective way to manage mixed coniferous forests, logging and grazing research on Northeastern Oregon forestlands shows.

Analysis of a 15-acre clear-cut demonstration area on Eastern Oregon Experiment Station's 2,000-acre Hall Ranch confirmed that clear-cut logging and slash burning appears to enhance forest quality and productivity, benefit deer and elk and make the forestland a productive grazing area during part of the reforestation period.

Contributing to success of this procedure are several characteristics unique to the mixed coniferous forest of this area. This type of forest occupies the best growing sites, usually north-facing slopes with deep soil and the greatest available soil moisture. It normally supports a mixture of grand (white) fir, Douglas-fir, western larch and ponderosa pine.

Grand fir enhanced

Logging practices going as far back as the 1800s tended to follow a selective cutting procedure. This greatly enhanced the dominance of grand fir, a species that in the past was undesirable to log because it is highly susceptible to heart rot before reaching maturity and produced little useable lumber. As a result, most of today's mixed coniferous forests are highly diseased and produce only about one-half the number of useable trees they are potentially capable of producing.

OSU range and forest management specialists and Experiment Station su-

perintendent J. A. B. McArthur contend that these sites, with proper management, can once again become productive with more desirable Douglas-fir and ponderosa pine species and, at the same time, provide choice grazing land for livestock and wildlife.

The Hall Ranch site, 12 miles southeast of Union in the foothills of the Wallowa Mountains, is representative of large acreages of mixed coniferous forests in Northeastern Oregon, Washington and Idaho. It is in a 20 to 25-inch precipitation zone.

Demonstration area established

The demonstration area was logged in 1963. In the spring of 1964 it was burned and seeded with blue wild rye, mountain brome and a mixture of orchard grass, tall oat grass, manchar smooth brome, timothy and common white clover. The next year, three five-acre lots in the area were planted with seven varieties of tree seedlings. Bulk of the seedlings, planted 1,000 to the acre, were Douglas-fir, western larch, ponderosa pine and western white pine. Grand fir, Engelmann spruce and lodgepole pine were planted in smaller numbers.

Study objectives were threefold. Researchers wanted to determine performance of different tree species, effect of different ground covers on tree seedling growth, and performance of domestic cattle grazing the area and their effect on the seedlings, ground cover and browse.

One of the five-acre plots was surrounded with a deer fence and the other two were cattle fenced so the effect of

wildlife and cattle together could be compared with that of cattle alone.

Production increases

Forage production on the demonstration area rose to 1400-1700 pounds per acre compared to 100-200 pounds per acre prior to logging. Average daily gain of bred yearling Hereford heifers grazing the area ranged from 1½ to 2 pounds a day. Gains of yearling Hereford steers on open canopy sites created by previous selective cutting, including removal of all diseased trees, were 1¼ to 1¾ pounds per day. A contributing factor to this difference in gain was that slash remaining in the selective cut area hindered grazing by reducing access to available forage.

Among the tree varieties planted, the two species considered most desirable for lumbering—Douglas-fir and ponderosa pine—had the highest survival rate. After 6 years, more than 70 percent of these two species survived. Survival rate among the other species dropped to less than 50 percent. Even if further losses are sustained among the Douglas-fir and ponderosa pine species, the researchers estimated the trees will require thinning to provide about 350 trees per acre, normal for a healthy mature forest of this type.

Some seedlings damaged

Greatest damage to the seedlings was caused by browsing by wildlife and cattle. Cattle also caused some trampling damage. Douglas-fir and ponderosa pine were the preferred species for browsing. In the area accessible to both wildlife and cattle, damage by deer and elk on these two species accounted for 32

Grass seeding and livestock grazing during reforestation period after clear-cutting make forest land productive

percent of seedling mortalities. Damage by cattle accounted for seven percent of the Douglas fir and five percent of the ponderosa pine mortalities. In the area that excluded wildlife, cattle damage accounted for 23 percent of the Douglas-fir and 16 percent of the ponderosa pine mortalities.

The browsing damage was offset by the fact that many seedlings were merely "pruned" and aided in growth as result of the browsing. The pruning effect was caused by livestock preference for lateral buds from the previous

year's growth. Browsing of the area around the tree seedlings also aided growth by keeping them free from dominance by surrounding vegetation.

Comparing the area in which deer and elk could graze with the one from which they were excluded gave indication that both wildlife and cattle are necessary to maintain browse shrubs such as ninebark, willow, oceanspray, snowbush and red stem ceanothus at levels usable by the animals. Neither cattle nor deer and elk alone browse sufficiently on the shrubs to check their rapid growth.

Orchard grass and blue wild rye appeared to be the most suitable grasses to seed following the burning. They adapt well to the mixed conifer forest site and produce an abundance of forage with minimum competition to the tree seedlings.

Management implications cited

The Hall Ranch study has several implications for management of mixed

coniferous forests. Most important is the apparent compatibility of good forest management and range management procedures, enhancing forest quality and wildlife feeding opportunities and, at the same time, allowing profitable utilization of forestland for cattle grazing. OSU range management specialists estimate that proper management will provide approximately 20 years of grazing on the clear-cut sites before their grazing efficiency is significantly reduced by cover from the new forest—a forest containing a healthy stand of desirable trees for logging.

Future research will concentrate on a second clear-cut area of 55 acres logged in 1969 and burned and grass seeded in 1970. Patterns of natural reforestation from the surrounding forested area will be studied along with development of range management procedures designed to insure efficient grazing of both the open land and surrounding forest without fencing.



Cattle graze the 15-acre experimental area clear-cut in 1963.

research briefs

Mechanization requires many things of the strawberry

STRAWBERRY HARVESTER + HARVESTABLE strawberry = mechanical strawberry harvesting.

Although OSU agricultural engineers have successfully tested a prototype strawberry harvester, two basic problems must be solved to make mechanical harvesting an economically realistic practice. One is the process of getting the fruit off the ground and into the harvester. The other is getting most of the strawberries to ripen at the same time.

USDA horticulturalist Francis Lawrence and the OSU Agricultural Experiment Station are working together to solve these problems by breeding and field testing plants that will hold their fruit off the ground for the harvester while having all the fruit ripen at once.

Many variables considered

However, the solution is not as simple as developing a strawberry variety with these key characteristics. The plant breeder must also satisfy the grower and processor with respect to disease resistance, productivity, ease of capping, color, texture and flavor.

Lawrence's goal is to develop a strawberry plant that meets industry requirements and produces at least three tons of acceptable fruit per acre in one picking. This would be comparable to the yield obtained in two or three pickings of the popular Northwestern variety.

Although many varieties contain one or more favorable traits, it has taken Lawrence five years to develop a handful of selections that might have the right combination of all desirable characteristics.

The next step, Lawrence said, is to test these selections in large plots.

Lawrence estimated that it will be at least two years before any of his selections will be tested sufficiently for possible release as a new variety.



Cross-breeding has developed this promising strawberry selection which holds its fruit off the ground.



Entomologist Peter Westigard checks coddling moth trap.

Sex goes to work in war against coddling moth

THE MATING URGE IS TURNING INTO A boomerang for the male coddling moth.

This major pest overwinters as larvae, emerges as a moth the first of May, mates and the female lays eggs a week later. By the end of May, the egg hatches and the worm bores into pears or apples. A second generation is launched in July or August.

If spray is not used, the grower begins to lose his crop. Medford area growers customarily spray three times—in mid-May, June and July—and a fourth time for later varieties of fruit.

Spray kills indiscriminately

The spray, an organophosphate, kills coddling moths. But it also kills predators and parasites not tolerant to the spray which results in other species becoming pests.

Needed, said Peter H. Westigard, entomologist at the Southern Oregon Experiment Station, is a non-chemical control for the coddling moth. It could reduce spray cost 60 percent.

He is experimenting with pheromone, a synthetic sex attractant obtained from the USDA at Yakima, Washington, in simple traps in five orchards. A rubber band coated with the synthetic hormone, available for the first time this year, attracts the male coddling moth.

By comparing the number of trapped males, Westigard is determining coddling moth populations. By comparing them with infestations he can decide whether it is time to spray for the pest.

A sex attractant for the female coddling moth? Not possible, said Westigard.

But pheromone, when more easily available, could be another major control by luring hapless males to a not-so-tender trap.

Model of economists aids in decisions on water diversion

ECONOMISTS AND OTHER SPECIALISTS trying to provide information for decision-making about water diversion have some help.

OSU agricultural economists Bruce R. Beattie, Emery N. Castle, William G. Brown and Wade Griffin developed a model to measure economic efficiency effects—including expected regional impacts—of proposed diversion schemes.

By accounting for regional direct and indirect costs and other cost factors, the model can be used to estimate income redistribution impacts of interbasin water transfer schemes. For example, the marginal value productivity of an acre-foot of water used on irrigated cotton and .91 acre of land: an estimated \$33.32.

In Agricultural Experiment Station Technical Bulletin 116, which includes both the theoretical framework and demonstrations of how the model works, the economists point out that political pressure for interbasin water transfers is bound to become increasingly intense.

It is most urgent, they add, that economists clearly communicate the economic implications — including expected regional impact—of proposed diversion schemes.

Chemicals stimulate growth in sheep on pasture

IF ONE GROWTH STIMULANT IS GOOD, how about using two?

OSU animal scientists W. D. Hohenboken and John H. Landers, Jr., tested two chemical growth stimulants on 400 grazing lambs and found that either resulted in an average 15 percent gain over control animals.

The stimulants, diethylstilbestrol (DES) and zeranol (Zer), are commonly used for increasing daily gain and efficiency of feed use in cattle and sheep. Small pellets containing the chemicals are implanted in ear tissue.

The stimulants were known to be effective when used on feeder lambs in feedlot situations. The OSU experiments dealt with pasture finishing of feeder lambs, a common procedure among Oregon sheepmen.

In addition to finding that the chemicals produced similar gains, Hohenboken and Landers found that implanting both chemicals in the same animal did not have any advantage over either chemical by itself.

Ewes and wethers responded equally well to DES. Zer had a greater effect on ewes. But the researchers cautioned that adverse weather conditions during the experiment could have affected results and that differential effect of the stimulants between sexes should have further study before conclusions are drawn.

12 grass species planted to determine ecology picture

ONE MAN'S VIEW OF EASTERN OREGON rangeland: A network of ecological sites that support different types of vegetation representing the effective environment.

Some sites produce more than other sites. A reliable way to determine the potential of a land area for range improvement by seeding is desired, said Larry Rittenhouse, range scientist at the Squaw Butte Experiment Station. It is also desirable to know the best grass to seed on an area, he added.

Rittenhouse has initiated a study to produce the desired information. He has seeded improved varieties of 12 grass species in each of three ecological sites—Low Sagebrush-Idaho Fescue, Big Sagebrush-Bluebunch Wheatgrass-Thurber's Stipa, and Big Sagebrush-Basin Wildrye sites. Some of the seeded species have a wide range of adaptability. Others do not.

Rittenhouse will measure survival and production of the different grasses. Seedlings will be made annually for five years to remove weather-related variations.

Plans call for expanding the study to additional ecological sites within the Squaw Butte geographical area.

(Continued from page 3)

Duplication data vital

The process of how the virus duplicated itself is vital. Once the virus enters the cell, two events must occur:

- 1—The DNA or RNA of the virus must instruct the cell to become malignant.
- 2—The instructions must include a means of using the cell machinery to produce new virus so new infections can continue. (If this instruction fails, the new virus would not form and the disease could no longer be spread or be perpetuated.)

George Weber, a graduate student in Beaudreau's laboratory, has been looking at early events that occur with the

humans. It has been attractive to utilize the concept that all tumor viruses contain an enzyme that transcribes RNA chains into DNA chains.

"This study is being made in our laboratory and the experiments indicate that blood from people having leukemia contains a particle that has this particular enzyme."

Beaudreau's laboratory group is studying the properties of this enzyme from human leukemia, trying to show that it is the same as that found in the virus of animal leukemia.

Leukemia samples are obtained from patients at the University of Oregon Medical School Hospital and United States Public Health Service Hospital in Seattle with the help of the Cancer

"...that blood from people having leukemia contains a particle that has this particular enzyme."

cell and virus after 2 to 12 hours of infection. He has observed that new and complete virus is formed as early as 10 hours after infection but cells are not changed to malignant cells until 70 hours after infection.

Two premedical students from OSU, Dave Murry and Janet Price, worked last summer with Beaudreau on a special project. Their goal: to determine what important structures in the RNA molecules allow the enzymes to recognize the proper RNA and determine the spot along the RNA chain to start making a copy.

Their studies suggest that the enzyme is selecting only certain parts of the molecules for transcribing into DNA.

The human link

How do these studies relate to human cancer?

The major problem in human cancer research is establishing a causative agent (virus).

"From our study of animal leukemia, we might expect that the number of virus particles would be too low to be observed in the electron microscope," said Beaudreau.

"Therefore, there has been no other means to relate virus and cancer in

Institute in Bethesda, Md. As fractions from blood and tissue culture suspected of containing virus are isolated, samples are examined in the electron microscope for virus particles.

To find out if the test for virus activity in a cell could be applied to human leukemia, Beaudreau and his team studied the plasma of two aged patients provided by the Seattle hospital.

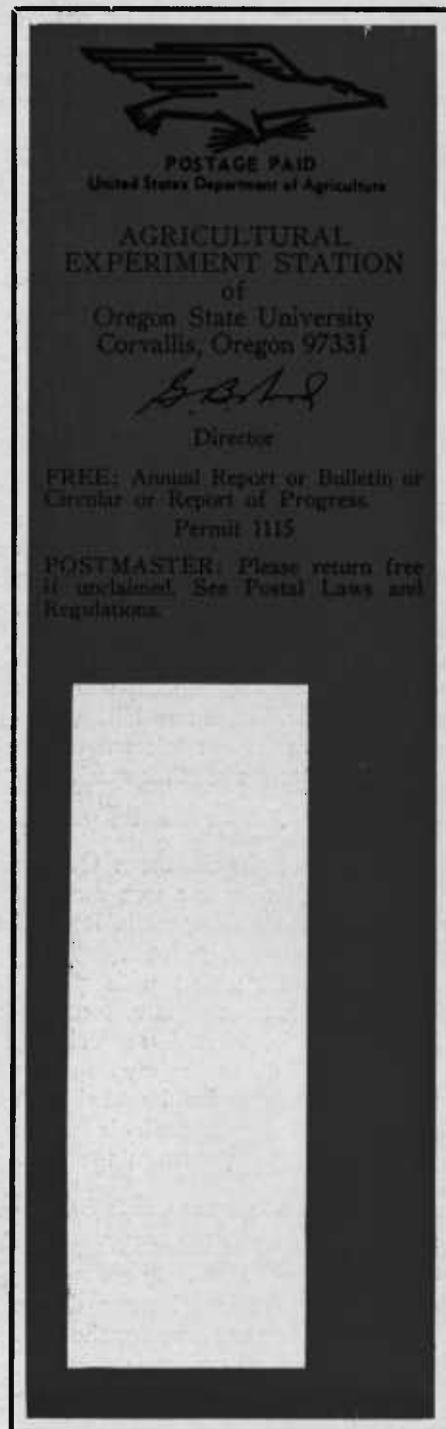
As expected, the DNA polymerase activity obtained was low but the experiments demonstrated the presence of an enzyme activity in leukemic plasmas characteristic of animal tumor virus.

New study possibilities

The experiment also gave evidence that the enzyme activity was contained in a virus particle.

"It remains to be seen if this enzyme activity can be frequently detected and under what conditions or therapy it will persist," said Beaudreau. "We know therapy can eliminate detectable enzymes.

"Obviously, more studies need to be done before it will be possible to relate this observation to viral infection but our results suggest that a new opportunity for study of human cancer may be available."



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