

# *Annual Report*

OF THE

OREGON AGRICULTURAL  
EXPERIMENT STATION



## *Oregon's* AGRICULTURAL PROGRESS

*Through Research*



STATION BULLETIN 477

M A R C H • 1 9 5 0



## Foreword

The impact of a population growth in Oregon of more than 50 per cent during the past 10 years is being felt in agriculture as well as in an expanded industry. Oregon's agriculture is rapidly becoming more intensive and more highly specialized. This situation creates a "pressure" on the land with more soil management problems, more insect pests, more plant and animal diseases, and many other problems of a wide variety.

Intensification of industry also brings on problems of air pollution by effluent gases that cause damage to plant growth and to livestock. It brings industrial wastes that pollute our streams and damage commercial fisheries and game fish.

The Experiment Station, with the mutual support of agricultural industry groups and implemented by Federal, State, and private financial aid and by the participation of the U. S. Department of Agriculture and the U. S. Department of Interior, is giving increased attention to the problems mentioned. Because of wide public interest, rural health and rural housing are likewise being given consideration.

The success of research undertakings, though not always obvious, is substantial. Research results followed by approved methods and practices indicate large returns on funds invested.

We commend to the interested public a careful examination of the undertakings—their progress and results—outlined in this report.

A handwritten signature in dark ink, reading "Wm. A. Schomfeld". The signature is fluid and cursive, with a long, sweeping underline that extends to the right.

Dean and Director

# OREGON'S AGRICULTURAL PROGRESS THROUGH RESEARCH



**T**HIS report has been organized on a commodity basis for the convenience of the reader. Discussed within the sections are production, processing, and marketing problems and related research in disease, insect, and pest control, bacteriology, agricultural chemistry, agricultural engineering, agricultural economics, and resource conservation. The report was prepared by Sam H. Bailey, Experiment Station Editor, and Norville R. Gish, Assistant Experiment Station Editor.

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## **Field, Forage and Seed Crops**

### **CEREALS**

#### **Research Workers Seek Better Cereal Crops**

A comprehensive cereal breeding and varietal testing program is being conducted by the Experiment Station in an effort to develop new, high-yielding, disease resistant varieties for the many diverse areas of the state. This work is conducted at the Central Experiment Station and at seven of the Branch Experiment Stations.

The cereal work at the Central Station includes a broad program of varietal testing for all winter and spring cereals grown in the Willamette Valley. A breeding program aimed at the development of improved 2-row malting barleys, high-yielding, disease resistant spring oats, and better adapted high-yielding winter barleys is under way.

Cereal investigations at the Branch Stations center around the development and testing of better varieties for their respective areas.

At the Pendleton and Sherman Branch Stations, located in the Columbia Basin, large breeding programs are directed towards the development of high-yielding, smut-resistant wheats. The Pendleton



Cereal variety trials are underway at various Branch Experiment Stations as a means of finding varieties particularly suited to the respective areas of the state. A section of the winter wheat nursery at the Sherman Branch Station is shown here.

program is built around breeding better varieties suited to the high rainfall area of the Basin as well as development of varieties suitable for early fall seeding. The work at the Sherman Branch Station is centered around developing varieties for the lower rainfall areas of the Basin. In addition to their breeding programs, both Stations maintain extensive varietal nurseries of winter wheat, spring oats, spring barley, and spring wheat in cooperation with the U. S. Department of Agriculture. These trials are grown on outlying farms as well as at the Stations.

Cereal varietal testing and selection of better adapted varieties to their particular areas is under way at the Klamath, Malheur, and Deschutes Experimental Areas, and at the Southern Oregon Branch Station.

Highlights of last year's work included the testing and release of two barley varieties and two new wheat varieties. Bonneville, a spring barley, was released for planting in the Snake River Valley after extensive tests and seed increase by the Malheur Station. Spray, a forage type spring barley, was released by the Sherman Station for hay production in Wheeler county and the immediate area.

At the Umatilla Branch Experiment Station a wheat under test for possible release was not found satisfactory in baking and milling



tests and was rejected. The wheat was to have been named "Uma" for the county of its origin.

Two new smut resistant winter wheats developed in Washington, Elmar and Brevor, are being released to farmers in the Columbia Basin through the Pendleton and Sherman Stations.

### **New Spring Barley Named Bonneville**

A new spring barley named Bonneville that is high yielding and late maturing was released last year following several years of test planting at the Malheur Branch Experimental Area.

Recommended for spring planting in the Snake River Valley, Bonneville is a selection from the cross Coast-Lion-Trebi by Winter Club. The new variety was developed at the Utah Agricultural Experiment Station and tested there and at the Malheur Area. It is stiff strawed and smooth awned.

Bonneville out-yielded Trebi in test plantings. Its stiffer straw permits it to stand up well under irrigation and strong winds on the fertile soils of the Snake River Valley. The new barley grows slightly taller than Trebi and heads a few days later. It does not tend to skin or crack as easily as Trebi. In limited malting tests, Bonneville has been classed as a feed barley.

### **Spray Barley Released for Hay Production**

A new barley named Spray was released for hay production in Wheeler county and the immediate area last year.

Named for the town of Spray, Oregon, the new barley has been under test at the Sherman Branch Station since 1939. It is a six-row, hooded barley variety that looks very much like Meloy but has more leaves, finer stems and is slightly earlier heading. Spray was a selection from a composite cross made by the U. S. Department of Agriculture and sent to the Sherman Branch Station for testing. The new variety is recommended for use only in Wheeler county and adjacent comparable areas.

The release of the new barley marks a step forward in the research aimed at improvement of spring barley varieties for both hay and grain purposes in that part of the state.

### **2,4-D Sprays Improve Wheat Yields**

Wheat yields have been increased and harvesting conditions improved in the Columbia Basin through the use of 2,4-D sprays for weed control as recommended by the Sherman Branch Experiment Station.

Work with 2,4-D has been carried on for three years with good results. Experiments have demonstrated the value of the material as a control for weeds in wheat fields. Early trials with Sinox sprays required large volumes of water and proved impractical for dry-land farming.

New spray forms are more effective than dusts, and early treatment has given better results than late treatment. Yield increases have been noted but there has been no significant difference in test weights.

Additional work on weed-control measures for wheat is planned since spraying for weeds has become a regular practice in the Columbia Basin.

### Farmers Favor Six-Inch Drill Spacing

A survey of Oregon farmers made last year to determine whether grain drills with 6- or 7-inch spacings are most popular resulted in a wide margin in favor of the smaller spacing. Manufacturers would like to standardize equipment on one spacing in order to simplify manufacturing processes and lower cost of production.

Although the 6-inch spacing is the most popular throughout the state as a whole, the survey revealed a growing demand in the wheat district for a 14-inch spacing. The wider spacing is preferred by the wheat farmers because of its value in helping to reduce soil erosion.

Results of the survey indicate that while there is support for larger spacings, many farmers are not willing to consider anything but a 6-inch spacing and acceptance of any other type will be slow.

### Adapted Hybrids Increase Oregon Corn Yields

A 20 to 30 per cent increase in yield over the old open-pollinated corn varieties may be expected from adapted corn hybrids in Oregon, according to Experiment Station tests.

Yields of up to 140 bushels per acre have been produced in trials at both the Umatilla Branch Experiment Station and the Malheur Experiment Area. Since the higher yields do not greatly increase the cost of production, growers will receive added profits.

With Oregon's hybrid corn acreage up from zero to 75 per cent of the state total in 10 years, and with the proved ability of hybrids to produce remarkable yields, possibilities for corn production throughout the state are good.



Field trials conducted last year indicate that some new Experiment Station hybrids may be better adapted to Oregon conditions than those now being widely grown. Some are particularly promising from the standpoint of early maturity and disease resistance. If further tests are successful, present hybrids may be replaced by improved ones in a few years.

Fertilizer trials indicate that corn yields may be increased on irrigated land by heavy nitrogen fertilization. Additional experiments are planned to determine proper fertilizer rates and cost of production with heavy nitrogen fertilizer applications.

New inbred lines appear promising for use in producing good commercial hybrids, and about 1,000 are being grown for additional trials. Plans also include production of foundation seed for commercial hybrids.

## **Insecticides Tested for Corn Earworm Control**

Possibilities for control of corn earworm on a commercial scale with insecticides appeared promising last year in small-scale trials. Such control would be of great value to Oregon sweet-corn producers, especially in the Hermiston area where the insect is the biggest obstacle in the way of corn production.

On plots sprayed with 5 per cent DDT, there were 97 per cent clean ears compared to 20 per cent on untreated plots. Parathion-treated plots also had a high percentage of clean ears.

## **Fog Generators Help Control Storage Pests**

Aerosol fog generators have proved both practical and economical for control of insects pests in grain elevators, where it is not possible to use regular spray equipment.

Tests indicate that excessive populations of stored-grain insect pests can be controlled with residual insecticides. Aerosol applications with the fog generators lend themselves nicely to such a program.

Tests made with a small cub generator for control of stored-products insects, household pests, and livestock pests proved effective. Trials with wettable powders against filbert moth and other nut storage pests were effective, but the powders were not as easy to apply as oil formulations.

## FORAGE AND SEED

### Forage Production Problems Investigated

The forage-crop investigations conducted cooperatively by the Experiment Station and the United States Department of Agriculture for the past 34 years produced important findings again last year. A summary of results follows:

**Alfalfa trials:** Atlantic alfalfa was the highest-yielding variety last year in tests at Corvallis and Talent. Ranger, second in yield in Corvallis tests, was the highest-yielding variety at the Klamath Experimental Area where alfalfa is grown in combination with meadow foxtail. None of the creeping or rhizomatous alfalfas have yet demonstrated vegetative spreading.

**Clover trials:** 40 strains of subclover are under test. The most vigorous strain in 1949 was Nangeela, the strain released last year by the Experiment Station. Of 12 biennial sweet clovers, Willamette and Spanish were the most vigorous in the first year tests. Strain tests of Ladino and white clover were started under irrigation.

Lime and mineral fertilizers have shown no clear-cut effects on yields of Ladino clover for forage or seed. Seed yields were increased with each additional irrigation up to three applications.

**Soybean trials:** No varieties yet tested are satisfactory for Oregon.

**Lotus trials:** Adapted grasses in combination with Lotus are effective in excluding weeds. Lotus corniculatus (broadleaf form) outyields Lotus uliginosus in forage production. The highest-yielding strain of Lotus corniculatus is F. C. 22734.

A 7-year summary of date-of-planting trials with Willamette vetch show that plantings made between September 15 and October 30 were more productive of seed than plantings made later.

**Hay and pasture grass trials:** Different grasses and Lotus corniculatus were grown together for seed production. The most productive mixtures of both grass and Lotus seed were Rainier red fescue and Lotus and Tualatin oatgrass and Lotus. Perennial ryegrass greatly depressed Lotus growth and yield of seed.

A summary of 6-year trials comparing Alta fescue seed production in 3-foot rows and in solid plantings shows 121 per cent more seed from row plantings than from solid plantings. Red fescue in 3-foot rows yields 112 per cent more seed than the solid plantings.

The summary of 5-year trials with fertilizers on grasses shows that Alta fescue in 3-foot rows produced highest seed yields with annual applications of 96 pounds of nitrogen per acre; red fescue yields were best with yearly applications of 56 pounds per acre.



Seed yields decreased as planting rates were increased above 8 pounds per acre for Alta fescue; 6 pounds per acre for Chewings fescue; and 9 pounds per acre for red fescue in solid stands.

Turf production trials: There is a continuous increase in the use of soil amendments in turf production. Nitrogen and phosphorus are the chief minerals used. On poor soils, the addition of peat moss or sawdust to promote moisture retention and tilth is increasing.

## Forage-Crop Diseases Studied

Forage-crop diseases are being studied on a broad scale as part of the overall program of forage-crop investigations conducted in cooperation with the United States Department of Agriculture.

The prevalence of blind-seed disease was reduced in 1949 from the 1948 level and further reduction is possible in 1950 if badly infested fields that were not burned are spring plowed.

Universal burning of all fields after harvest was recommended for Linn county as a control measure in view of the prevalence of the disease. Another control measure suggested prior to the 1949 harvest was that the maximum amount of light-weight seed should be taken off the fields during harvesting operations. This practice, which will help reduce the disease potential, will be generally effective for the first time in 1950.

Badly infested fields were found in Benton County for the first time in 1949.

The search for resistance in *Lolium perenne* was continued. Seed was obtained from cross pollination of two resistant but self-sterile plants. More than 2,800 progeny plants were transplanted to a spaced-plant field nursery and will be tested for resistance in 1950.

Protracted rotation of vetch crops with application of weed sprays to kill out volunteer legumes in intervening grain and grass crops is recommended as the fundamental principle of vetch disease control. This practice, together with increased soil fertility, has resulted in great improvement in vetch crops in Linn county.

## Branch Stations Conduct Forage Programs

A statewide program for improvement of forage and seed crops is being conducted at the various Branch Experiment Stations in cooperation with the Central Experiment Station.

At the John Jacob Astor Branch Experiment Station and the Northrup Creek Experimental Area the emphasis is on pasture

improvement on both low and hill lands. The increased use of *Lotus uliginosus* (*L. major*) in the area is contributing to a higher level of forage production for both dairy and beef cattle. A pasture renovation program with Astoria bentgrass is under way in an effort to correct the sod-bound condition of that grass and increase forage and seed production.

Seed increase of Talent alfalfa is being pushed at the Southern Oregon Branch Experiment Station and a grass improvement program is being started. Grasses that appear to be best adapted to that area include Alta fescue, Harding grass, and Reed canary grass. The value of grasses for farm roadways is being demonstrated with Alta fescue showing particular promise. Creeping red fescue and highland bent grass have also been found good for roadway plantings.

Improvement of the Klamath strain of creeping alfalfa is being emphasized at the Klamath Experimental Area along with the enlargement of alfalfa varietal trials. Trials with grass-alfalfa combinations indicate that meadow foxtail is perhaps the best grass for this purpose with Alta fescue also showing promise. Sweet clover is being used in the alkali-soil improvement program. *Lotus corniculatus* is the most promising grass to date in preliminary trials on muck soils.

At the Squaw Butte-Harney Range and Livestock Station, the improvement of native meadows is being stressed. Varietal trials with forage and seed crops are being continued.

The project on improvement of pastures for both beef cattle and sheep is being continued at the Eastern Oregon Branch Experiment Station. Alfalfa and alfalfa-grass plantings are under test.

Umatilla Branch Experiment Station maintains a continuous soybean program and is also studying the problems of turkey and sheep pastures.

At the Red Soils Experimental Area work is being continued with grasses and fertilizers as part of the program for rebuilding the depleted red hill soils of that area. Nitrogen fertilizers have been found valuable for forage and seed production. Row seeding has been found superior to solid plantings for seed crops. Burnet is showing well in nursery varietal trials.

Varietal trials with various legumes and grasses are under way at the Malheur Experimental Area, the Pendleton Branch Experiment Station, and the Sherman Branch Experiment Station. The Hood River Branch Experiment Station and The Dalles Experimental Area are working with forage crops as orchard cover crops.

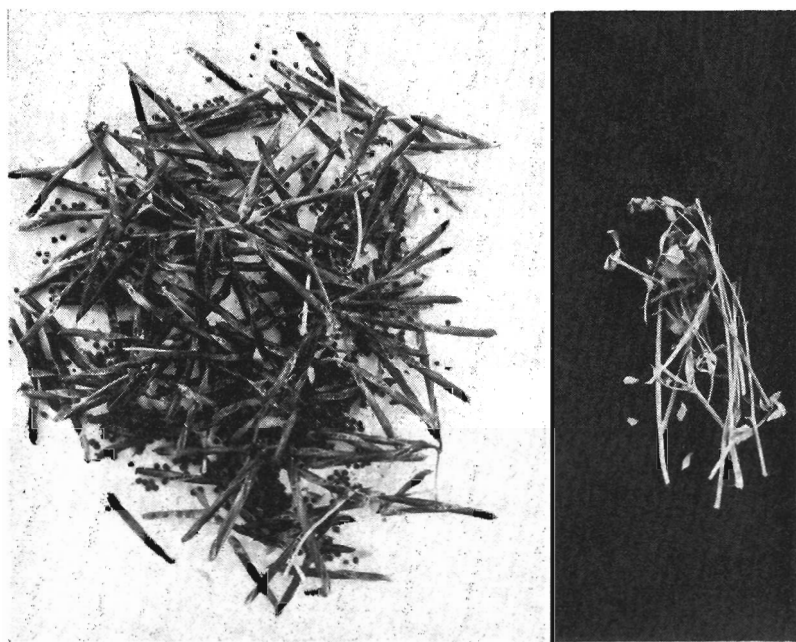


## Pollination Role of Bees Demonstrated

The important role played by bees in the pollination of legumes was demonstrated in preliminary tests last year. Initial results of the experiments indicate that bees are essential to the production of a paying crop of hairy vetch seed, Ladino clover seed, and Lotus seed.

The primary aim of studies last year was to make a general survey of the pollination problems of legume seed production especially as they concern Ladino clover, hairy vetch, red clover, and Lotus in Oregon.

Cage tests were made on all but red clover. A six-foot square plastic screen cage was placed in a legume field and seed pollination checks were made on the plants inside the cage. They were compared with checks in a similar plot not inside the cage. Preliminary checks



The role of bees in legume pollination is being investigated with an eye on improved crop pollination. Bees are essential for production of seeds in Lotus plants. Fully-developed pods and seeds from a *Lotus major* plant to which bees had access are shown on the left. In contrast to this heavy set of seed are branches from a plant where bees were excluded, right. Almost no seed pods developed and those that did contained no seed.

were also made for nectar concentration and bee population. Counts of bee population were made in red clover fields in several counties.

Additional studies of the same four crops will be made this year. The project may be expanded eventually to include all fruit and berry crops as well as seed crops.

Ladino studies will be carried on at the Granger Experimental Farm and in Josephine and Jefferson counties. Hairy vetch studies will be conducted in the Willamette Valley, Lotus studies in Jackson and Clatsop counties, and red clover in the Willamette Valley and Jefferson County.

### **New Alfalfa Seed Soon Available**

Seed of the new Talent alfalfa developed at the Southern Oregon Branch Experiment Station will soon be available for limited general distribution.

More than 120 acres were harvested for seed this season on the Branch Experiment Station and by cooperating farmers who are growing the new variety to increase the seed supply.

This variety was one of numerous strains and varieties planted in test rows in 1937. It early showed its superiority and has since proved to be the best among 31 strains and 23 varieties for southern Oregon conditions. Limited tests have also been made elsewhere with good preliminary reports from Willamette Valley and Klamath County trials.

Known originally merely as French strain No. 19274, it soon showed that it started earlier in the spring, grew later in the fall, and showed regrowth after cutting much quicker than other sorts. Together these characteristics result in an extra cutting each season compared with standard varieties.

Other advantages are that Talent grows densely enough to keep it more free of weeds and grass; it has a root system that adapts well to varying conditions; and it has proved so resistant to disease that stands 10-years old are still producing well. It is leafy and fine branched as a hay crop.

The name Talent was given in honor of the pioneer of that name from whom the town nearby was named and who was active in the early development of Rogue River Valley agriculture.

### **New Sub-Clover Strain Released**

A new strain of subterranean clover that promises to be better than either Mount Barker or Tallarook for western Oregon plantings was released for purposes of certified-seed increase last year.

Named Nangeela, the new sub-clover is a winter-hardy, fast-growing strain that is an excellent forage and seed producer. Small amounts of seed may be available to growers through commercial seed dealers next fall.

The new strain has several important advantages over the present recommended strains, Mount Barker and Tallarook. One advantage is that Nangeela is ready for spring grazing sooner than Mount Barker and grows as late into the summer as Tallarook. It matures seed as early as Mount Barker and has distinct leaf markings that make identification for seed certification easier and more certain than with the other varieties.

An Australian variety, Nangeela was first planted in experimental plots at the station in 1938. Seed was furnished by the division of forage crops and diseases in the U. S. Department of Agriculture.

The strain has been passed upon by the College certification board and growers who meet the requirements for sub-clover certification may have the new strain certified in the future. The Experiment Station will continue to produce the foundation seed needed for increase purposes as long as is required to build up an adequate seed supply.

## Ladino Seed Yields Doubled by DDT Dustings

Ladino clover seed yields can be more than doubled by dusting with DDT to control lygus bugs, according to tests conducted by the Southern Oregon Branch Experiment Station in Jackson and Josephine counties.

In the two counties last season, yield records were obtained from 66 growers who dusted their clover fields with DDT and from 98 growers who did not make dust applications. The average yield of clean seed per acre for growers who used DDT was 141 pounds. For the non-dust growers, the average yield per acre was 63 pounds—or a difference of 78 pounds per acre in favor of dusting.

When viewed in the dollar-and-cents light, the value of dusting becomes even more striking. With seed selling for approximately \$1.25 per pound, the additional 78 pounds of seed that was gained on the average from dusting would return \$97.50 per acre. Subtracting the cost of two dustings during the season—\$9 per acre—would leave extra income of \$88.50 per acre.

DDT dust programs used by the growers included either one or two applications of 30 pounds of 5 per cent DDT or 20 pounds of 10 per cent DDT applied by airplane or by ground duster.

## Grass Seed Cultural Practices Studied

Improved cultural practices for grass seed production in the Willamette Valley may result from tests on fertilizer applications and rate of planting.

Row plantings showed great advantage over solid plantings of Alta fescue and red fescue while limited applications of nitrogen fertilizer gave increased seed yields. Production of Alta fescue seed was increased with nitrogen applications up to 96 pounds per acre but 132 pounds per acre cut down seed yields. Red fescue failed to make economical use of nitrogen when applied at rates greater than 56 pounds per acre.

Problems of tall fescue breeding were given preliminary study and an intensive program set up which will involve growing 25,000 plants in 1950. Among problems to be studied are vegetative propagation, self-fertility, use of male sterile plants as females, inbreeding, inheritance, and measurement of palatability.

## Sunflower Varietal Tests Started

Varietal trials with sunflowers were initiated by the Umatilla Branch Experiment Station last year. Yields of open-pollinated varieties were compared with the Advance hybrid variety and insect damage on other varieties was noted.

Open-pollinated varieties have been grown as turkey forage for some time but Advance sunflowers have produced better results in limited trials so far.

The effect of nitrogen fertilizer on sunflowers was also investigated. Although fertilizer was applied late in July when the sunflowers were in the early bud stage, the results were still favorable. It is believed that earlier applications may result in even better yields.

## Safflower Assumes Added Importance

The return of wheat acreage allotments has increased the importance of safflower as a possible substitute crop for wheat in eastern Oregon. Although safflower yields are low, good quality oil is produced. Safflower yields in pounds per acre are about one-third those of wheat. If local market outlets develop, the potential value of the crop will be greatly increased.

In varietal trials at the Sherman Branch Experiment Station last year, safflower yielded better than flax and was easier to handle than corn. No breeding program is planned until the importance of the crop warrants its establishment.



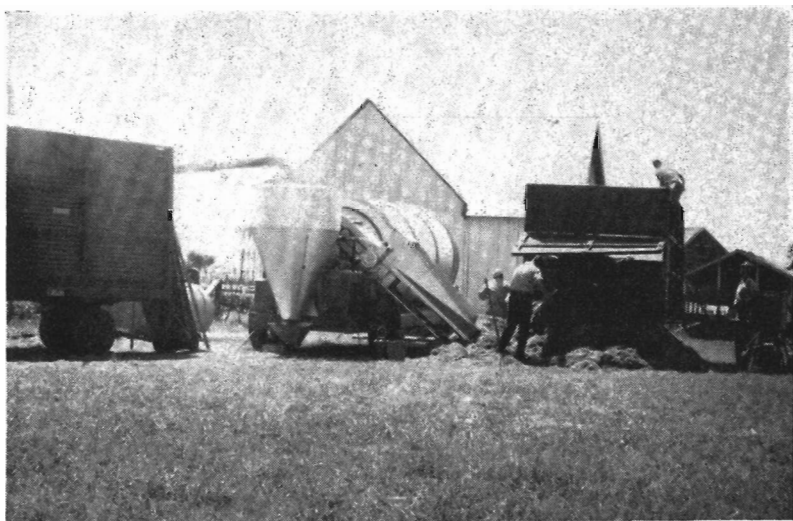
## Dehydrator Used in Hay Drying Tests

Artificial drying experiments conducted last year have shown that using a dehydrator in drying hay makes it possible to put up high-quality forage with low nutrient losses.

The work included tests on first cutting alfalfa in the Willamette Valley and Pacific Coast grasses at the Astoria Branch Experiment Station. Alfalfa was dehydrated and ground into meal with a hammer mill and coast grasses were dehydrated to determine whether the processes have a place in the Oregon preservation program for forages. A small, portable, commercial dehydrator was used but was not entirely satisfactory.

Considerable difficulty was experienced in grinding the dried alfalfa. Even with an over-all moisture content of 17 per cent, the alfalfa packed onto the hammers of the mill and forced work stoppage. Trouble also was encountered in drying stems to a sufficient degree for proper grinding with the hammer mill. Fuel costs per ton of dried alfalfa averaged \$6.14.

Nutrient losses in drying both grasses and alfalfa were low. Protein losses were small in both trials but carotene loss was less for Coast grasses than for alfalfa.



The process of dehydrating Pacific Coast grasses is shown here. Fresh, field-chopped grasses are fed into the dehydrator for drying and in turn are blown into bulk carriers for future storage.

## Artificial Drying Cuts Corn Storage Loss

Ear corn with a high moisture content can be safely stored through the winter without spoilage if artificially dried to a 20 per cent moisture content, according to results of corn drying tests made last year.

Trials were conducted to test the operation, performance, and economy of a small, portable dehydrator used in drying ear corn in cribs in the Willamette Valley.

The tests were made by forcing warm air from the portable dehydrator through an air tunnel constructed of welded wire and placed on the floor of an airtight crib.

Drying temperatures of 150° F. apparently do not lower the feed value of artificially dried corn. Chemical analysis of test samples showed a carotene content of 3.46 parts per million for artificially-dried corn compared to 3.07 parts per million for air-dried corn. Ears must be husked clean if drying is to proceed with any degree of efficiency and economy.

## Grass Seed Yields, Returns Compared

Net returns per acre to Willamette valley growers of Chewings and Alta fescue and of Highland bent grass averaged almost the same in 1948 but all far outstripped the acre returns from perennial and common rye grass according to results of a completed cost-of-production study.

On well-drained valley and river-bottom soils, common rye brought an average net return per acre of \$10; perennial rye, \$27; Chewings fescue, \$67; and Alta fescue in solid stands, \$64.

On poorly-drained valley soils, the net return per acre averaged \$15 for common rye; \$11 for perennial rye; and \$32 for Alta fescue in solid stands. Rye grasses have certain advantages, however, that assure their continued production. Stands are more easily established; there is less variation in returns from year to year than there is with Alta fescue; they still are some of the most profitable crops that are grown on poorly-drained valley soil; and there is a large market for rye grass seeds.

In hill-soil studies, Highland bentgrass returned an average net of \$60 per acre; Chewings fescue, \$56; and Alta fescue in solid stands, \$71.

The net return from Alta fescue grown in rows was higher than that from solid stands. The net cost of producing Alta fescue in rows per pound was 9.6 cents compared to 7.6 cents for solid stands, but the higher yields in row fields made the net return per acre \$136

compared with an average of \$57 for solid stands. Another decided advantage of cultivating Alta fescue in rows is the possibility of maintaining high yields over a long period of time. The yield in solid stand decreases rapidly as the stands become older.

The cost studies present a true picture of the techniques and problems involved in grass seed farming. They will prove useful to farmers in selecting the most profitable kinds of grass seeds for their particular soils. Further, they will help farmers choose the most profitable methods of producing the crops they choose to grow.

### **Seed-Marketing Procedures Surveyed**

A desire among Oregon seed growers to learn more about the manner in which their products are marketed has prompted a study of market outlets for Oregon-grown seeds.

Twenty-six seed agencies throughout the state are supplying information on the hours of man labor and machine labor required to clean selected lots of various types of seed. Data on cleaning charges have been provided by cleaners. Producers and members of the trade were visited to determine specific difficulties reducing efficiency in moving Oregon seed from producer to consumer.

Additional data will be collected and evaluated this year and the foundation laid for a long-range program of seed-marketing research.

### **Control Sought for Clover Head Weevil**

Controls are being sought for the clover head weevil, which inflicted heavy white clover seed losses in the central Willamette Valley last year. Some growers reported damage so great from the weevil that it was not profitable to harvest their seed crops.

Initial control work was done on a 225-acre tract. Thirty pounds of benzene hexachloride dust per acre were applied by plane. Even though the field was badly infested with the clover head weevil, a better-than-average crop of 231.8 pounds of seed per acre was harvested. Additional work is being done this year.

### **Insecticides Stop Sod Web Worms**

More effective control of the sod web worm is indicated for the future by preliminary results of insecticide tests against both larvae and adults. The effects of cultural practices on the insect are also being studied.

Although it will be another year before recommendations can be made, applications of DDT and benzene hexachloride have been found effective in preliminary trials.

DDT killed 44 per cent and benzene hexachloride killed 60 per cent of the larvae found in test plots. Percentages of adults killed in field tests ranged from 76 to 90 per cent for DDT and from 81 to 93 per cent for benzene hexachloride. Toxaphene and parathion were also tested against adults but results were not so good.

Plans for additional work include testing the new compounds "118" and "497" for effect on the sod web worm larvae.

## POTATOES

### Insecticides Slow Disease Carriers

Applications of insecticide dusts are at least partially effective in controlling insect vectors—or carriers—of potato virus diseases. Many growers have adopted dusting as a standard practice since, in addition to eliminating the virus carriers, dusts also kill flea beetles, cucumber beetles, leafhoppers, and lygus bugs.

Information obtained from tests last year indicates that insecticide dusts for aphid control are most effective early in the season prior to the time roguing can be done. This is particularly true if the aphids move into the fields early and do not migrate over a long period of time.

The green peach aphid is the important vector of potato viruses in Oregon. It is not known where it overwinters, but large numbers fly into potato fields in the spring. It has been found that if control of aphids is to reduce spread of virus disease, the control must be almost perfect, especially in the early season. Parathion, the new organic insecticide, gave better control of aphids on small plots than any insecticide tested to date.

### Potato Diseases Investigated

A comprehensive research program on potato diseases was conducted during the year.

The virus disease leafroll, which causes serious losses of grade due to stem-end browning, continued to be the most important disease problem. Special grades had to be established to allow sale of these potatoes, otherwise hundreds of tons of potatoes would have been a complete loss. Studies on the control of leafroll and similar diseases were continued with major emphasis on the effect of disease spread when the vector population had been reduced. Indiscriminate selling of insecticides for virus disease control has been prevented by these studies.



This White Rose planting in the greenhouse shows the symptoms of the late-breaking virus disease. Tubers are forming above ground in the axils of the leaves. A broad program of research is underway on this and other potato diseases.

The need for clean seed to prevent disease led to extensive studies on special tuber selection, eye indexing, and plot isolations to establish several lines of foundation Netted Gem seed. Several seed lots of high quality were established.

The late-breaking virus disease was found to be distinct from other potato diseases and new to Oregon potato growers. Studies on its nature and behavior were completed.

Because potatoes are grown under widely varied conditions in Oregon, there are several areas with distinctly different disease problems. Seventy-two new potato varieties have been brought into the state for tests of resistance to certain of the diseases prevalent in each of the areas. The variety Calrose was distributed to five county



agents for planting and evaluation as to late blight resistance. It was reported highly resistant to late blight in all areas tested.

Preliminary tests were conducted on the effectiveness of several new fungicidal chemicals in preventing seed-piece decay. Zerlate and phygon were the most promising of the materials tested.

## **Chlordane Controls Tuber Flea-Beetle**

A soil treatment of 5 pounds of chlordane per acre gave 98 per cent control of the tuber flea-beetle in trials last year. No off-flavor was imparted to the potatoes.

Trials with the soil insecticide were conducted at Corvallis, Jefferson, and Astoria. In every case, control was at a high level. Field tests with chlordane, BHC, and other new soil insecticides are planned for next year. The development of a soil insecticide program that would require only one application at the time of spring plowing would be of tremendous value to commercial growers and home gardeners.

Complete control of the Colorado potato beetles and larvae was achieved in trials with 5 per cent DDT and 5 per cent methoxychlor dusts applied with a knapsack hand duster.

## **Irrigation Requirements for Potatoes Determined**

Potatoes are an important crop in small irrigated areas in and around the Columbia Basin. Climatic conditions are favorable to the potato industry and adequate marketing and processing facilities are available.

Investigations at the Umatilla Branch Experiment Station last year were aimed at discovering the best irrigation and fertilization practices for the crop in the area.

In the studies, no increases in yield were noticed on plots irrigated 21 times during the season over those irrigated only 14 times.

In fertilization tests, higher yields were obtained with increased amounts of nitrogen up to 120 pounds per acre at all the moisture levels. Splitting the 120 pounds into two 60-pound applications at the higher-moisture levels was advantageous. More increase was also obtained from manure applications at the higher-moisture levels.

Spacing trials with 36- and 18-inch rows showed higher total yields from 18-inch rows—but this was accompanied by a reduction in top quality potatoes. This reduction in quality was due mainly to the large number of small tubers found in the closer spacings.

## Quality Loss in Potato Marketing Studied

Oregon potato producers are at a disadvantage in competing in big eastern markets because of the long shipping distance involved. Studies on potato marketing are aimed at finding how Oregon growers can best handle their product in the face of this disadvantage.

Last year, the quality loss in marketing Oregon early-crop potatoes in Chicago were investigated. The over-all findings indicate that the quality of Oregon's early-crop potatoes is at least comparable to that of potatoes grown in other competing areas with the exception



Bruises received in transit were found to be one of the most important factors contributing to quality loss in the marketing of Oregon early-crop potatoes. Early potatoes were found more susceptible to bruises and decay than mature potatoes.

of California. Quality, however, can be improved. Such improvement might come through an increase in maturity; a reduction in mechanical injuries; and a decrease in the amount of decay.

Extremely early potatoes have been found very perishable and special care must be taken in handling them. The amount of mechanical injury appearing in the trials suggests that a reduction of injury should be possible with better handling from the growers to the consumers.

The stage of maturity and the weather conditions under which the potatoes are harvested are important factors in decay. Exposure of immature potatoes to summer weather—especially wind—lessens their resistance to decay. For best results, potatoes should be picked very soon after digging, carefully loaded, and delivered without delay to shipping sheds. Care should be exercised in the picking and shipping sheds and cars should be properly loaded.

Oregon growers cannot expect to compete favorably in marketing early-crop potatoes unless high quality potatoes are produced and unless the potatoes are handled carefully during the various marketing stages.

## HOPS

### Broad Research Program Under Way on Hops

Since 1930, the United States Department of Agriculture has cooperated with the Oregon Agricultural Experiment Station in the conduct of hop production, breeding, disease, and quality investigations.

A recently revised program carries five lines of work including: (1) hop breeding for improvement in disease resistance, quality, and yielding ability, (2) the development and improvement of dust and spray schedules for hop disease control, (3) the development of field and laboratory techniques relative to breeding and agronomic investigations on hops, (4) agronomic investigations relative to increasing and maintaining yield in hops, (5) chemical investigations relative to evaluation of hops.



The development and improvement of dust and spray schedules is part of the comprehensive program of research under way on hops.

A uniformity trial was conducted to determine the size and shape of plot, number of replications and the efficiency of experimental designs. The analyses of the data indicated that the use of small plots (1 x 5 hills) was effective in conducting experimental trials.

Tests indicated that in the Fuggles Variety highest yields were obtained by training two vines per string, 3 strings per hill; and greatest response to nitrogen and phosphorus containing inorganic fertilizers resulted from the application of 75 pounds of nitrogen plus 75 pounds of  $P_2O_5$  per acre. The increase in yield in pounds of dried hops per acre in comparison to the two checks (4 vines per hill and no treatment) was 340 and 320 pounds, respectively. The significant differences in yields obtained in the two trials did not affect the total soft-resin content of the hops produced.

### Standard Quality Test for Hops Studied

In an effort to establish a standardized system of hop-quality evaluation, methods of inspection and grading are being studied.

Investigations are to determine which factors of hop quality can be measured accurately, which factors can be analyzed quickly enough to be useful from a grading standpoint, and how well a set of grades can measure the hop quality.

Five hundred samples of hops will be analyzed for soft-resin content, moisture content, lupulin content, condition of lupulin, aroma, percentage of broken cones, and discoloration.

## FLAX

### Flax Varietal Trials Continued

Varietal trials were continued last year in the search for a high-producing high-fiber-quality flax that is immune to disease. More than 1,000 single-plant selections from the previous year were grown in the trials and the most promising strains were introduced into advanced yield trials. Many of the single-plant selections were discarded because of rust susceptibility.

Cascade fiber flax, released for commercial production in 1945 by the Experiment Station, received international recognition last year when a cooperative breeding institute of Holland, Sweden, and Denmark officially adopted Cascade as the foundation strain for future breeding work.

The problem of wax content is being studied. (Too much wax complicates the spinning operation.) In checks of fiber samples

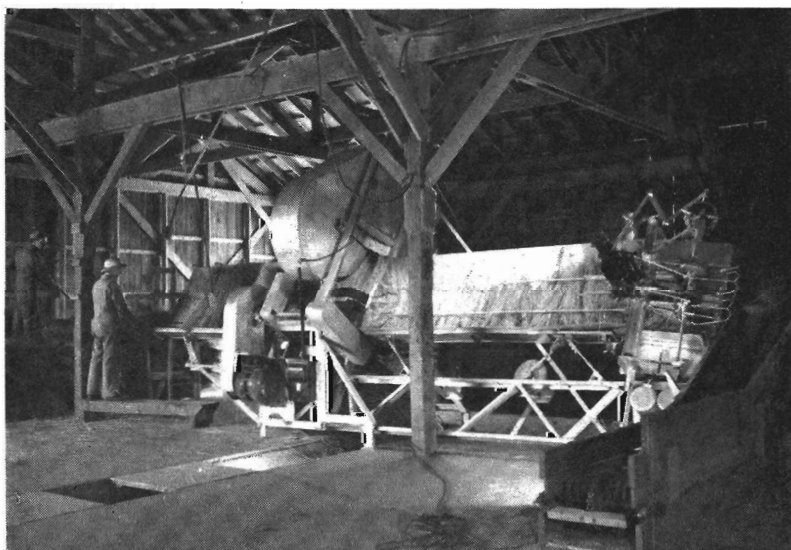
from various growing areas, no significant difference was found between varieties now being grown commercially. The biggest differences in wax content resulted from differences in the date of planting and date of harvest. Wax content is known to increase substantially in the last stages of maturity.

There was no significant difference noted in total wax content between samples from retted straw that had been turned during drying and samples that had not been turned.

### **New Deseeder, Puller Developed**

Engineering investigations of fiber flax processing last year produced a remodeled rotary-comb deseeder and a self-propelled push-type puller that promise to speed up flax operations and cut down production costs.

Automatic conveying, butting, and bundling equipment were incorporated in the remodeled deseeder. Tested under commercial conditions at the Mt. Angel flax plant, the deseeder was found to be better in several respects than previous models.



This remodeled rotary-comb deseeder cuts down labor requirements and speeds up flax operations at a saving to growers. Only two man hours are required to process a ton of straw with the new machine compared to ten man hours for the whipper and four for the early comb deseeder.



A crew of four men deseeded more than three tons of flax per hour on the new machine and bundles were of uniform size, with even ends. The capacity was increased from one ton per hour for the whipper and two tons per hour for the old rotary-comb deseeder to three tons per hour for the new machine. Labor requirements were cut to two man hours per ton of straw processed for the new machine, compared to ten man hours for the whipper and four for the early comb deseeder.

The new puller has many unique features. It carries a hydraulic lift to raise and lower the pulling section in adjusting it with relation to the height of the flax; an auxiliary gas engine to operate the puller belts making their speed independent of the tractor's forward motion; a double needle binder that ties two strings on the bundles, giving better protection and keeping the straw straighter; narrow pulling throats that pull the flax more easily; and wider pulling belts with a face of soft rubber that grips the flax straw more firmly and does less damage to the straw than the belts used on commercial pullers.

### **Season Affects Wax Content of Fiber Flax**

The wax content of flax fiber may be affected by the time of season in which the flax is grown, preliminary investigations indicate.

Flax planted early in the spring seems to have less wax than that planted late in the spring. Examinations of commercially prepared flax fiber from six producing areas of the Willamette Valley indicate that there is no relationship between wax content and the area where the flax is grown.

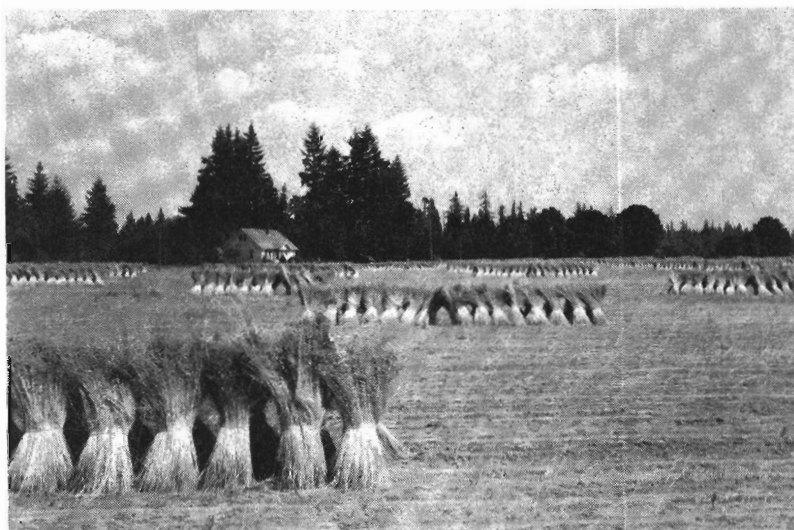
Rets varying in length from 68 to 164 hours had no effect on the wax content of the resulting fiber. Maturity studies showed that wax content increases with maturity but most rapidly beyond 80 days after planting.

### **Pulling Flax at Right Time Boosts Income**

Oregon fiber-flax growers can substantially increase their income by pulling the crop on the basis of maturity rather than convenience, according to fiber-flax studies.

When the flax is pulled at the proper time of maturity—in the early golden yellow stage—there is maximum quality and quantity of flax fiber, high seed germination and oil content, and low wax content. All of these factors are desirable for the greatest return to the grower.

The proper stage of maturity for pulling is when the majority of the green stems have turned golden yellow and have shed their



A substantial increase in income can be realized by pulling the flax crop on the basis of maturity rather than convenience. The proper time to pull the crop is when the majority of the green stems have turned golden yellow and have shed their leaves from the lower one-third of the stem.

leaves from the lower one-third of the stem, the investigations show.

In trials last year, this stage of maturity was reached between 78 and 85 days from planting. Because the time will vary from year to year with the weather and other growing conditions, inspection of the crop is the only sure way of properly timing the pulling operation.

It is the usual practice in Oregon to pull flax after it has passed the optimum stage of maturity. After the optimum stage of maturity, the line-fiber yield and quality begins to drop rapidly and the percentage of tow wax begins to rise. The high wax content makes the fiber difficult to handle by the spinners.

### Precise End-Point Sought for Flax Ret

The success or failure of a flax processing plant may depend upon the retting process. If the straw is retted too long, the fiber becomes weak and breaks during the scutching operation and the amount of line fiber is reduced. On the other hand, if the flax straw is removed from the retting tank too soon, the straw is found to be tough and the scutcher will not clean the fiber.

Retting studies are aimed at developing a testing method that can be used by the practical flax retter to determine a precise end-point for the ret. Such a method would reduce losses from retting that run into thousands of dollars annually.

Studies last year showed that the optimum constant temperature for retting is near 35° C. There are indications that fiber quality is improved when a four-hour rinse and a 10 to 20 per cent daily replacement is used. Source of water has been found to influence fiber quality, particularly color.

### **New Market Outlet Foreseen**

The development of a process for weaving Oregon linen yarn into heavy materials suitable for draperies, upholstery materials, rugs and coarse table linen by an Experiment Station home economist may open up a new market outlet for Oregon-grown fiber flax.

The new materials are attractive, durable, fire resistant and are easily cleaned. They can be made entirely of flax yarn or combined with other fibers. The possibilities for quantity production of the materials with power machinery is being investigated.

## **SUGAR BEETS**

### **Winter Temperatures Affect Seed Yields**

For the first time in more than 13 years of sugar beet seed production in western Oregon, there was some serious damage from freezing last year. The seed yield for the area, however, was the highest ever produced and the effects of temperature and other factors on seed production were the basis for intensive studies.

There is little evidence that variety influences yield, but temperature does exert an influence. The normal winter temperatures of western Oregon are conducive to complete reproductive development (thermal induction) in even the more bolting-resistant varieties of sugar beets overwintered in the field. Complete reproductive development, however, is not necessarily conducive to highest seed yields.

It is believed that winter temperatures which are less favorable for complete reproductive development—either below about 35° F. or above about 50° F.—may result in more vegetative vigor of the plant and higher seed yields. This helps to explain the record yields last winter when temperatures dropped below freezing for a considerable time.

In the Medford area, some plants in heavily fertilized plots—400 pounds per acre of ammonium sulphate at each of three side



The new selective weed killer, IPC, shows real promise for control of grasses in sugar beets. In this field trial, the two rows on the right received a late fall application of IPC at the rate of 3 pounds per acre. The two rows on the left were untreated and are overrun with grass.

dressings in the spring—fell over badly and restricted seed development on the under side branches. A possible remedy for this would be to delay application of some of the fertilizer until the bloom stage so as to get the effect more in size of seed ball rather than in stalk growth.

Applying half of the spring nitrogen as sodium nitrate was superior to straight ammonium sulphate. Potash appeared to be of no benefit. Germination was not affected by the fertilizer treatments.

Unthinned and 3-inch spaced singles were not injured as badly by freezing weather as were the larger beets from the more widely spaced singles. The 3-inch singles gave a slightly better seed yield than the thinned stand.

Studies of beet root development in compacted soils, showed that 15 to 20 per cent non-capillary pore space in the soil is essential for optimum beet root growth.

Strikingly improved crop growth has frequently been observed following burning of brush, straw, or trash piles on western Oregon soils. Preliminary studies indicate that some of the effects of such

burning are to make the soil less acid and to increase greatly the nitrifying power of the soil.

Uncompleted trials indicate that IPC may be very effective in controlling rye grass in beets provided due consideration is given to treating when the grass is either very small or not yet emerged.

## VEGETABLE SEED

### Research Aims for Better Seed Crops

Vegetable-seed crops are still relatively new in Oregon. Their intensive cultivation in certain areas is expected to make production problems and insect and disease hazards more acute. The vegetable-seed research program now underway includes studies to increase production of high quality seed per acre.

Culture and fertilizer requirements of some of the more important crops are being studied, along with developing new disease- and insect-control methods. Results of these studies will make it possible for growers to adopt certain field methods and techniques that will increase seed-production possibilities. For example, high cucumber-seed yields obtained in last year's experimental trials indi-



Cucumber seed yields ranged from 500 to well over 1,000 pounds per acre last year in experimental trials. These high yields indicate a possibility for the development of a profitable cucumber seed enterprise in Oregon.



cate that this phase of the vegetable-seed industry can be developed as a profitable enterprise in Oregon.

Despite the fact that extensive flood damage to overwintering seed crops destroyed much experimental information last year, a number of important results were noted in trials on cabbage, onions, table beets, cucumbers, and squash.

Tests with cabbage showed that best yields are obtained with high nitrogen levels and that smaller spacing between and within rows tends to increase seed yields. A cover crop interplanted in rows proved to be a sound soil-conservation practice. Comparisons of seed-to-seed and transplant methods showed yields from seed-to-seed and 45-day transplants were higher than those from 60-day transplants, but the 60-day transplants were higher in survival.

Cucumber investigations indicate highest seed yields will be obtained from earliest plantings. Nitrogen was the only fertilizer element that gave significant increases in green weights and seed yields. Pickling varieties outyielded slicing varieties tested but removal of pickle crops reduced seed yields.

Nine varieties of squash were tested for yield; and cultural practices for table beets were studied. With seed-to-seed table beets, slightly increased yields were obtained from unthinned stands, topped plants, and from two-foot row spacings. Transplanted beets failed because of an adverse season.

Culture and fertilizer trials will be emphasized in future tests with cabbage, onions, table beets, and cucumbers. Production methods and techniques will be sought which will improve seed quality, increase yields, and minimize insect and disease losses.

### **Cabbage Insect-Control Measures Studied**

Control measures for some of the important insect pests of cabbage seed crops were sought last year with emphasis on the cabbage seedpod weevil.

Benzene hexachloride was found to be the most effective insecticide available for control of the seedpod weevil, which causes from 10 to 30 per cent damage in many cabbage fields. It is regarded as the most serious pest of the seed cabbage industry. Timing of benzene hexachloride dust applications is important if the adult weevils are to be killed before they lay their eggs in the seedpods.

Observations have indicated that benzene hexachloride may have a toxic effect on immature grub weevils inside the developing seedpods.

Varietal tests showed seed losses ranging from 10.3 per cent for Ferry's Round Dutch to 30.5 per cent for Copenhagen Market,

Wisconsin All Season, and Marion Market. Weevil populations were apparently directly proportional to the amount of bloom present.

Parathion has given promising results for control of the cabbage aphid on seed cabbage, although nicotine preparations are still recommended. Work is aimed at developing an insecticide control which will be effective on both seedpod weevils and aphids.

## WEED CONTROL

### IPC Controls Quackgrass, Grassy Weeds

The search for more effective weed-control chemicals has turned up a new, highly-selective weed killer that shows tremendous promise for control of weedy grasses in a variety of crops.

Named IPC (for O-Iso-propyl-N-phenyl carbamate), the chemical effectively controls quackgrass and grassy weeds in legume seed crops, vegetable crops, various horticultural crops and orchards, sugar beets and perennial grasses. Results of field trials indicate that the use of IPC in Oregon could save farmers from 2 to 4 mil-



A demonstration of the effectiveness of the new selective weed killer, IPC, in controlling rye grass and blue grass in Ladino clover is shown here. The clean plot in the foreground received a treatment of 4 pounds of IPC per acre. The area in the background was untreated.

lion dollars annually on leguminous crops alone. Its overall value may approach that of 2,4-D.

Discovered in England but tried there and in other places without too much success, IPC's remarkable possibilities have come to light almost exclusively through the efforts of Experiment Station workers. IPC had earlier shown promise for quackgrass control in greenhouse and laboratory trials in England and other places in America but field trials were disappointing. It was found here, however, that applying the IPC in oil makes an effective quackgrass control. Disking as a post-treatment—a week or 10 days after the spray application—greatly enhances the effectiveness of the application.

One of the first commercial-scale trials with IPC was made on a 60-acre Ladino clover field near Medford. There the clover had been taken over by grassy weeds to the point where the average yield of seed was only 80 pounds per acre. Application of IPC eliminated the grasses to the point that the average yield jumped to 250 pounds per acre. The treatment cost approximately \$700. The net increase in return realized was estimated at \$5,000.

Use of IPC for selective grass control in *Lotus corniculatus* brought a net seed-yield increase of approximately 65 pounds per acre. This means an increased net return—above the cost of materials and application—of about \$70 per acre.

Other phases of the weed-control program last year produced a full-scale control program for a number of seriously increasing weed pests that inflict annual losses computed in millions of dollars.

Controls were developed for tansy ragwort, wild garlic, St. Johnswort, wild blackberries and for weeds in alfalfa and strawberries.

The new grass killer, trichloroacetic acid, was found to be effective on some grasses but is not as highly selective as it needs to be for control of grass in many of the crops being grown in Oregon. The weed-control programs for alfalfa and strawberries, which are built around IPC and dinitro phenols, gave savings of up to \$75 an acre in strawberries and from \$15 to \$30 an acre in alfalfa.

It was found that the sodium salt of 2,4-D and potassium cyanate may be safely applied to many of the bulb crops for weed control. Trials with corn showed that 2,4-D is not suitable for pre-emergence weed control but is effective as a post-emergent control.

The recently publicized herbicide, 2,4,5-T, was tested on 18 species of plants and its value as a control for wild blackberries was demonstrated.

## Progress Noted in Gorse Control

Substantial progress was made last year in the development of gorse-control programs in the southern coastal counties where this shrub pest has claimed nearly 25,000 acres of once productive grazing land.

Work with chemical combinations was expanded during the year in an effort to find those combinations that give the best control with the least cost. A new chemical, 2,4,5-T, showed real possibilities both on established gorse stands and as a selective in pastures. Most of the earlier gorse trials have included 2,4-D as the initial treatment with more severe-acting chemicals such as ammate and arsenite being applied later. This procedure was reversed last year because 2,4-D appears to be more effective on plants which have been weakened by previous treatment.

The results from the pasture trials show conclusively that pastures seeded on land cleared from gorse can be maintained effectively. A combination of close grazing with sheep, adequate fertilization,



Pasturing with goats has been found relatively effective in controlling gorse. The area to the left of the fence has been pastured with goats for four years since it was burned. The area to the right has not been pastured or treated since the burning.

and the use of selective sprays can keep gorse well in check. It appears that the combination of butyl ester of 2,4-D and 2,4,5-T used in the new pasture spraying may give much better control than the other selectives used. There are indications also that rolling before spraying may be of material benefit.

Demonstration trials were presented in several counties last year and gorse-control programs were initiated in Curry, Coos, Lane, Douglas, Lincoln, Clatsop, Columbia, and Clackamas counties. Because of the heavy production and the longevity of the seed and the extremely high resistance of the gorse plant, it does not appear possible to eradicate this pest entirely. It is certain, however, that infestations may be controlled and gorse acreage reclaimed.

### **Beetles Used in St. Johnswort Control Tests**

Attempts to devise a control for the noxious St. Johnswort weed by using beetles were continued last year. Two species of beetles, which feed only on the weed and do not attack forage or food crops, are being used.

A second colony of 1,200 beetles of one species was collected in California and released at Corvallis last year to augment the colony released in 1947. A colony of 3,500 beetles of the other species was also released at Corvallis and colonies of 5,000 each were released at Roseburg and Glendale Junction.

Inspections showed that both species survived the unusual 1947-48 winter which included 39 days of freezing weather. Continued study will be necessary to determine whether the spring generation will successfully pass through its life cycle.

Advanced tests on fields infested with St. Johnswort cannot be made throughout the state until the beetle colonies are well established and sufficient increases in numbers are accomplished.



## **Horticultural Crops**

### **TREE FRUITS**

#### **New Fruit, Nut Varieties Show Promise**

The scope of the fruit and nut variety-improvement program was greatly increased last year with the addition of 531 new varieties of fruits and nuts to the Experiment Station collection.

A search for new seedlings and bud sports was carried on throughout the Pacific Northwest and some promising material was found. Cooperative variety trials were set up at eight branch stations and experimental areas.

Although many of the project plantings are too recent for definite results to be available, some of the older fruiting varieties offer considerable promise.

Some new introductions of peaches appear particularly good. Varieties such as Hale Haven and Red Haven may prove to be of commercial importance in Oregon. The Melrose apple may prove



to be a commercial sort and the Red Jonathan appears to be an improvement over the parent variety. Among the Japanese plums, Santa Rosa and Shire appear to be the best of their type for the Willamette Valley.

While no new varieties have been officially released for use in the state, growers are already making extensive use of the results obtained. Propagation material is being furnished to many growers and nurserymen.

### Tree-Fruit Varieties Sought for Home Orchard

Tree-fruit studies, made last year at the Umatilla Branch Experiment Station, were aimed at finding varieties suitable for home orchards. Although this area is not adapted to commercial tree-fruit production, work has been continued in view of the increasing interest in the home plantings.

Results of variety trials indicate that spring frost is a greater



Some vegetatively propagated root stocks have been found effective in producing small, early-bearing fruit trees. Especially desirable for home gardens are these small Gravenstein trees bearing fruit in their second year. Other stocks are being tested to combine this early-bearing character on a slightly larger tree for commercial use.

hazard to fruit production in the area than winter damage. Attention has been centered on late-blooming varieties rather than those which are winter-hardy.

Performance records were kept on a total of 164 varieties of apples, pears, apricots, peaches, plums, and cherries. They were evaluated as to fruit and tree characteristics including time of bloom, hardness, susceptibility to spring frost, adaptability to the region, and susceptibility to insect and disease damage.

### **Dowicide C Reduces Pear Storage Decay**

In preliminary tests last year, pears treated with Dowicide C in the fruit wash have shown about 4 per cent less total decay after storage than those receiving the conventional washing treatment. With a state crop of several million boxes annually, important savings could result from partial control of decay losses. Dowicide C treatments have given good control of gray-mold rot, material reductions in canker rot, and slight control of blue-mold decay.

Continued study has been made of skin blemishing or friction injury in pears. This condition, which caused serious losses in the Hood River district in 1947, did not occur in 1948 after the packing of fruit which had been stored for periods of three months. Apparently skin blemishing is affected by certain unknown seasonal growing conditions which make the fruit more susceptible in some years.

During the past two years, the effect of fertilizer treatments on the chemical composition, physiological activity, storage life, and dessert quality of apples and pears have been studied. Differences in chemical composition between pears from nitrogen-fertilized plots and from nonfertilized plots were noted. Pears showing nitrogen deficiency tended to be coarser in texture and poorer in dessert quality than pears grown with nitrogen fertilization. No differences in storage life were noted.

Fruits from the low-nitrogen plots tend to be higher in total sugars and acidity and lower in total nitrogen than fruits from the high-nitrogen plots. Similar results were obtained in tests with Ortley apples.

### **Studies Aimed at Reduction of Pear Losses**

A reduction of pear losses due to blemishing and an increase in revenue through longer storage life were the aims of studies conducted last year on respiratory enzymes and volatile products in fruits.

Results indicate that substantial savings for growers will result if effective control of ethylene production by fruits or ethylene concentrations in storage rooms can be obtained.

Extensive laboratory and commercial tests have been conducted to determine what effect removal of volatile gases from storage rooms has on the keeping quality of pears. Bartlett, Bosc, and Anjou pears were used. They were kept in storage at temperatures of 30 to 31 degrees F. and some of the rooms were equipped with activated-charcoal scrubbers to remove the volatile products produced by the fruit. Other rooms were not equipped to remove these products.

In experimental tests, Bartlett and Bosc pears did not keep longer and did not have better quality. Anjou pears responded to treatment but to a lesser degree than was observed in previous years.

In commercial tests, Anjou pears failed to respond to treatments with charcoal scrubbers in the commercial storage rooms. This indicates that ethylene is not being effectively removed from commercial storage rooms. Methods are being studied for improving the efficiency of scrubbers in adsorbing the gases.

### **Hood River Pear, Apple Costs Analyzed**

It cost Hood River apple growers an average of 90 cents per loose box and \$1.47 per packed box to produce apples for market in 1947 and 1948. The figures came from a group of selected growers who are keeping supervised cost-account records.

The cost of winter pear production during the same period averaged \$1.05 per lug box, and \$1.17 per packed box. Bartlett pears for canning cost an average of \$1.64 per lug box, and \$73 a ton to produce.

The study, made at the request of fruit growers and processors, will enable the producers to plan their production programs more efficiently. Information also may be used in considering wages, shipping rates, and import tariff rates.

### **Oregon Wild Plum Planted Commercially**

More commercial and home plantings of the Oregon or Pacific wild plum are being made in Lake and Klamath Counties as the value of this native species for a plum-preserve product becomes more widely recognized.

Growing wild in Lake and Klamath counties, certain selections of the plum produce an excellent preserve of distinctive flavor. The species itself is a very hardy variety, a prolific bearer and a late bloomer that may be adapted to some areas of the state where few

fruits can be grown. Experimental plantings have been made by the horticultural department at the Klamath Experimental Area, The Dalles Experimental Area, the Malheur Experimental Area, the Southern Oregon Branch Experiment Station, the Umatilla Branch Experiment Station, and in Lake and Klamath counties with the cooperation of county agents and growers.

The project is concerned primarily with selecting the best types from the wild thickets for study and hybridization; finding the most suitable rootstocks for orchard production; and determining the pollination requirements of the species. The plum has been found to be self-sterile and requires cross-pollination.

More than 2,000 trees were propagated and distributed last year by the Lakeview Chamber of Commerce and its agriculture committee in Lake County. A 10-acre commercial orchard was planted this year in Klamath County. At least two other commercial orchards are in production in these southern Oregon counties.

### **Pollination of Weatherspoon Prune Studied**

Erratic production of the Weatherspoon prune in the Milton-Freewater section and elsewhere has prompted a study of the pollination requirements of this variety.

These studies, which have now been carried on through one growing season, show definitely that sterility is a problem with this variety. The studies also show that Italian is a good pollenizer for Weatherspoon, provided that pollen transfer recurs. Apparently, the problem is largely one of pollen transfer, since Weatherspoon often fails to set crops even when grown in close proximity to Italian trees. Attempts will be made to solve the pollen transfer problem through the use of bees or artificial means.

### **Thinning Aids Prune Orchard Recovery**

Thinning of stands shows promise as an aid in rejuvenating old prune orchards.

In tests last year, the blocks where one-half of the trees had been removed averaged 8,510 pounds of prunes per acre while the unthinned blocks gave an average yield of 6,516 pounds. The greatest yield per tree was obtained in the three-quarter thinned blocks, but the per-acre production in these blocks dropped to 4,636 pounds. Stem-end shrivel was prevalent in the unthinned blocks but was less evident in the thinned blocks.

Of the various cultural practices employed in the attempt to rejuvenate old prune orchards, thinning of stands has proved to be the most effective thus far.

### **DDT Proves Economical Prune-Thrip Control**

Latest studies on thrips control in prune orchards show that DDT is still the most effective and economical insecticide available. Comparable, but no better, results were obtained from the new parathion. Prune growers are using the DDT program with excellent results throughout the state where there has been a thrips problem.

Plans for next year's experimental work include investigating the effectiveness of applying sprays and dust by airplane. Airplane application may solve the problem of getting to the thrips in the early spring months when the orchards are often too wet for practical control by ground equipment.

### **Virus Diseases Under Attack on Broad Scale**

In an attempt to get maximum information in the shortest time on the virus diseases plaguing The Dalles area, the problem is being approached from several directions. Four Experiment Station departments—plant pathology, entomology, horticulture, and soils—are cooperating with The Dalles Experimental Area in carrying out a broad research program.

The virus diseases little cherry and Western X disease of peaches were first detected in Oregon orchards about 10 years ago. Since that time they have been inflicting increasingly heavy damages each year. In some areas of the nation and British Columbia, the viruses have ruined the tree-fruit industry.

That the same virus causes little cherry, Western X, and red leaf choke cherry disease was proved earlier by Experiment Station plant pathologists. The role, if any, played by apricots and prunes as symptomless hosts of the diseases is being studied now.

Another important phase of the work is concerned with finding the insects that carry the diseases. Insects under suspicion are being collected, caged in cloth bags, and used in supervised "feeding" trials. While still in the bags, they are permitted to feed upon infected trees and are then transferred to healthy trees in an isolation nursery plot. Any subsequent outbreak of little cherry or Western X disease can then be traced to a particular insect and controls may be developed.

To observe the relative rates of virus spread in sprayed and unsprayed orchards, a "knock-down" concentrated spray is being

applied to one-half of each of four orchards. The value of the sprays in checking the virus spread may be determined by a comparison of results obtained over a period of two or three seasons.

A second isolation area is being established 12 miles from The Dalles for use in the search for a cherry variety having natural resistance or immunity to the little cherry virus. More than 300 varieties of cherries will be planted in the area and trees will be systematically inoculated in an effort to produce the disease and to find resistant varieties. If an inferior cherry variety from a market standpoint proves to be resistant to the virus, a breeding program will be initiated to get quality as well as resistance in the variety.

Other phases of work deal with the value of virus-free nursery stock for establishing cherry orchards; the retarding of the spread of little cherry by tree removal; the effect of branch removal on checking spread of virus within an infected tree; and the value of Mahaleb root as a means of combatting little cherry.



The effects of "little cherry" are apparent in this striking comparison of healthy and diseased Bing cherries. An intensive program of research is underway on virus diseases in The Dalles area.



Insects suspected of carrying the virus diseases from tree to tree are caged in these cheese-cloth bags and allowed to feed on infected trees. They are then transferred to healthy trees to check whether they are carrying the diseases.

### Studies Aimed at Stopping Mineola Moth

Already beset with virus-disease problems, cherry growers in The Dalles section suffered additional losses last year from the Mineola moth. The moth, which made a sudden appearance, inflicted heavy damage in some areas. Some growers elected not to pick their cherries rather than risk possible rejection at the packing house because of Mineola larvae infestations.

The Mineola moth will be the principal target in next year's insect-control work by the entomologist who has been appointed on an emergency basis to work throughout the spring and summer at The Dalles Experimental Area. Other insects to be investigated include the Oriental fruit moth, pear thrips, green peach aphids, and cherry fruit fly.

The emergence times of the pear thrips and cherry fruit fly were charted last year. These insects will continue to be under



observation as a grower service. Parathion and hexaethyltetraphosphate were found effective in controlling green peach aphids in trials last year.

## Blossom-Thinning Sprays Tested

The most costly single orchard operation with apricots and peaches is hand thinning. With an eye on reducing this expense, trials are under way at The Dalles Experimental Area on the effects of growth-regulating chemicals as blossom-thinning sprays. Elgetol (sodium dinitrocresylate) was tested last year in various concentrations.

Preliminary results indicate that the blossom-thinning materials, if applied carefully, hold promise for reduction of thinning costs. Because there is a very real possibility of the caustic spray materials eliminating all of the blossoms, however, additional trials are planned for the future and must be made before recommendations are possible.

## Insect Program Started at Milton-Freewater

Fruit growers of the Milton-Freewater area will benefit from the newly expanded orchard insect control program launched last year. Studies are under way on the life history and control of all important insects of the area including the Lesser apple worm in cherries and prunes, the codling moth, the cherry fruit fly, pear and prune thrips, peach twig borers, thistle aphids, spider mites, rust mites, and the shot-hole borer.

The Lesser apple worm, originally a pest of apples, and a close relative of the codling moth, has become a serious pest of prunes and cherries in that area. The worm is readily controlled on apples with lead arsenate sprays but this program cannot be used on cherries and prunes because of the spray-residue problems on fruits that are sold fresh and unwashed in the market.

The cherry fruit fly first gained notice as a serious pest in the Milton-Freewater section last year when it caused moderate losses in the Fruitvale district. An effective spray control program has been worked out but the emergence time of the fly in the area must be checked to insure best timing in application of sprays. Because this area ships much of its cherry crop to the fresh-fruit market, it will be necessary also to determine how many spray applications will be needed for control.

## DDT, Cryolite Check Codling Moth

Information obtained last year from seasonal history studies of the codling moth will enable Oregon apple growers to time their spraying operations for greater effectiveness. A new satisfactory control for codling moth also was developed.

Seasonal history data were used to warn county agents and growers when it was time to apply insecticides for moth control. Methods and control materials have been improved to meet changing conditions.

Lead arsenate and calcium arsenate were used first as control insecticides, but the codling moth developed resistance to them. New materials were tested and DDT and cryolite were found to be satisfactory.

Three applications of DDT were made in experimental trials. The first two applications were made at the rate of 2 pounds of wettable 50 per cent DDT to 100 gallons of water. The third spray was 1 pound to 100 gallons. Results showed 99.2 per cent of the apples free from worms.

Cryolite was applied at the rate of 3 pounds per 100 gallons of water. Four applications were made. This control was 97 per cent effective against codling moths.

## Sprays Give Outstanding Control of Mites

Two spray materials, 88-R and S-1175, gave outstanding control of mites, and several other materials gave satisfactory control in spray studies conducted at the Southern Oregon Branch Experiment Station as part of the Western Cooperative Spray Project.

No specific tests were carried on last year for codling-moth control but excellent control again was obtained by growers where DDT was used according to recommendations drafted earlier.

All tests for spider-mite control were made on pear trees with 10 different materials under test.

The 88-R spray gave very satisfactory mite control over a long period of time. Some spray injury occurred in the first cover in the form of small brown spots on the foliage, but this was not considered of commercial importance. S-1175 also gave outstanding control and caused no spray injury. It is slow acting, but has a long residual effect and kills most of the eggs.

Dinitate satisfactorily controlled two-spotted and Willamette mites. In two plots, European red mite infestations built up toward the end of the season. This material caused some browning of leaf

tips, and toward harvest time an increasing number of leaves became mottled with yellow and dropped.

EPN miticide gave satisfactory control and caused no injury. Twenty-five per cent parathion was exceptionally effective against European red mite at  $\frac{3}{4}$  to  $\frac{1}{2}$  pound per 100 gallons. Good control of European red and two-spotted mites was gained with one pound dosages of 15 per cent parathion. Neotran gave good control of European red mites when applied at one-pound strength after the winter eggs had hatched. TEPP gave good control but a second application was necessary in 10 days. Some spray injury was noted.

Genitol 923, Arathane, and toxaphene did not give satisfactory control.

One-third pound Z-1 deposit builder was used with all materials except Dimite. DDT was added in the first and third cover sprays.

## SMALL FRUITS

### Improved Small-Fruit Varieties Sought

The breeding work with small fruits is aimed at the development of new commercial varieties for Oregon. While all small fruits are receiving attention, major emphasis is being placed on strawberries, raspberries, and blackberries used in freezing and canning. In some cases, emphasis is being placed on the factor of disease resistance. A number of varieties developed at the Experiment Station have been released within recent years. These include the Brightmore strawberry, the Willamette red raspberry, and the Pacific, Cascade, and Chehalem blackberries.

The work on red-stele resistant varieties of strawberries was pushed during the past year. In the work, 17,537 crosses were tested for resistance and of this number 2,045 were saved for field planting and future observation. In the course of these studies it has been found that the native wild strawberry is a good source of red-stele resistance. Other sources of resistance found were U.S. 3374 and Oregon 1815 and 2012.

About 2,700 new blackberry crosses bore fruit the first time this year. Forty-five selections were made from the group. Some of these appear promising from a freezing or canning standpoint. Final selections were made from a planting of 2,200 red raspberry crosses. Forty-three selections were made from this planting.

Variety trials of new selections were extended in various parts of the state.

## Prospects for Blueberry Culture Promising

Possibilities for the development of blueberry culture in Oregon continued to be promising during the past year. Research to date indicates that the high-bush blueberry can be grown successfully in the Willamette Valley and in other regions with comparable climatic and soil conditions. Essential requirements seem to be a good moisture supply, good aeration in the top soil and a high level of nitrogen fertility. Various mulches also appear to be highly beneficial.

The blueberry research program touches many phases of production, including variety trials, irrigation, soil fertility, soil mulches, pruning, pollination, harvesting, and storage.

The variety trials now include all of the varieties that have thus far been named and introduced. Some of the new introductions appear to be promising, but have not been sufficiently tested under Oregon conditions. Among the older varieties, Jersey, Stanley, Concord, and Dixie have given good performance. Jersey, while not an ideal variety in all respects, is vigorous and productive and bears fruit of good size and good shipping quality. At this time it appears to be fairly desirable from a commercial standpoint.



This section of the blueberry plantings at the Central Station horticultural farm is evidence that the high-bush blueberry can be grown successfully in the Willamette Valley. The small, retarded bushes at the upper right are in a plot that has not received nitrogen and point up the need for a high level of nitrogen fertility in plantings.

## **Grape Varietal Trials Under Way**

Varietal trials and studies on cultural problems of grapes indicate that future grape production in Or gon will probably be restricted to varieties suitable for certain specific uses on an industrial basis and to home selections.

There is a prospect of developing a wine industry if suitable varieties of grapes can be found but this task will be difficult because the varieties must be specific for different kinds of wine.

Experimental work forecasts some prospect for growing grapes to be used in the manufacture of unfermented grape juice, a limited opportunity for growing grapes for fresh marketing, but no possibility for the production of grapes for raisins.

Seven new varieties were set out last year as part of the varietal testing program and a number of old varieties were discarded because they failed to show promise either for use of the home gardener or for industry. Results obtained in the varietal tests form the basis for recommendations throughout the state. The long-arm system of pruning has been found to increase production by a considerable amount and to greatly facilitate the management of vineyards.

## **Strawberry Growth Problems Studied**

Observations on strawberry plants indicate that yields and quality are generally correlated with the carbon-nitrogen balance of the plants themselves. Yields and quality are lowered when the strawberry plants make excessive vegetative growth. The same is true when the plants lack vitality and make too little vegetative growth. Maximum production and maximum quality are obtained with plants that make moderate or average growth.

Strawberry varieties vary considerably as to their ability to make vegetative growth. On a given piece of ground, one variety may make sufficient growth for maximum production while another does not.

While all details have not been fully worked out, it is believed that the carbon-nitrogen balance in strawberry plants may ultimately be a reliable guide as to the application of nitrogen fertilizers.

## **Small-Fruit Diseases Investigated**

The search for controls of strawberry virus disease, raspberry yellow rust, and boysenberry stamen blight and dry berry was the basis for considerable research in the field of small-fruit diseases last year.

Studies of strawberry virus diseases have been centered around the establishment of virus-free certified plant stock, a necessary step before transmission or virus separation work can be attempted. Only 14 of 600 selected plants have failed to show disease symptoms in greenhouse trials. These have been isolated for future study.

Experimental applications of fungicidal sprays on raspberry plants have given satisfactory control of raspberry yellow rust. Tests have shown that timing is very important in spray applications for the disease. A delay of a few days may greatly reduce the effectiveness of the control. Applications made just as the unfolding buds of the raspberry plants begin to show green will give good protection during the critical period between the initiation of growth and the harvest season.

Lime-sulphur has been recommended as the best control material because of its availability, low cost, and consistently good results. Four gallons of commercial lime-sulphur per 100 gallons of spray have given best results.

Extensive observation of individual plantings of boysenberries was made to determine the possibility of reducing losses caused by stamen blight and dry berry. Results of the stamen-blight studies indicate that more work will be necessary to learn when the infection takes place. Work with the dry-berry phase has shown that there are a number of conditions with separate causes known as dry berry. One form is thought to be caused by mites, another by fungi, and a third by lack of moisture.

### **Berry Cost Study Completed**

A comprehensive study of the costs of producing berries for processing in the Willamette Valley was completed last year. Labor and yield were found to be the two most important factors involved in the production costs. The largest item of cost was labor, which ranged from 62 per cent of the total cost of producing strawberries to 75 per cent of the cost of producing red raspberries.

The cost of producing strawberries for processing in 1947—the year covered by the study—averaged \$537 per acre, or 15.06 cents per pound. The average yield was 3,529 pounds per acre.

To produce boysenberries, it cost an average of \$470 per acre, or 11.16 cents per pound. The average yield was 4,212 pounds per acre.

Loganberry production costs averaged \$441 per acre, or 12 cents per pound with an average yield of 3,674 pounds per acre.

The cost of producing red raspberries averaged \$609 per acre, or 12.94 cents per pound with an average yield of 4,705. Black

raspberry costs by comparison were \$347 per acre, or 15.81 cents per pound with an average yield of 2,195 pounds per acre.

The figures can be used by individual growers as a basis for judging the efficiency of their individual operations and for improving their farming practices. The processing industry can use the findings to advantage in planning their operations.

## **Control Sought for Omnivorous Leaf-Tier**

Suitable controls for the increasingly dangerous omnivorous leaf-tier were sought last year. The insect is considered to be the most damaging pest of strawberries, flax, and nursery stock in Oregon.

Research was done on the life history of the insect in order to determine the best time to apply control insecticides. Promising insecticides were tested in field trials but results obtained were not conclusive.

Continued research is planned. Since the insect is found only in the Willamette Valley and in south central Washington, control will depend on local research findings. If some method of control can be worked out, a major source of trouble for strawberry growers, cannerymen, nurserymen, and flax growers will be removed.

## **Wood Wastes Make Valuable Soil Mulches**

The value of wood wastes as organic mulches and soil amendments for horticultural crops has been definitely established. Investigations last year were expanded to include a study of the soil-management practices necessary with the use of such materials and the fundamental changes in plant nutrition that occur following their use. The strawberry, which is adaptable to this type of culture, is being used in these tests to measure plant response.

Previous studies have shown that such wood wastes as fir sawdust, if properly used, make a practical mulch without detrimental effects. If sufficient nitrogen-bearing fertilizers are applied with these materials to compensate for the nitrogen used during the decomposition processes there will be no detrimental effects to the crop and at the same time increased production due to improved conditions for plant growth may result.

The improved growing conditions are not fully understood, but are assumed to be the result of improvement in the physical, chemical, and biological properties of the soil. Future studies are directed toward a better understanding of these factors. The value of wood wastes as sources of organic matter for humus renewal needs to be





Strawberry mulches have been found effective in increasing strawberry yields. While the economics of this method of soil management needs further study, the mulch investigations are producing basic information on the nutritional requirements of strawberry plants.

determined and evaluated in terms of its effects on crop yields.

Although, the use of wood wastes, particularly fir sawdust, has not been generally recommended as a soil management practice, certain specialty crops lend themselves to this type of culture. Blueberries are a specific example.

## NUTS

### Controls Developed for Filbert Insects

The controls developed for filbert insects—moths, fruit tree leaf-rollers, shot-hole borers, and the omnivorous leaf tier—will mean substantial savings from insect losses for growers in future years.

The life history of the filbert moth has been worked out, making it possible to time the applications of insecticides properly. Under ordinary conditions the filbert moth may be controlled with two applications a year of lead arsenate spray or dust, or a DDT spray or dust. In well-spaced orchards DDT applied to the ground and lead arsenate to the trees gave better control than either chemical alone.

The fruit tree leaf roller, a serious filbert pest, may be controlled by DDT or DDD spray or dusts.

Shot-hole borers may be controlled with a DDT wash made up of one pound of 50 per cent DDT to five gallons water, applied just as soon as the infestations appear in early spring. A 100 per cent kill was observed at the Station when the solution was applied to tree trunks with a brush early in the spring. Delayed applications made after they were tunneled in failed to give any control.

Applying a 5 per cent DDT dust when the cover crop is turned under or when worms appear on replants will control the omnivorous leaf tier and may save almost a year's growth on newly planted filberts.

## **Defoliation of Trees Lowers Walnut Quality**

The importance of retaining foliage on walnut trees was demonstrated last year. Tests proved that anything which prematurely defoliates trees lowers the quality of the product. It may also decrease future yields.

Irrigation of walnut trees resulted in marked differences in vigor of trees, retention of leaves, and condition of kernels. Nuts from irrigated trees had 3 per cent more kernel meat and a lower degree of shrivel than those from non-irrigated trees.

Harvesting tests indicate that heat and drought probably combine to produce the dark kernels so often found in walnuts. Shaking walnuts off the trees before hulls are well cracked has resulted in increased shriveling.

The experiment has shown that there is nothing to be gained by rushing the harvesting and that mechanical shakers should not be used until the bulk of the walnuts have well-cracked hulls.

## **Filbert, Walnut Production Costs Examined**

A study of filbert and walnut production costs and practices was begun last year in an attempt to help growers reduce costs and increase efficiency of production. The study will be completed next summer.

Cost records for at least 100 representative orchards will be gathered and analyzed to determine the cost of production under various Oregon conditions. These figures can then be used by individual growers as a basis for judging the efficiency of their operations and for improving their farming practices. Industry can use the data to chart the position of nut growers in varied market situations.

An earlier study of nut production costs was made in the early 1930's when most of the Oregon orchards were still young and such

things as costs of establishment were fundamental. The new study will bring the findings up to date and will check the effects on production cost of various expenses or losses connected with mature orchards, such as fertilizing, thinning, spraying, and presence of "blanks" or shrivels.

### **Wet Weather Slows Filbert Harvester**

Wet weather has proved to be a serious handicap to filbert harvesting operations carried on with the suction-type harvesting machine developed by the Experiment Station. The machine has been found practical and workable in dry weather.

One major change was made in design last year. Rubber was added to the cleaning-cylinder auger in the dirt-cleaning unit. Wet weather prevented adequate testing of the new unit, however. Plans and procedures for constructing the machine were published last year.

## **VEGETABLES**

### **Rhubarb Varieties Tested**

Varietal trials of rhubarb were continued during the past year. Out of the 33 varieties under trial, 14 were selected for freezing and canning tests. Trials with these have not been completed but a few appear to be superior to those now being grown commercially. Some of the varieties will be released to growers in the future if they continue to perform in a satisfactory manner.

Efforts to find a control for "bolting" in celery and beets were continued. Ortho-chlorophenoxy-propionic acid was applied at intervals during the season at the rate of 100 parts per million. This material had shown promise in trials in the Midwest but in the tests at Lake Labish it gave only minor results on beets and no results on celery.

### **Controls Sought for Vegetable Diseases**

The search was continued last year for controls for three of Oregon's most perplexing vegetable diseases—celery blight, onion downy mildew, and sclerotinia disease or "white mold" of beans.

Encouraging results were noted in spray and dust trials for celery stands at Lake Labish. Every one of seven spray mixtures and four dust formulations gave almost complete control of late

blight, with the dusts tending to give slightly better results than the sprays. Tests are being continued in order to be certain of consistent results and in order to determine which of the materials are most effective and economical to use. The number of sprays or dusts needed per season to give maximum control of the disease is also being checked.

Onion downy mildew control trials were hampered by bad weather and flooding but the need for a fungicide that will stick to the surface of the onion leaf was apparent. In the future, special attention will be paid to finding more effective wetting and sticking agents.

An intensified program on control of white mold of beans indicated that there may be real chances for success with sprays or dusts in this area. Attempts to control the mold with sprays and dusts have not been successful in other sections but the climatic conditions appear to favor such control in the Northwest.

## Parathion Controls Food-Crop Insects

A new organic pesticide known as parathion has shown promise as an effective control for mites, aphids, and many other insect pests of vegetables and fruits. Studies show that if applied from a week to a month prior to harvest—depending on the crop—the pesticide deteriorates sufficiently to offer no hazard to the consumer. The material is very toxic to humans, however, and those who handle it in the orchards and fields should observe every precaution to avoid exposure.

Residue analyses were made for amounts of parathion deposited on apples, pears, cherries, berries, beans, Italian broccoli, and cauliflower to determine concentrations necessary for the control of the particular insect pests. Results indicate that parathion breaks down or volatilizes comparatively rapidly. The speed depends on the surface sprayed or dusted. On the waxy surface of an apple it was retained more than three times as long as on the surface of a leaf. Vegetables such as Italian broccoli retain large amounts and should not receive a dust application later than one week before harvest.

Studies on decomposition of parathion, DDT, and methoxychlor during the canning and freezing processes have shown that residues remaining on the processed foods are not enough to constitute a health hazard. In these tests, DDT and methoxychlor lost from 25 to 50 per cent while parathion lost as much as 75 per cent by decomposition.

Tests with a new spray machine gave more even applications

and equal control effectiveness compared with hand spray gun applications against codling moth on apples and pears. TDE, another new insecticide, was tested as a control for the orange tortrix and residue analyses showed that applications made a week or more before harvest do not leave a residue harmful to health.

### **Reason for Breakdown in Carrots Probed**

The mystery of the breakdown in carrots in a single commercial field near Eugene is still unsolved but research last year ruled out the possibility of the breakdown having been caused by a disease organism.

The report of the breakdown occasioned considerable worry in 1946 when it was first reported but the breakdown has not spread to adjacent fields despite flooding of the area which provided a carrier for fungi or bacteria present. Three departments—plant pathology, horticulture, and soils—have cooperated in the study.

It was found last year that there is a positive correlation between the date of planting and the amount of breakdown. Carrots planted late showed less breakdown than those planted in early plots but they were also smaller, of course, from the marketing standpoint.

### **New Insecticide Controls Symphylids**

A new insecticide—chlorinated propane-propylene—has been found effective in controlling symphylids, a troublesome soil pest that inflicts heavy damage in such intensive crops as vegetables, bulbs, mint, nursery crops, and flowers, and in home gardens.

The cost of the control program is high—upwards to \$100 per acre for materials and labor—but monetary returns from crops of high valuations more than pay for the cost of treatment. Controls have endured for three years and may last longer.

The fumigant is injected into the soil at the rate of 35 gallons or 350 pounds per acre at a time when the soil temperature is 55 degrees or higher. Since the chemical will kill existing vegetation, the best control period is during August or September after the year's crop has been removed. The effect on the soil is temporary, however. It is possible to plant a cover crop as early as 10 days after soil treatment.

It is necessary to pulverize the soil well before injections are attempted. Otherwise, the chemical, which turns to gas upon release, will not penetrate clods and the symphylids within the clods will survive.

Rotary tillage over a two-year period has brought about significant reductions in symphyliid populations. The increase in yields of crops has more than offset the additional tillage costs. Mechanical control of the pest by rotary tillage is not probable but conditions are apparently created which are not favorable for symphyliid development.

### **Soil Treatment Used Against Carrot-Rust Fly**

In small-plot tests with residual soil treatments for control of the carrot-rust fly last year, DDT, chlordane, toxaphene, DDD, and benzene hexachloride all showed promise. Additional tests are planned during the coming year to determine whether the residual soil treatments are practical and effective.

In addition to the soil treatments, DDT dusts applied by airplanes and DDT weedicides are being tested.

### **DDT in Formaldehyde Kills Onion Maggot**

DDT added to formaldehyde solution and applied at the rate of 2 pounds per acre gave excellent control of onion maggots again last year in field trials, and the treatment is now being suggested for growers who must use formaldehyde for smut control.

The new treatment is an improvement over the one used formerly in smut areas which combined formaldehyde for smut control and calomel for maggot control. That treatment produced some stunting of the plants.

The calomel (mercurous chloride) seed treatment is satisfactory for sections where smut is not a problem. With this treatment, the calomel is mixed with the seed at the rate of 2 pounds of calomel to 1 pound of seed. Both calomel USPXI and USPXI precipitated give control but the precipitate flows through the planter with less clogging.

The only drawback to the calomel treatment is the relatively high cost. Attempts to find a more inexpensive control treatment are planned for future years.

### **Toxaphene Dusts Control Squash Buds**

Well-timed applications of 5 per cent toxaphene dust will control squash bugs on Umatilla Marblehead squash without crop injury under either dry or moist weather conditions and will mean substantial yield increases.

The timetable found most effective calls for inspection of the field by June 1 for presence of bugs, and the first application imme-

diately after the first bug is seen. Two more applications should be made at not more than 10-day intervals following the first application and a fourth application should be made two to three weeks following the third.

In trials last year, it required about 45 pounds of toxaphene dust per acre for the four applications.

## Garden-Pea Sheller Developed

Time spent in shelling garden peas has been greatly reduced by the development of a mechanical garden-pea sheller. The labor-saving machine, although not yet perfected, is faster than hand shelling even when time spent picking over the product for unshelled peas is considered.

Changes made in the design of the machine last year included installation of rubber pads on the beaters and speeding up of the machine. This gave improved results and the percentage of unshelled peas coming through was reduced to a negligible amount.

Among problems still to be solved is the development of a means for separating small pieces of pod from the shelled peas. Also some shelled peas still escape from the machine.

Tests indicate that blanching peas in boiling water prior to shelling will aid in opening tight pods although it is of no advantage in the case of loose pods.

## NURSERY

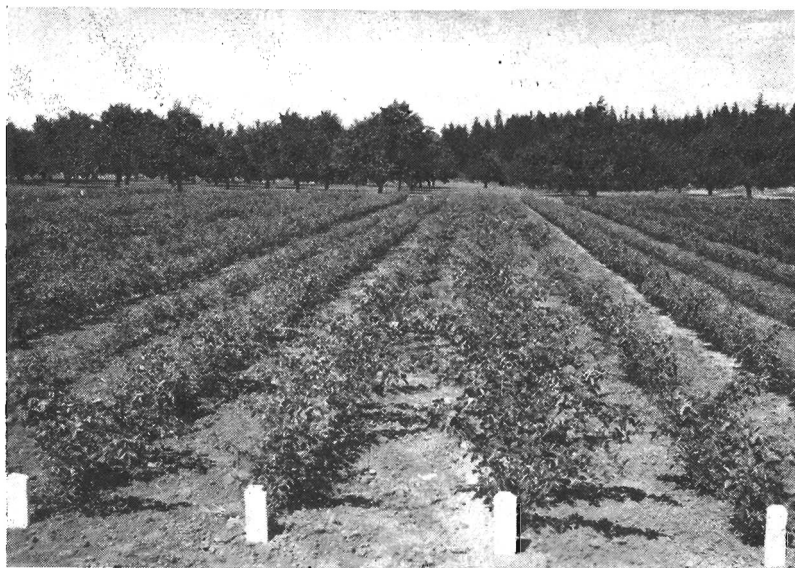
### Paper Mulch Used in Rose-Stock Production

Studies dealing with rose-stock production problems have reached the point where definite recommendations can be made to this important branch of the nursery industry.

The use of a paper mulch similar to that used on pineapples in the Hawaiian Islands has shown definite advantages in the production of field-grown roses by reducing the weed-control problem and by increasing the early spring growth that is essential for early budding and less labor. A study of budding methods promises to explain the cause of common bud-failures and to determine the most satisfactory budding period.

Some 20 *Rosa multiflora* rootstocks are being tested for selection of outstanding types for Oregon rose-stock production. The need for more uniform rootstock material of this species has long been realized. The questions of hardiness, ease of propagation, and com-





"Pineapple" paper mulches have been found effective in reducing weeds in rose stock nurseries and in promoting earlier spring growth for budding operations. The block of four rows in the center are fall planted; those at the right and left, spring-planted. The fall-planted rows, left to right, are standard mounded; 12-inch paper; 20-inch paper; and shallow planted without paper mulch.

patibility of these selections with important commercial varieties are being considered.

A method of defoliating field-grown roses with a chemical spray prior to digging and storage has been developed. A spray composed of Nacconol NR plus a summer oil emulsion has satisfactorily defoliated most varieties of hybrid teas in 10 to 14 days without injury to the plants. Studies are being made to determine the earliest stage at which these plants can be satisfactorily defoliated without reducing storage quality.

## Holly Investigations Expanded

Holly investigations have been enlarged into a separate horticultural project in an attempt to further the development of this increasingly important specialty crop.

One of the pioneer institutions in holly research, the Experiment Station has conducted studies on this crop for the past 15 years as

part of the over-all nursery crop project. The growth of the industry into an orchard tree crop in its own right and the pressing need for more information on production practices prompted the establishment of the separate program.

There are now approximately 1,000 acres of holly planted in the state with some 400 acres in production. The estimated return to Oregon growers last year was \$200,000. Prospects for future development are bright. The cool, moist climate of the Northwest is ideally suited to the production of top-quality holly, and improved handling and storage techniques developed at the Experiment Station permit marketing in distant eastern and southern areas.

Past work has concentrated on developing propagation techniques and on finding the best handling and storage practices. The new project centers around finding the best varieties for commercial production, determining the best cutting and pruning practices, and studying pollination requirements. It also continues the studies on handling and storage.

More than 60 holly varieties are now under test. Studies on pruning and cutting practices are being conducted in cooperation with holly growers in the Portland area.

### **Uniform Fruit-Tree Rootstock Material Sought**

The development of more uniform rootstock materials for fruit-tree production will be a decided advantage to both the nurseryman providing the planting stock and to the orchardist growing the trees. Such uniformity in these materials can be achieved in one of two ways—either by vegetative propagation or by careful selection of seed trees. Rootstock investigations will determine the feasibility of both of these methods.

Results during the first five years of tests comparing the production of commercial varieties of apples on various East Malling (British) clonal stocks as against seedling understocks show the advantage of certain of these Malling stocks in promoting early bearing. The increasing interest on the part of home owners and orchardists in these smaller, more uniform, earlier-bearing, and easier-cared-for trees emphasizes the need for further information as to the place of these trees in Oregon horticulture.

Experimental plantings of these trees at the Experiment Station and in certain orchards in Marion and Hood River counties are in their third year. Some fruit was produced on these trees this year. In coming years, these plantings will help to determine the relative cost of production of small, closely-planted trees as against larger trees planted at greater distance.

A program of seed-tree selection is now under way for the development of improved cherry rootstocks. Seed samples from over 50 trees in the Pacific Northwest and eastern plantings are being tested for germination, uniformity, and ease of propagation in the nursery. Eventually the best will be observed further as to their effects on orchard production. A similar program is needed for various other fruit-tree rootstocks.

### **Drying Gladiolus Corms Reduces Botrytis Rot**

Rapid drying of gladiolus corms will greatly reduce botrytis rot, according to results of storage studies made last year.

Various methods of botrytis rot prevention were tested. Quick drying, washing, and turning at a fast rate while drying were checked against conventional slow-drying methods of storage.

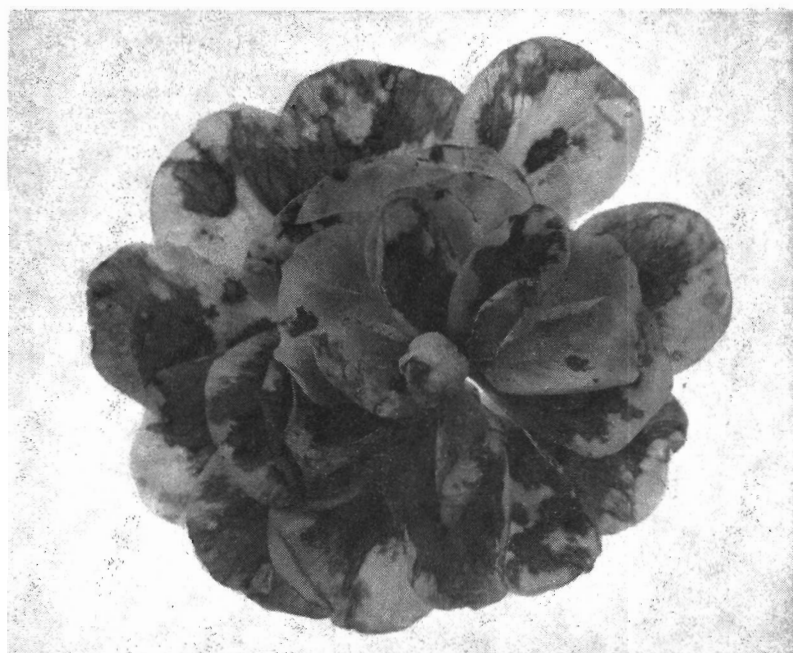
While rapid drying sharply reduced the rot over slow-drying methods, no significant differences were obtained between rapid drying for 23 hours at 95° F. and 15 hours at the same temperature. Washing apparently has no effect on the number of rots, according to test results. Turning for fast drying also resulted in little change. Application of good commercial practices, where drying began immediately after harvesting, limited losses to between 4.5 and 7 per cent.

### **Nursery Disease Problems Studied**

Because many different species of plants are grown in nurseries and because plants and plant materials are introduced from all over the world, disease problems are always present. Investigations are being conducted on several serious nursery problems including camellia flower blight, root rot of Mazzard cherry seedlings, lilac stem canker, crown gall, holly leaf spot, cypress root rot, and control of fungus and bacterial diseases of gladioli. Propagation of virus-free nursery stock is also being studied.

Camellia flower blight is the first serious disease of that plant to appear in North America. It was first reported in Japan in 1919 and was probably brought into this country with imported nursery stock. The disease may be recognized by the brown spots which develop on the petals of camellia flowers. Small at first, these spots become larger until the whole flower becomes brown.

The blight is caused by a fungus similar to the one that causes brown rot of cherries, peaches, and plums. The fungus is inactive in the bases of old, infected flowers from late spring to January, when it again becomes active and spore cups develop. The disease is spread with the release of spores from these spore cups onto other



Camellia flower blight may be recognized by the brown spots which develop on the petals of camellia flowers. These spots are small at first but become larger and finally cover the whole petal. No other part of the camellia plant is affected.

flowers. An extensive program of sanitation seems the best way to combat camellia flower blight and the Experiment Station has outlined and published such a program for home growers and for nurserymen.

A lilac stem canker disease has caused a number of nurserymen to abandon propagation of lilacs. Purple-flowered varieties are most severely affected, while white-flowered varieties appear to be immune or highly resistant.

A study of the development and use of virus-free nursery cherry trees has been conducted for the past six years in an attempt to find sources of sweet and sour cherry varieties free from virus diseases. As such trees were found they were distributed for future nursery propagation. Various chemical and physical methods of virus inactivation are being considered as possible methods of obtaining virus-free sources.

## **Croft Lily Nutritional Problems Studied**

Nutritional studies of the Oregon Croft lily are being made to determine whether scale-tip rot and certain physiological leaf blight disorders are associated with the nutrition of the bulb in the field or in forcing. The importance of the various fertilizer elements in determining the forcing quality of bulbs also is being considered.

Results indicate that a properly-balanced soil-management program is necessary for the high production of bulbs of good forcing quality. The possibility of a deficiency of certain elements in coastal bulb soils is apparent and these studies will make possible a better understanding of these needs. The importance of the lily-bulb crop to Oregon makes it desirable that information be made available to growers as to the nutritional requirements of this crop.

## **Fleck, Streak Diseases of Lilies Diagnosed**

Although fleck and streak diseases are not common in lily plantings in the Pacific Northwest, their occasional appearance in northern Oregon and southern Washington has constituted a menace to lily culture in these areas. Several attempts have been made to determine their origin and recent experiments have proved that certain plants in the garden can introduce these diseases into Croft lilies. Results of these experiments have provided the first definite proof that the sporadic occurrence of fleck in Croft lily plantings can be explained as an "escaped virus" from cucumbers or some of the many hosts that harbor western cucumber mosaic disease. Among these hosts primrose species and the common polyanthus are common in the area where streak has occurred and are regarded as a potential source of the disease. Polyanthus primroses containing the streak-inducing virus show no specific symptoms.

Three virus strains of western cucumber mosaic were isolated from cucumbers and one from a polyanthus primrose. The lilies receiving the cucumber strains developed various degrees of fleck disease. Those inoculated with the primrose strain developed the streak disease which is a severe form of fleck.

## **Controls Developed for Indoor Plant Pests**

Control of insect pests on indoor plants poses a real problem for greenhouse operators and home owners because conditions indoors are especially favorable for the increase and spread of these pests. Work was continued last year on control procedures and a circular of information issued which outlines detailed control measures.



Controls were developed last year for many of the common greenhouse pests including the mealy bugs, shown on a coleus leaf in this enlarged photograph. The wax covering on the bodies of the mealy bugs complicated the development of controls, but new materials—parathion or a thiocyanate—were found effective.

One of the most difficult-to-control of these greenhouse pests is the common two-spotted mite (red spider). Its small size—about one-fiftieth of an inch long—plus its high reproductive capacity, its devitalizing effect on plants, and its resistance to older insecticides combine to make it a real nuisance on indoor plants. Experiments showed the mite may be controlled, however, with some of the new materials including parathion or insecticides containing TEPP (tetra ethyl pyro phosphate). Dust containing one quarter of one per cent of the active parathion gives reliable control. Spray was effective when one pound of the 15 per cent powdered concentrate was used in 100 gallons of water.

Mealy bugs have a wax covering on their bodies which makes control with sprays difficult. Inclusion of additional wetting agent in a spray containing parathion or a thiocyanate was, however, found effective in control trials. Parathion spray is used at 1 pound of the 15 per cent concentrate in 100 gallons of water. Careful timing of

water sprays to remove the dead bodies of the females was found necessary in severe infestations in order to contact and kill the eggs beneath the females.

Parathion is also effective in controlling greenhouse whiteflies when used at 1 pound of the 15 per cent active concentrate per 100 gallons of water. Because the characteristic flight of the adult insects when disturbed makes it difficult to hit them with a contact insecticide, it is recommended that all plants in a house be treated at one time so that the whiteflies will have to alight on a treated leaf surface.

The control program developed for aphid or "plant lice" calls for the use of parathion, nicotine sulphate, or HFTP. Special care must be exercised in using the potent new materials—especially parathion—because of the danger involved to the user. Instructions and precautions should be carefully followed to avoid possible ill effects.

### Reliable Control Found for Orange Tortrix

The chemical  $D_3$  has been found reliable and safe in controlling the orange tortrix, a cane fruit and greenhouse insect pest that feeds on loganberries, youngberries, boysenberries, raspberries, and Himalaya blackberries.

The life history of the tortrix of cane fruit was studied so that proper timing of chemical applications is possible. The orange tortrix overwinters in the larval stage beneath leaves caught on berry cane thorns and in cane galls. The larvae become active in March and feeds on the new foliage.

Either a 5 per cent  $D_3$  dust used at about 40 pounds per acre or a spray used at the rate of 1 pound of 50 per cent wettable  $D_3$  per 100 gallons of water is recommended. Two treatments during the season are sufficient for effective control.

## FOOD PROCESSING

### Frozen Fruit Puree Dessert Developed

A very promising commercial type frozen fruit puree dessert was developed last year using boysenberries, strawberries, peaches, cantaloupes, sweet potatoes, and apples. Blending of fruits, especially in the case of high acid, strong-flavored fruits such as boysenberries, with milder fruits such as apples and peaches was found desirable.

Studies on the effect of ingredients and preparation procedures upon commercial type frozen fruit puree desserts showed that the kind and per cent of stabilizer used played an important role in the quality of the product.



Methocel (Dow methyl cellulose ethel) and gelatin were the two stabilizers that gave the largest overrun, had the most desirable melting-down characteristics, and were also easy to use.

The rich natural color, flavor, and sweetness of the frozen puree dessert give it real commercial possibilities.

### **Glass Fruit-Juice Concentrator Designed**

An all-glass vacuum fruit-juice concentrator, capable of condensing fruit juices while saving the aromatic flavors that would be lost with ordinary boiling, was designed and constructed last year in semi-pilot size.

The concentrator is now being used in extensive trials to determine its possible research or commercial use. It has several applications for research purposes, such as preparation of concentrates for subsequent fermentations. Commercially it could be used to reduce shipping bulk of juices to save transportation costs.

The all-glass construction makes it possible to see what is going on during the concentration process and to gather data heretofore unavailable.

### **Chemical Preservation of Food Tried**

The processing times and temperatures required for the proper canning of meats and non-acid vegetables, such as peas and corn, are known to be conducive to overcooking and consequently poor flavor.

A new research project was started last year to study the possible elimination of long-time, high-temperature processing methods by means of chemical preservatives. Trial procedures were standardized and the two most commonly used test organisms were prepared in the laboratory.

### **Flavor of Fruit Sirups Compared**

Flavor of fruits packed with corn sirup, puritose A and puritose B, and table sugar combinations were compared this year by a "taste panel." Taste tests were made to compare fruits which had been packed with 30 different sirup variations. Sliced and whole strawberries, raspberries, apricots, peaches, pears, and apples were processed for the study, and were used in the tests. The taste panel found that fruit packed with 40 degree and 50 degree sirups were superior to those packed in higher- or lower-density sirups.

Frozen and canned fruits were packed in consumer- and institutional-size containers, and were opened at different intervals through-

out the year. Tests for drained weight, net weight, volume of sirup, Brix of sirup, pH and Brix of mascerated fruit and sirup were made.

Jams and preserves were made with the institutional-size packs of all frozen fruits, except apples. Approximately 106 batches of jam were made to develop the best type of product, the best method of preparation, and the best level for replacement of sugar by corn sirups. Tests were made with 25, 33, and 50 per cent replacements. The 25 and 33 per cent replacements were found best.

## **Berry, Vegetable Varieties Tested**

Freezing and canning trials are run on varieties of fruits and vegetables found promising in breeding and varietal selection projects to determine their adaptability for use in commercial food processing.

Last year one raspberry cross, one strawberry cross, and one boysenberry cross showed promise for commercial processing and will be tested further. Four strawberry varieties, three raspberry, three blackberry, one loganberry, and one boysenberry variety were studied both fresh and frozen. Fresh fruit was tested for total acid, soluble solids, reducing sugar, and ascorbic acid (Vitamin C).

Samples were harvested in early, middle, and late season. The increase of ascorbic acid content in strawberries harvested late in the season was phenomenal—80 to 115 milligrams per 100 grams, nearly double the content of ascorbic acid in citrus fruits. Soluble solids and reducing sugar content increased steadily in all four strawberry varieties as the season progressed. No orderly variation in acid content appeared, however. Raspberries and blackberries did not show orderly changes in soluble solids, sugar, or ascorbic acid with changes in the season.

## **Snap Beans Tested for Industrial Freezing**

The introduction of bush varieties of snap beans to industrial freezing would mean a tremendous saving of money in harvesting operations. Last year four varieties of snap beans were graded, analyzed, and frozen to determine their suitability for commercial freezing.

Data obtained included the percentage yield after harvest and after processing, the total solids, Vitamin C, starch and crude fiber content of the fresh beans and the frozen beans after holding for 24 hours.

Research findings are promising but additional research is required before the introduction of new varieties or recommendations may be justified.

## **Frozen-Vegetable Standards Studied**

Correlation of enzyme activity with quality and storability of frozen vegetables was investigated last year as part of the study on determination of frozen-food standards. Information on the handling, preparation, and freezing of peas and corn was gathered in visits to commercial frozen-food plants. Samples of the vegetables were taken for storage tests at the food technology department.

Final compilation of the data will help the frozen-food industry know what constitutes quality in frozen vegetables.

## **Methane Gas Produced from Pear Wastes**

The economical utilization of cannery wastes and the reduction of stream pollution by anaerobic fermentation of food-processing wastes are being studied.

A 150-gallon fermenter was constructed for the production of methane gas and reduction of the B.O.D. (biochemical oxygen demand) of cannery wastes. Maximum gas production has been 10 cubic feet of combustible gas per pound of dry pear waste and 1.88 cubic feet per pound of fresh pear waste. Indications are that other cannery wastes may be successfully fermented by this method.

## **Retention of Vitamin C in Jellies Studied**

The retention of Vitamin C in jams and jellies is of importance in so far as it will contribute to the daily Vitamin C requirements in the diet. Studies to discover the factors influencing the Vitamin C retention in marmalade and synthetic jelly were continued last year. Factors under investigation included type of sugar used, type of container, amount of head space, and storage conditions. Findings are being analyzed.

## **Storage Losses of Grapes, Celery Reduced**

Reduction of storage losses of grapes due to mold development and reduction of micro-biological spoilage of cold-storage celery were two developments of tests on grapes and celery last year. Studies regarding protection by means of transparent, high gas, and vapor-transmission films in combination with liquid or gaseous one-time disinfection shows sufficient promise to warrant expansion into small-scale field tests.

Pilot-plant tests were made on 25 crates each of grapes and celery, treating freshly harvested products and holding them under typical cold-storage conditions. Analyses for physiological damage,



The value of proper treatments is evident in this comparison of pre-packaged celery samples after 120 days of cold storage. The celery on the left was untreated; the celery in the center was the best sample from the various treatments; and the celery on the right, the poorest.

microbiological contamination, color, flavor, and general acceptability were made.

A field test with 145 crates of celery was made. Three compounds were found in preliminary trials to reduce mold growth.

The results of the storage studies were very promising. Reduction in waste of cold-storage grapes and celery will be of direct benefit to the grower, the cold-storage warehouseman, and indirectly, to the ultimate consumer.

### Storage Tests Made on Filbert Butter

Filbert butter, produced in experiments on utilization of waste and surplus filbert nuts two years ago, was found to be at least as stable as peanut butter in storage tests conducted last year. The filbert butter is tasty, has good consistency, and has demonstrated considerable promise as a commercial product.

Last year's studies were aimed at determining whether the filbert butter could be held for a satisfactory length of time by the retailer and the homemaker. Tests proved that it can be when an anti-oxident is used to prevent rancidity of the oil. The study will be continued during the coming year.

Filbert oil proved to be one of the most stable oils in storage studies. Only a slight change was evident after two-year storage at room temperature. Filbert oil was found to be high in B vitamin content, especially thiamine.



## **Soil and Water Conservation**

### **SOILS PROBLEMS**

#### **Soil Survey Work Continued**

Another 100,000 acres of land were mapped in Douglas County last year as part of the Experiment Station soil survey, which now covers more than 11 million acres of land in the state. Field work in the Douglas area is expected to be completed next fall.

The survey, initiated in 1917, supplies a scientific basis for soil and water conservation and use, and lays the foundation for study of fertilizer needs and for permanent agriculture for each soil or farm. Preliminary inspections were made of North Tillamook, Baker, Eagle Valley, Lower Powder Extension, and Muddy Creeks last year and soil conservation districts and soil keys were established. Irrigability land classifications inspections were made of Baker, Starfield Extension, and Rogue River Basin projects at the request of the U. S. Bureau of Reclamation.

#### **Fertilizer Research Valuable to Farmers**

In 1949, fertilizer plots were maintained for the 29th consecutive year as part of the over-all program for developing a permanent

system of soil fertility. Field plots established 30 years ago at the Eastern Oregon and John Jacob Astor Branch Experiment Stations are now among the oldest field-fertilizer trials in the west.

The research program of fertilizers has produced findings that have been of untold value to farmers of the state. The fundamental importance of maintaining organic matter—the chief source of soil nitrogen—through the use of crop rotations, green manure and cover crops, crop residues, livestock-feeding enterprises, and manuring was established early.

Liming acid soils in northwest Oregon has been found essential for successful and continued growth of legumes needed for the maintenance of soil nitrogen. Phosphates have been found especially valuable on red-hill soils. Sulphur is needed for legumes, especially on basaltic soils, while boron has value in maintaining yield and grade quality of several commercial crops in the humid region of Oregon.

### **Wood-Waste Effects on Soils Evaluated**

There are vast quantities of sawdust and other waste wood products in Oregon which may be utilized for mulching or the improving of the physical properties of the soil. There is also considerable public interest in the best ways to use such products on the soil in order to get the best results.

To determine the value of the various wood wastes, and to find the effect of the wood wastes on the physical and chemical properties of the soil are the objectives of long-range soil and mulch trials.

Earlier studies have indicated that the lumber wastes do make long-lasting mulches that conserve moisture, keep the soil cooler in hot weather, and eliminate the need for cultivation. The necessity for using a nitrogen fertilizer with sawdust has been demonstrated.

Last year's trials with wood mulches on Chehalis silty clay loam soil showed that when nitrogen fertilizer is used with sawdust, plants make good growth.

### **Soil Erosion Project Established**

Soil erosion problems of the Columbia Basin are being studied on a broad scale at the Pendleton Branch Experiment Station following the establishment in late 1948 of a Columbia Basin Soil Erosion Project, operated in cooperation with the Soil Conservation Service.

The objectives of the project are threefold:

1. To develop a practical conservation farming program for the Columbia River Basin that will provide the necessary protection from



A Columbia Basin Soil Erosion Project has been established at the Pendleton Branch Experiment Station to study problems of erosion and soil management. In this fall-seeded wheat field in the Columbia Basin, the run-off of spring waters took a heavy toll in top soil.

erosion, will be the most economical to follow, and that will produce the highest yields.

2. To determine practical and economical agricultural methods, including seed-bed preparation, maintenance of soil fertility, seeding and harvesting of crops in conjunction with stubble mulch and other conservation practices found to be necessary to control erosion in the area.

3. To determine the types of farm implements best adapted to farming with the conservation practices necessary to control erosion, and to determine the most effective method of using these implements under different soil, slope, and cropping conditions.

Field-scale plots will be set up in the various rainfall belts of the area and tillage plots will be established on each site to test the adaptability of the various implements to the most promising tillage systems.

Results of the project will provide farmers of that area with a pattern for economical and effective soil use and conservation.



## Depleted Red-Hill Soils Rebuilt

The extensive soil fertility trials being conducted at the Red Soils Experimental Area demonstrated again last year that the depleted red-hill soils of the Willamette Valley can be rebuilt if the soil is managed wisely and if attention is given to finding crops adapted to that type of soil.

Humus, green manure, lime, and phosphate soil-fertility trials were conducted again last year as a basis for fertilizer recommendations in that area. The need for liming and phosphating the depleted red soils has been proved throughout the years. Limed plots have produced yields of red clover which were double those of unlimed plots. Grass and legume-seed yields also have been doubled with fertilizers.

## Arsenic Soils Made Productive

Arsenic control in old orchard soils has posed a real problem for farmers in southern Oregon but the Southern Oregon Branch Experiment Station has continued experiments and shown that with a sweet clover and soil sulphur treatment the arsenic soils can be made productive for cereals.

Large amounts of lead arsenate were used as a spray in apple orchards of that area for many years before the 1930's, and large concentrations had built up in the soil under the trees. Chemical analysis of the soil on the Branch Experiment Station showed as high as 1,600 pounds per acre of lead arsenate spray residue still present in the top eight inches of soil.

In 1948, yields of certified Kanota spring oats on a sweet clover and soil sulphur treated plot yielded 56 bushels per acre while in an untreated field across a 20-foot roadway the yield was 15 bushels. Spring wheat on treated soil produced up to 60 bushels per acre and spring seeded velvon barley as high as 85 bushels per acre.

## Orchard Soil and Fertilizer Problems Studied

Soil management and fertilizer practices suited to the orchard area of The Dalles are being investigated at The Dalles Experimental Area with particular emphasis on permanent grass sods, fertilizers, and erosion control.

Fertilizer trials are not advanced enough to permit significant growth responses and yields, but it has been observed that nitrogen had a striking effect upon fall and spring cover-crop growth.

Trials with permanent grasses and legumes show that unless large quantities of irrigation water and nitrogen are available, cherries

and peaches cannot be grown in a permanent grass sod under the climatic conditions existing at The Dalles. If adequate sprinkler irrigation and nitrogen are available to support both tree and grass growth, the problem of soil erosion is virtually eliminated and yields are increased.

Grasses such as sheep fescue, which have low moisture and nitrogen requirements and which have shown well in test plots, will be given further trial next year.

## **Turkey Droppings Boost Crop Yields**

Turkey droppings may be expected to increase crop yields if growers will range their birds on land that can be cropped in succeeding years, according to results of experiments conducted at the Umatilla Branch Experiment Station.

Studies included an analysis of the effect of nitrogen fertilizers on Sudan grass following turkey dry lot. Various applications of fertilizer were made on plots with concentrated turkey droppings and with scattered droppings. Higher yields were obtained from the plots with concentrated droppings.

Experiments were started last year on the effect of nitrogen fertilizer on corn following turkey dry lot.

Corn was planted on a plot used as a turkey dry lot during the 1949 breeding season. Various applications of ammonium nitrate fertilizer were made. Half of the fertilizer was side-dressed when the corn was 12 inches high and the remainder when it was 36 inches high.

Yields of 147 bushels per acre were obtained without the addition of the fertilizer. Adding either 80 or 160 pounds of actual nitrogen per acre did not increase the yield.

## **Fertilizers Needed on Grass Pastures**

Satisfactory yields of grass pasture cannot be obtained on the very sandy, shallow, and low-fertility soils in the Columbia Basin without the use of fertilizers, according to 1948 and 1949 tests at the Umatilla Branch Experiment Station. Fertilizers high in nitrogen are especially effective.

Various applications of nitrogen fertilizer on an established orchard grass pasture all produced greatly increased yields over the untreated plots. The best yield was produced by the test plot given the highest nitrogen application. The yield from nitrogen plus phosphorus was higher than nitrogen alone.



Nitrogen fertilizer brought good returns on this field of Chewings fescue. The plot on the left received an application of 100 pounds per acre of ammonium sulphate in early October plus an application of 400 pounds per acre of calcium cyanamid in February. It produced more than 600 pounds of clean seed per acre—more than twice the yield of the plot on the right which received no nitrogen.

### Fertilizers Increase Alfalfa Hay Values

Using sulphur, and a mixture of sulphur and boron as fertilizers on alfalfa fields will not only increase yields but may also improve the nutritive value of the hay, according to trials conducted last year.

In tests last year, three lots of lambs were fed hay from three different alfalfa plots. One plot was fertilized with sulphur, the second with sulphur and boron, and the third was not fertilized. Lambs fed on sulphur-fertilized alfalfa hay gained 43 per cent more than lambs on the non-fertilized alfalfa, and lambs on the sulphur-boron-fertilized hay gained 28 per cent more than those on the untreated plot. Hay refusal was about the same for all groups.

The fleece of each sheep was examined carefully after the trials and none of the animals indicated any sign of malnutrition. Every fleece was bright, lustrous, and strong. Studies of the effect of hays from plots treated with sulphur or sulphur and boron on the reproductive organs are planned for the future.

### Potash Needed for Some Oregon Soils

Last year trial plots revealed that efficient use of potash produced striking results on mint and black raspberries. Good response was noted with potatoes and slight response with fiber flax.

Potash has been found needed on acid peats, leached sandy soils, and worn grain land with tight subsoils when they are turned to production of intensive crops. Where high-potash fertilizer is used, attention should be given to the magnesium supply. A pre-



Potash deficiency in the soil produced leaf scorch in the mint plant at the right. The normal plant growth on high potash soils is shown at the left.

liminary map of available potash levels in Oregon soils was prepared last year. Some soil areas in eastern Oregon and more extensive areas in western Oregon were found to be unfavorably low in available potash.

### **Importance of Minor Elements Demonstrated**

The importance of minor elements on certain crops and soils was demonstrated again last year in minor-element studies. Elements under investigation include boron, copper, manganese, and zinc, along with inorganic toxins.

Many leached western Oregon soils and some eastern Oregon soils have been found low in boron. Optimum and critical concentrations of boron vary widely with Oregon soils and crops, however.

Dormant copper sulphate sprays gave results similar to soil applications. Manganese on muck soil increased the yield of mint oil but not its quality. Selenium was found unfavorably high in certain local sedimentary areas in south central Oregon at around 3,000 feet. Zinc trials are being conducted on raspberries and potatoes but recommendations are not yet possible.

### **Grazing Best Use for Jefferson County Land**

Continued use as grazing land under Federal supervision is the best agricultural utilization of 118,000 acres of Federally-owned land in the Central Oregon Land Utilization Project in Jefferson County, a land-use study of the area showed this year.

The study was initiated at the request of the Jefferson County Court and county land use committee to decide if the county would profit by having the lands returned to private ownership and if grazing was the best land use.

Grazing was cited as the best utilization of the land in the light of low wheat yields and the prolonged droughts and crop failures which may again occur in that area.

### **Effects of Insecticides on Soils Investigated**

Investigations into the possible effects of soil insecticides and selective herbicides on soil micro-organisms and soil fertility were initiated last year.

Concern that continued use of certain soil insecticides might possibly lead to lower crop yields and even soil sterility has prompted intensive research. Similar problems are faced with selective weed killers and general herbicides.

Efforts with both soil insecticides and selective herbicides have been concentrated on determining the effects of field applications on numbers and kinds of micro-organisms and specific microbial functions such as soil respiration, ammonification, and nitrification. Screening tests will be made on the various insecticides and the pure chemicals used as herbicides.

## **IRRIGATION AND DRAINAGE**

### **Economy Stressed in Irrigation Water Use**

More effective use of irrigation water in the Willamette Valley is now possible as a result of continued investigation of irrigation and soil moisture problems.

Economical use of available irrigation water is expected to become increasingly important in the Willamette Valley in the future even with improved storage facilities. Investigations show that while a total of 740,000 acres of good irrigable soil types are available, it is physically possible to supply irrigation water for only 414,000 acres in the Valley.

Irrigation requirements for a number of crops have been determined and the comparative efficiency of surface and sprinkler applications of water has been studied.

On Chehalis silty clay loam, the net irrigation requirement of mint has been 12 inches for the past two years. It was 16 inches for alfalfa.

On Willamette silty clay loam, maximum potato yields were obtained with 7 inches irrigation while fiber flax did best with 8 inches and Alta fescue with 11 inches. Two 4-inch irrigations of new clover seeded in oats and vetch produced 1-ton hay yields while un-irrigated clover lay almost dormant.

Sprinkler versus surface irrigation trials showed a marked advantage last year for the sprinkler system. Application efficiency was 59 per cent for surface irrigation and 71 per cent for sprinkler applications.

Intensified study of application efficiency in irrigation will be the focal point for future investigations.

### **Grasses, Forage Crops Speed Irrigation**

Increased use of grass and forage crops on sloping, slowly-permeable soils in eastern Oregon will give better infiltration rates, reduce run-off waste, and conserve time in irrigation, according to tests at the Malheur Experimental Area.

The value of well-established grass sod for speeding water intake into the soil and lateral spread through the soil has been demonstrated. Measurements of the relative downward and lateral spread of water in soils have shown lateral movement to be a greater problem than downward movement. Measurement with Bouyoucos blocks has shown lateral movement to be remarkably improved by grass sod in its third season.

Moisture tests in the area have shown that neither corn nor grass use any appreciable amount of water below 18 inches. This indicates that a barrier exists in the sub-soil which is even greater to roots than to moisture. Soil samples taken from so-called non-saline soils frequently show considerable salt and sodium, which restricts the root zone and indicates that there may be salty soil scattered through much of the area.

Field trials on the eastern Oregon "slick spots," which are caused by high sodium content, show that these soils can be reclaimed by treatments of manure plus gypsum and manure plus lime. These treatments have increased water infiltration rates and given better grass stands.

### **Sprinkler Irrigation Problems Investigated**

As part of the over-all study of sprinkler irrigation investigations were started last year on irrigation pipe and pipe materials, sprinkler system designs, and operating problems of sprinkler systems.

Surveys of irrigation equipment and methods were made in Medford, Hood River, and The Dalles sections as a means of determining the irrigation problems of these respective areas. Future work will be aimed at solving these problems with the establishment of irrigation systems and methods adapted to the local needs.

### **Best Land-Use Sought for Irrigated Areas**

To help in the effective planning and development of new irrigation areas, a long-range study of the land-use problems on irrigated projects was started last year on farms on the North Unit of the Deschutes Irrigation Project in Jefferson County. At present only limited information is available upon which to base recommendations for land use and size of farms on various grades of land under new irrigation projects. The new study is designed to supply this information, to facilitate planning of new projects, and to assist farmers who are going onto the project in farm planning and operation.

The capital required to operate farms under new irrigation projects will be studied including such items as cost of preparing

land for use and capital needs during the early years of farm development.

Records of selected farms on each of the various land classes were collected last year and will be analyzed to determine the land use adjustments needed on soils of various quality. Year-to-year records from these farms will be gathered during the next five years as a means of charting the growth and development of the newly-irrigated farms.

### **Snow Survey Aids Water-Management Program**

The need for a program of efficient water management is being more fully realized as the western areas approach the point of complete utilization of water supplies. A valuable tool in water-supply management is the snow survey, which measures the amount of water stored in snow on remote mountain watersheds. This information, plus data on watershed soil moisture conditions, makes possible accurate forecasts of water flow. Surveys have been conducted in Oregon for the past 19 years and last year's survey again proved of great value to agencies planning and administering water resources.





## **Livestock**

### **GENERAL LIVESTOCK PROBLEMS**

#### **Progeny Tests Basis for Selection Program**

Great variation in rate and economy of gains noted within and between sire groups affords opportunity for effective selection and improvement of livestock, research has shown.

Records compiled on 29 calves fed individually in 1947 and 1948 show a great variation in gains per day and amount of feed required per 100 pounds of gain, greater feed efficiency of the rapidly gaining calves, and greater gains of bulls over heifers.

A comparison was made between 8 animals of the 29 on test that were gaining the best and 9 animals gaining the least in the feeding program. The test shows feed costs of \$19.06 per 100 pounds of gain for the better gaining calves and costs of \$26.58 per 100 pounds of gain for the poorer gaining animals. The less economical group of animals required 40 per cent more feed per 100 pounds gain than did the more efficient group of 8 animals.

Rapid gaining calves are more efficient in feed utilization than slow gaining animals. This indicates that under practical conditions, marked improvement can be made by selecting cattle on the basis of

*rate of gain* where it would be impractical to feed the animals individually in order to learn the amount of feed consumed by each.

Studies at the Squaw Butte-Harney Branch Station during the last eight years show that cancer eye seldom occurs in red-eyed Herefords, whereas white-eyed Herefords may or may not develop cancer eye depending upon irritation and genetic susceptibility. Larger calves at birth are generally the larger ones at weaning and mature cows wean heavier calves than younger cows. Larger cows have heavier calves at birth and wean heavier calves than smaller cows, making it essential that allowances be made for age and size of dam when selecting beef cattle for heavy weaning weights.

After progeny testing with one cooperator, it was found that calves from a better sire gained 0.4 pound more per head daily during the winter feeding period than calves from another bull, although both bulls were purebred animals equally outstanding in appearance.

Impressed by the breeding improvement program, 4-H club members in many cases are buying good steer calves at weaning from producers that can show records of rapid gains in their cattle.

Relation of growth rate, fattening ability, and live-animal appraisals will be determined in the future. An effort will be made to determine if cattle that do well under feedlot conditions will make efficient use of roughage and pasture.

## Beef Cattle Disease Losses Reduced

At least 20 serious disease problems confront the beef industry of the state, inflicting an estimated \$5,000,000 loss annually. Research is aimed at reducing these losses and notable steps forward have been made in recent years.

Oregon ranks at the top of the national list with its brucellosis elimination program developed by the Station. Research last year included current work on brucellosis control along with these other diseases:

Calf scours: Sulfathalidine, which was introduced in eastern Oregon in 1945, has been used extensively and has proved quite satisfactory in controlling the disease. The use of folic acid in a small number of calves did not appear to have any effect on the occurrence of scours.

White muscle disease of calves: Recognized as a serious problem in the beef raising counties of the state, white muscle disease also has been reported in the Willamette Valley. It is definitely not associated with what are considered poor feeding conditions. Alpha-tocopherol gave no apparent protection last year in trials.

Urinary calculi: Calculi collected and analyzed last year were found to consist mostly of silicates. Blood samples collected from calves in affected areas were found to contain normal carotene.

Scab mites: DDT and benzene hexachloride both appear to be effective in controlling scab mites, but benzene hexachloride proved toxic for calves in dilutions as low as 0.1 per cent.

Poisonous plants: Only nematode free fescue screenings should be used as feed. Pastures containing English ryegrass and *Senecio jacobii* should be used with care.

### New Beef Barn Provides Research Facilities

Construction of a new, scientifically-designed beef barn that provides needed facilities for expansion of beef-cattle research is nearing completion, with only interior finishing work still to be done.

The first of its kind in the country, the new one-story structure will house 150 animals, complete with modern laboratories that will be used in breeding and feeding studies. The artificial insemination laboratory is one of the best equipped in the nation.

The main section of the barn is 240 feet long and 46 feet wide.



Expansion of beef cattle research will be possible in the future with the completion last year of the new, scientifically designed beef barn. The barn provides housing for 150 animals, complete with modern laboratories.

Use of prefabricated laminated roof trusses has eliminated the need for support posts in this section, permitting operation of mechanical cleaners. Individual stalls for feeding 54 calves are provided. They will be used in tests on the efficiency of feed utilization by calves and in the development of efficient strains of cattle within breeds.

Four half-open concrete wings, each 25 by 72 feet, project from the north side of the main section, and two 90-ton silos are built at the back. Three of these wings will be used as loafing sheds by the herd during the rainy season and the fourth will house the herd bulls. The loafing sheds have clay floors and open on to concrete corrals as a means of eliminating the mud problem.

The old college beef barn was destroyed by fire in 1946. The new structure is almost completely fire proof. Walls are made of concrete to ceiling level. Hay is stored in a separate, all-metal, Butler-type building.

## Fertility Tests Made on Farm Livestock

Low-fertility livestock means low incomes and lost profits. Because the fertility problem is of tremendous importance, a comprehensive, long-range program on measurement of fertility of farm livestock is being conducted.

Findings of studies on semen evaluation have been used to advantage on a commercial basis in herds of the Oregon Dairy Breeders Association. Four tests have been found helpful in predicting semen quality but there is still real need for a more rapid method.

A blueprint and list of material needed for construction of a dummy cow for use in semen collection have been developed and are available to the public. The dummy is adaptable to the size of the bull and is safe because of its flexibility, sturdy construction and padding. An improved artificial vagina for sheep also has been developed.

Prolonged use of thiouracil or thyroprotein for growing rams has proved harmful rather than beneficial in trials to date. Thiouracil-fed ram lambs responded for a period of about two months with greater body weight but then began to lose appetite and failed to grow. Thyroprotein-fed ram lambs, especially Romneys, became nervous and irritable. At mating, the rams became almost unmanageable because of extreme excitement. Semen from treated lambs was about normal.

There is evidence that thiouracil fed to swine for a limited time will result in a decrease in the amount of feed needed per 100 pounds

of gain. The fat is largely external, however, and the drip after frozen storage is greater. Both thiouracil and thyroprotein are potent drugs and cautious use of them is advised.

The catheterized-urine-sediment test, used to diagnose pregnancy in humans, proved unsuccessful in cattle diagnosis.

### **Costs, Benefits of Range Reseeding Studied**

In an attempt to determine the economic feasibility of artificial range reseeding on various kinds of Oregon range land, research was started last year on the costs and benefits involved in the reseeding operation.

Little information on which to base recommendations for range reseeding is available at the present time. The new study is designed to supply this information for the benefit of ranchers of the state. The value of reseeding on various kinds of range land will be considered along with the costs involved in clearing, seeding, and managing the land.

### **Role of Minor Elements Investigated**

The role of minor elements in animal nutrition is being studied as a basis for recommendations on supplementary mineral feeding and in connection with several livestock disorders.

Studies are underway with iron, copper, cobalt, and manganese. Work is also being conducted with molybdenum, which is of interest in animal nutrition because it occurs in sufficient quantities in some parts of the country to give rise to toxicity in forage crops.

Standardization of hemoglobinometers for checking blood of cattle and sheep in areas where suspicion of minor element deficiency exists was accomplished last year. Since deficiencies of iron, copper, and cobalt may result in anemia (lack of red color in the blood) the hemoglobin content of cattle and sheep blood may give some clue to areas deficient in these elements.

### **Movement, Prices of Livestock Surveyed**

Total movements of livestock in and out of the state by origins and destinations were surveyed last year and data gathered on the seasonal variations of livestock marketing in Oregon. Livestock auction prices and methods also were studied, together with the adequacy and availability of market information.

The information will serve as a guide to better marketing on the part of the producers, as a background for extension work in live-

stock marketing, and as material for use by Oregon livestock organizations in connection with their proposed request for improved market news service.

Marketing information collected in Oregon will be used as part of a regional project on livestock marketing—both feeder and slaughter. Other states cooperating include Washington, Idaho, Montana, Wyoming, Colorado, New Mexico, and Nevada.

## **SHEEP**

### **Best Breeds for Hill Pastures Studied**

Four breeds of purebred rams are being used on crossbred Lincoln-Rambouillet ewes as part of the long-range study to find what breed or combination of breeds will do best under western Oregon hill pasture conditions. The value of the program is becoming more apparent with the increased number of sheep being raised in Western Oregon.

The four breeds of rams being tested are Romney, Hampshire, Cheviot, and Border Leicester. Lambing percentage, conformation and condition scores, and carcass studies are made on lambs from each breed.

In this year's work, the lambing percentage on the basis of groups—each having 30 ewes—showed Cheviot the leader with 153 per cent; Hampshire, 137 per cent; Border Leicester, 130 per cent; and Romney, 117 per cent. The average condition and conformation scores were also best for the Cheviot-sired lambs this year.

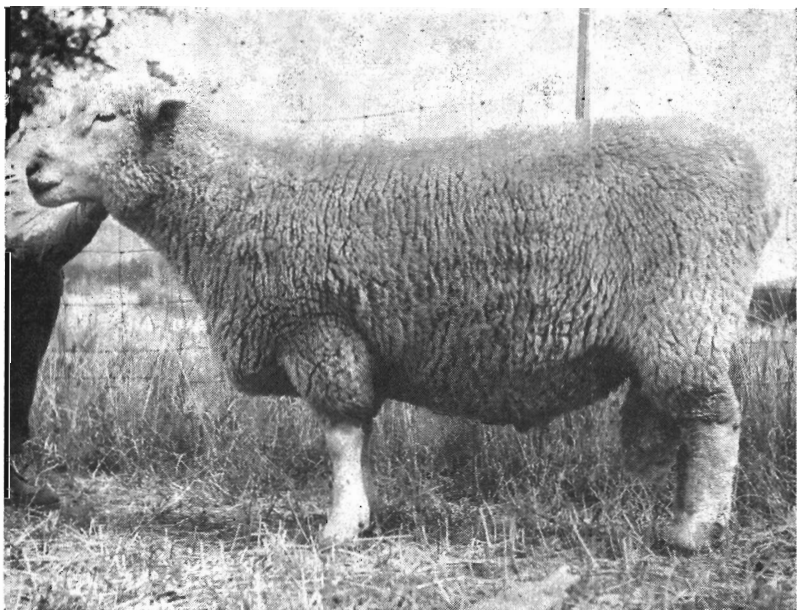
Carcass studies on all of the lambs indicate that all four sire groups were of desirable market weight. Dressing percentages were very similar and so were percentages of valuable cuts.

In pounds of lamb per ewe bred, the Cheviot- and Hampshire-sired groups led with 105 and 104 pounds respectively. The ewes bred to Border Leicester and Romney rams averaged 98 and 83 pounds.

### **Practical Set of Sheep Records Developed**

A workable set of sheep records that can be used to advantage by any commercial- or purebred-sheep producer have been developed and published by the animal husbandry department. The forms were adopted by the American Romney Breeders Association.

The records serve as a guide to the intelligent selection of

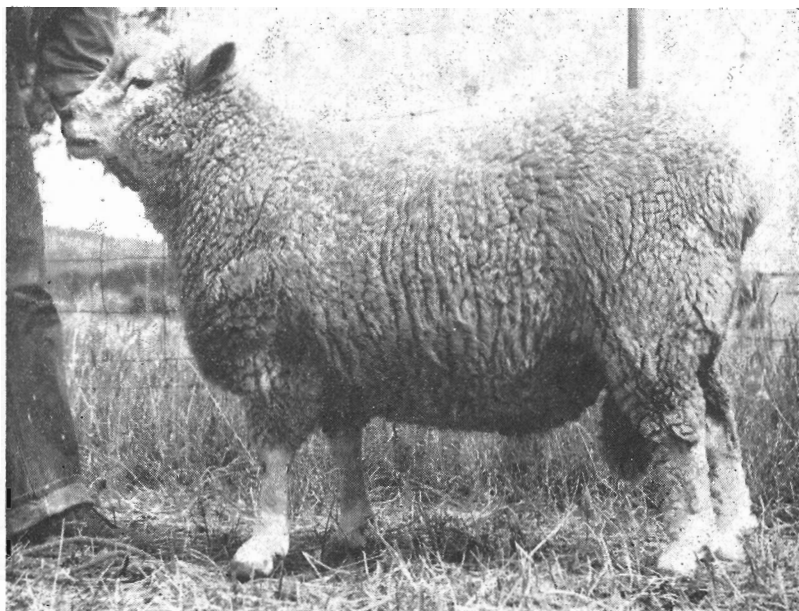


There is much more than appearance to consider in selecting the sheep to retain in the flock. The two rams shown above and to the right were scored almost the same on body conformation by three experienced judges. The ram above produced normal semen with 85 per cent of the sperm motile. Ewes mated to this ram settled with an average of 1.36 services. Lambs from these matings were scored 83 on body conformation and weighed an average of 74.37 pounds on June 22. The record of the ram on the right is much different despite similar appearance.

breeding animals and speed up stock-improvement programs. It has been demonstrated that it takes 20 to 30 times as long for improvement in livestock by selection on appearance alone as compared to selection on appearance coupled with production records. This is because many factors which affect productivity—such as fertility—cannot be evaluated by the eye alone.

For the purebred breeder, the records provide an additional selling feature which can be used to justify the asking of a premium price for breeding stock.

The system makes use of individual record cards on both ewes and rams. Cards are easy to keep and yet supply all the necessary information the grower needs to decide whether the animal is worth keeping in the flock.



This ram produced semen that was watery in appearance with only 35 per cent of the sperm motile. It required an average of 2.6 services to settle ewes mated to this ram. Lambs from these matings were scored 70 on body conformation and weighed an average of 55.31 pounds on June 22. Production records would have provided the additional information required to make a true evaluation of the two animals. Last year, a workable set of sheep records that can be used to advantage by any commercial- or purebreed-sheep producer were developed and published.

## Best Pasture Practices Studied

Pasture lands are assuming an increasingly important role in western Oregon's growing sheep industry and research is aimed at developing the best pasture establishment and management practices. Hill lands that are now producing undesirable plants, brush, and non-merchantable timber need to be converted into profitable production of pasture or timber.

Pasture establishment or improvement is recommended on the highest quality sites while timber production appears to be better adapted to the steeper hill lands where pasture maintenance requires expensive initial or recurrent brush-control measures.

Spreading of subterranean clover straw was found to be an



effective method of obtaining stands of sub-clover on hill lands. Seeding and fertilizing grass-land pastures where plowing was possible has resulted in increased quantity and quality of forage.

Ammate gave a 92 per cent kill last year when used on poison oak as part of the brush-eradication work. Ammonium thiocyanate gave 88 per cent control. Heavy grazing by Angora goats was found to increase poison oak plants. Goats also relish young Douglas-fir and their grazing detracts from the value of those areas which are potentially timber producing.

Expansion of the project is planned for coming months to include all phases of hill-pasture improvement and management.

### Sheep Reproduction Problems Investigated

Controlling the length of day by shortening the hours of daylight in the spring did not alter the breeding season of ewes in trials on the reproductive capacity of western Oregon farm sheep last year.

Tests were launched last year to determine whether high and low levels of fertility in sheep are inherited. High- and low-fertility ewes were bred to high- and low-fertility rams and the offspring will be checked carefully to see if fertility is an inherited characteristic.

In coping with the fertility problem, it is found that equal attention should be given to the reproductive condition and capacity of each sex rather than placing all the emphasis on the ram. A ewe's record for her first lambing may be used with a fair degree of accuracy as a basis for selection for early lambing. Optimum time in estrus to breed a ewe is when the vagina has much clear mucus, usually during the latter part of the heat period.

### New Sheep Barn to Aid Research Program

A more intensified program of research on feeding, management, and breeding of sheep will be possible in future years with the completion this fall of the new sheep barn. The new structure will house 150 head of sheep and will provide complete laboratory facilities for physiological studies and some wool work.

Built of concrete block, the barn is largely fire-proof and is designed so a maximum amount of work can be done mechanically. The main part of the barn, which houses offices and laboratories, is 34 by 72 feet. Two open-faced wings, 30 by 197 feet, are built out on the south side. They were planned on the theory that sheep require a minimum of shelter in the mild climate of the Willamette Valley.

Eight 20 by 24 foot pens are built in the wings for use in handling sheep in experimental trials. Concrete feed alleys run down the inside wall of each wing and self-feeders that hold both roughage and grain are used to best utilize trough space. All of the pens have sod floors except the two to be used in nutritional studies.

Irrigated pasture for the flock is available off the open-air wings.

## Improved Wool Preparation Increases Returns

A very definite need exists for improved preparation and marketing of Oregon wool. Growers lose thousands of dollars annually because of faulty preparation and lack of information regarding the shrinkage of their wools.

To enhance the market value of Oregon wools and increase returns to the wool growers, a project on the preparation and processing of wools was started last year. Preliminary work indicates that improved preparation will increase returns from 1 to 3 cents per grease pound. When applied to the total Oregon clip, such an increase would mean an increase in total return of from \$62,040 to \$186,120 per year.

Comparison of the marketing of grade wools with wools marketed ungraded in original bag lots is planned for the coming year along with continued studies on preparation and processing.

## Sheep Disease Research Shows Gains

Diseases cost Oregon sheep growers thousands of dollars annually and Experiment Station research in this field is aimed at reducing these losses and finding practical control measures. Disease work done last year was nearly as great as in prewar years and indicates the increasing importance of research in this field.

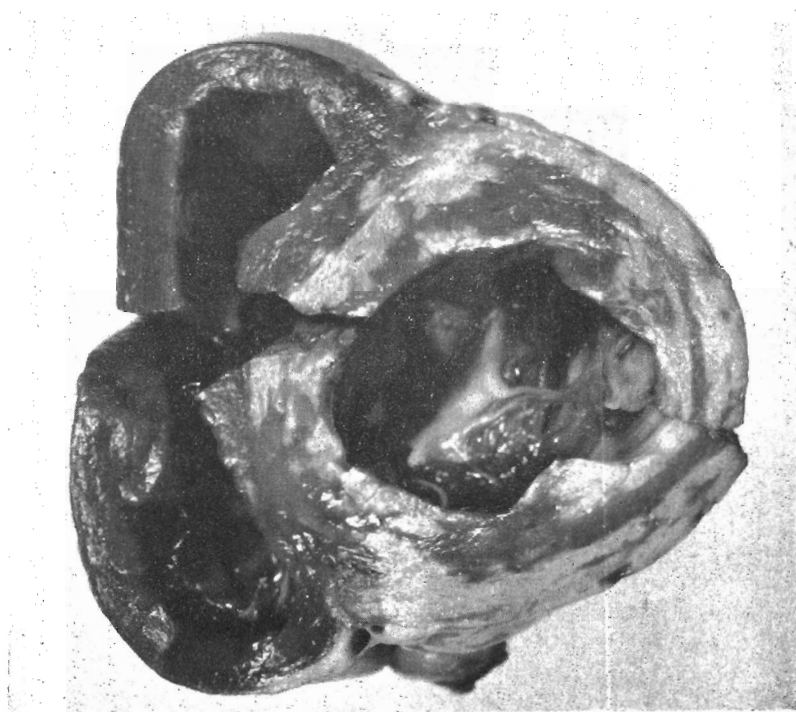
Work with diseases brought these findings last year:

**Ticks:** A single application of DDT spray at the rate of eight pounds of 50 per cent DDT per 100 gallons of water was again found to be 100 per cent effective for tick control.

**Foot rot:** A saturated solution of copper sulphate is recommended for foot rot.

**Lunger disease:** A progressive chronic pneumonia similar to that occurring in Montana, Lunger disease has been diagnosed in both western and eastern Oregon. No conclusions as to cause or treatment have yet been made.

**Stiff lambs:** A number of "white muscle" lambs were studied in Willamette Valley flocks. In every instance, the ewes had been



"White muscle" disease is one of the serious sheep diseases being studied. In this cross-section view of a heart taken from a diseased lamb, the white areas in the heart muscles may be seen.

wintered on a legume hay. Several of the lambs were treated with alpha-tocopherol with inconclusive results. Some lambs suffering from white muscle disease also showed lesions of enterotoxemia.

Enterotoxemia: This "pulpy kidney disease" appeared more often and earlier last year than usual. Lambs only three weeks old showed well-marked lesions. The use of a commercially produced anti-serum is giving quite satisfactory results in the prevention of this disease. Veterinarians are now able to provide this anti-serum. This disease is sometimes confused with white muscle.

Forage poisoning: Several lambs of sheep poisoned on rye grass were studied last year.

Lamb scours: Set backs in the very young lambs due to coccidiosis can be prevented by proper management practices.

**Listerella infection:** This disease was again diagnosed in Willamette Valley sheep. Flocks suffered severe losses.

**Worms:** Pheniothiazine and salt mixture did not eliminate worms but controlled them sufficiently to enable a large percentage of fat lambs to be produced on irrigated pastures by weaning time.

## SWINE

### Ladino Clover Pasture Lowers Hog Feed Costs

The cost of putting hogs on the market will be reduced by growing and fattening spring litters on ladino clover.

One acre of irrigated ladino clover will graze 30 to 35 growing and fattening pigs when they are self-fed on grain. A single acre will replace 2,200 to 2,700 pounds of grain in the pigs' rations. About 700 pounds of live-weight gain can be credited per acre of



Growing and fattening spring litters of hogs on Ladino clover will reduce feed costs. One acre of Ladino clover will graze from 30 to 35 growing pigs when they are self-fed on grain.

pasture, or at \$15 per hundred pounds live weight will bring in \$105 per acre.

A satisfactory protein supplement for these pigs is soybean oil meal.

### **Pigs Gain Well on Wood Molasses Ration**

In incomplete trials of feeding wood sugar molasses to pigs, test groups fed 15 per cent wood molasses and brewer's yeast in the ration gained slightly better than lots fed on a basal ration and 15 per cent wood molasses only. Ground barley, tankage, ground alfalfa hay, iodized salt, and bone meal were used in the mixtures.

Poor gains and inefficient feed utilization resulted when growing pigs were fed a ration containing 30 per cent by weight of Douglas-fir molasses.

It has already been demonstrated that wood molasses may be fed to swine without affecting the palatability of the fresh pork. If wood sugar molasses becomes available cheaply enough, it might be possible for this material to be used as a source of carbohydrate feed with proper supplements and thus enable more complete usage of the lumbering industry's byproducts. Additional trials will be conducted.



## **Dairy Production and Processing**

### **DAIRY PRODUCTION**

#### **Wood Sugar Molasses Promising as Dairy Feed**

As part of the long-range study of the feed value and use of the new waste wood product, wood sugar molasses, the Experiment Station last year conducted small-scale feeding trials with dairy cattle and studied the value of alfalfa ensiled with the wood product.

In both cases, wood sugar molasses showed real promise as a low-cost carbohydrate in dairy cattle rations.

Wood sugar molasses diluted with water and sprinkled over low-quality hay proved to be as palatable as cane molasses for dairy heifers. Cows showed a slight preference for alfalfa ensiled with 3 per cent wood sugar molasses to alfalfa silage made with 3 per cent cane molasses.

For dairy cows, as measured by milk production and weight changes, there was no appreciable difference in feeding value of alfalfa ensiled with wood sugar molasses or with cane molasses. Additional tests with this promising product are planned for the future.

## **Artificial, Natural Breeding Methods Compared**

A comparison is being made of the efficiency of artificial insemination and natural service breeding. To date a slightly higher rate of efficiency has been noted with artificial insemination, but no definite conclusions can be made.

Rates of semen dilution and frequency of collection are being correlated with keeping quality of semen from four College herd sires and two Oregon Dairy Breeders' Association sires. The project will be expanded in coming years to cover all important phases of fertility, breeding methods, and management of bulls.

## **Breeding Failure Causes Examined**

What causes and what can be done to prevent breeding failures in dairy cattle are being studied as part of a regional project in an effort to solve this serious problem. Other states cooperating include Washington, Idaho, Utah, and Colorado.

In Oregon special attention is being given to the influence of various nutritional and hereditary factors. An optimum ration has been formulated for the herd bulls to check the nutritional factors and level required to maintain optimum fertility in the animals.

The importance of carotene—provitamin A—in prenatal growth and breeding performance of the calf is being studied along with the relation and/or inter-relation of calcium, phosphorus, vitamin D, and season to reproductive performance. Investigations on the relationship of supplementary iodine and hormones are also under way. Findings will not be available until the test animals reach maturity.

## **Mastitis Control Program Intensified**

Mastitis is recognized as the most serious disease of dairy cows and an intensified research program is under way to find means of curbing and controlling the disease.

There are two types of organisms associated with mastitis—streptococci and staphylococci. Streptococci have been found to produce as much as 85 to 90 per cent of the initial infection in local areas. Staphylococci frequently enter to complicate the streptococci infections as well as infect clean quarters. The incidence of streptococci infections has been sharply reduced in recent years with penicillin and sulfanilamide drugs. Penicillin has been found most effective in early cases.

Milk samples checked last year showed an incidence of 9.3 per

cent streptococci and 24.2 per cent staphylococci. Injury from improper milking machine management was noted in many problem herds.

### **Improved Dairy-Building Designs Sought**

As part of a Northwest regional project in the improvement of dairy-farm structures and equipment, a study is being made of the influence of design and arrangement of dairy-farm structures and equipment on the quality of milk produced and on operating efficiency.

Consumers as well as producers will benefit from this work. The possibility of increased efficiency, a decrease in capital outlay, plus proven sanitary recommendations, will enable the dairyman to produce a higher quality product at a lower cost. He can realize more profit for his efforts and put his products on the market at a more reasonable cost to the consumer.

Records are being taken on dairy units in the state and a report of findings is expected next year.

A dairy-barn ventilation study is also under way at the College dairy barn as a means of determining the basic requirements for the ventilation system in barns in the Willamette Valley. An adequate ventilation system could result in appreciable savings to western Oregon dairymen through the protection of interior paint from mildew and sash from rotting. Added convenience and greater comfort for both the herdsman and the livestock also would be realized.

### **Production Costs Vary in Portland Milk-Shed**

Considerable variation in milk production costs was found to exist among selected dairymen in the Portland milk-shed area who cooperated in a study of the cost of producing fluid milk.

The lowest-cost producer was able to produce a hundredweight of milk for about one-third as much as the highest-cost producers. The primary factors accounting for the difference included efficiency in the use of labor, production per cow, feeding efficiency, number of cows in the milking herd, and butterfat test of the milk. Findings of the study have been made available to dairy representatives and county agents for use in comparing the efficiency of individual dairymen in their operations and in improving dairy management practices.

### **Changes in Milk Utilization Surveyed**

A project in maintaining and expanding the market for dairy products was started this year with a survey of the changes in utilization of milk in 13 northwestern Oregon counties.



Preliminary results indicate there has been a marked change in the utilization of milk in Oregon during the past few years. Because of the rapid increase in population without a proportionate increase in the number of milk cows or total milk production, there is increased demand for milk from the bottle and can trade.

Milk that was used for factory purposes 5 or 10 years ago is now being utilized in its fluid form. This means there has been an increase in grade A producers and a decrease in factory producers. Some cheese and butter factories are now operating at less than capacity.

A second phase of the study deals with costs of manufacturing cheese in different sized plants. The results indicate some significant savings in costs of processing and marketing may be realized by increasing volume wherever possible.



Research projects on irrigated dairy pasture management have been conducted since 1927 and have produced important information for Oregon dairy farmers.

### Relative Values of Germicides Investigated

A study of dairy sanitation procedures is being conducted to determine the relative effectiveness of various commercial germicidal compounds. Improvements in techniques and materials should result in significant savings for the dairy industry.

Comparisons of quaternaries and hypochlorites have shown that the hypochlorites are superior for the germicidal rinse commonly carried out just before use of the dairy equipment. The hypochlor-

ites provide more rapid germicidal action and cost less than quaternaries.

The most widely used dairy germicides were compared as to destructive ability on certain bacteria. A representative hypochlorite showed greater germicidal activity than three quaternaries. The detergent sanitizer approached the hypochlorite activity, but still was somewhat inferior against the *Pseudomonas* species, which frequently cause defects in milk and milk products.

Results of tests with detergent sanitizers offer promise of a superior combination cleaner and germicide which will aid in reducing bacterial counts in raw milk and save the farmer considerable time in sanitizing utensils and milking machines.

Bacterial counts and other observations indicate that the minimum steps necessary to get results from detergent sanitizer procedure include a thorough rinsing in cold or lukewarm water immediately after use, a thorough brushing with a warm detergent sanitizer solution, followed by hanging up or racking to provide dry storage with no further rinsing of any kind. It was found that periodic disassembly of equipment with thorough soaking and cleaning in a balanced organic acid detergent was necessary in some instances to remove accumulation of milk solids.

The detergent sanitizer compounds were remarkably effective against thermoduric bacteria—the bacteria that survive pasteurization of milk. During trials the success of the detergent sanitizer in maintaining low bacterial counts in milk and the simplicity of the procedure resulted in a definite preference for this method by many farmers. However, widespread adoption of detergent sanitizers should not be encouraged until further laboratory and practical observations have been made.

Farms included in the study of detergent sanitizers are in an area where farm water supplies are soft to moderately hard. There is evidence that detergent sanitizer procedures may be less successful in hard water areas because the hard-water salts tend to neutralize the bactericidal properties of the quaternary ammonium compound in the preparation.

## DAIRY PROCESSING

### Importance of Bacteriophage Underestimated

The importance of bacteriophage as a cause of starter failure or inhibition in cheddar and cottage cheese is generally underestimated, research showed last year. Studies on strains of bacteria resistant to bacteriophage—a virus that attacks and destroys starter-

culture bacterial cells with harmful results to the finished product—appear very promising, however. Development of such resistance in starter cultures would represent a significant contribution to the industry.

Little is known regarding the ultimate source of bacteriophage but its seriousness in retarding starter activity is becoming more widely recognized. Isolations of bacteriophage continue to be made from dairy plants that have never suspected it as a cause of their starter difficulties. The fact that most bacteriophage strains have greater resistance to heat than the host cell upon which they live means also that they are able to survive ordinary pasteurization of milk.

Methods for detecting bacteriophage and protective measures that can be taken to avoid it are being published for the benefit of Oregon cultured milk and cheese plants. Meanwhile the tests to develop and select strains of starter culture resistant to bacteriophage are being continued. Resistance to bacteriophage has been developed in different strains of starter culture by exposing the cultures to high concentrations of the bacteriophage and selecting surviving cells. Repetition of this exposure process with successive daily transfers yielded cultures that grew rapidly in the presence of their specific bacteriophages and were normal vigorous cultures in every other respect.

Tests of individual-resistance cultures showed about 98 per cent of the cells in the culture to be resistant to bacteriophage. This resistance was maintained for at least one month with daily transfers in the absence of bacteriophage. Investigations with an improved procedure indicate that cultures may be made 100 per cent resistant by repeated exposure to bacteriophage and careful selection of strains. These studies are being directed toward developing a schedule for use of resistant starters by Oregon dairy plants. In such a plan starter cultures will be replaced whenever laboratory tests indicate evidence of bacteriophage for the culture in current use in the plant.

### **Quaternary Compounds Slow Starter Activity**

Surprisingly low concentrations of quaternary ammonium germicides have been found to retard or inhibit starter activity in cultured milk products. This means that these increasingly popular germicides need to be used carefully on the farm and in cheese plants if starter activity is to be unimpaired.

As little as five parts per million of the quaternary compounds were found to partially inhibit starter growth at both 86° and 98°

temperatures—temperatures maintained in the manufacture of cheddar and related types of cheese. Marked inhibition was noted with 10 parts per million.

### **Carotene Used to Standardize Butter Color**

Carotene concentrates may be used to standardize the color and nutritive value of butter during transitional periods between fall and winter and winter and spring when the natural color and vitamin A values are below average. The concentrates do not affect the storage quality at either household or commercial refrigeration temperatures.

A simple method for standardizing the color of butter was demonstrated last year. It involves first determining the color of the cream fat, deciding on the color desired in the butterfat, and then calculating the quantity of the color required.

Carotene concentrates of high quality are now available for coloring butter, investigations showed. The concentrates impart no off-flavor and increase the vitamin A value of winter butter by as much as 5,000 units per pound. The concentrates can easily be added to the butter without disturbing regular dairy-plant operations.

### **Cheese Processing Problems Studied**

In cheese-making experiments conducted last year, high temperature heat treatment of the milk—170° to 180° F.—produced a weak body in the finished cheese whereas low temperature heat treatment permitted a bitter, rancid defect to develop.

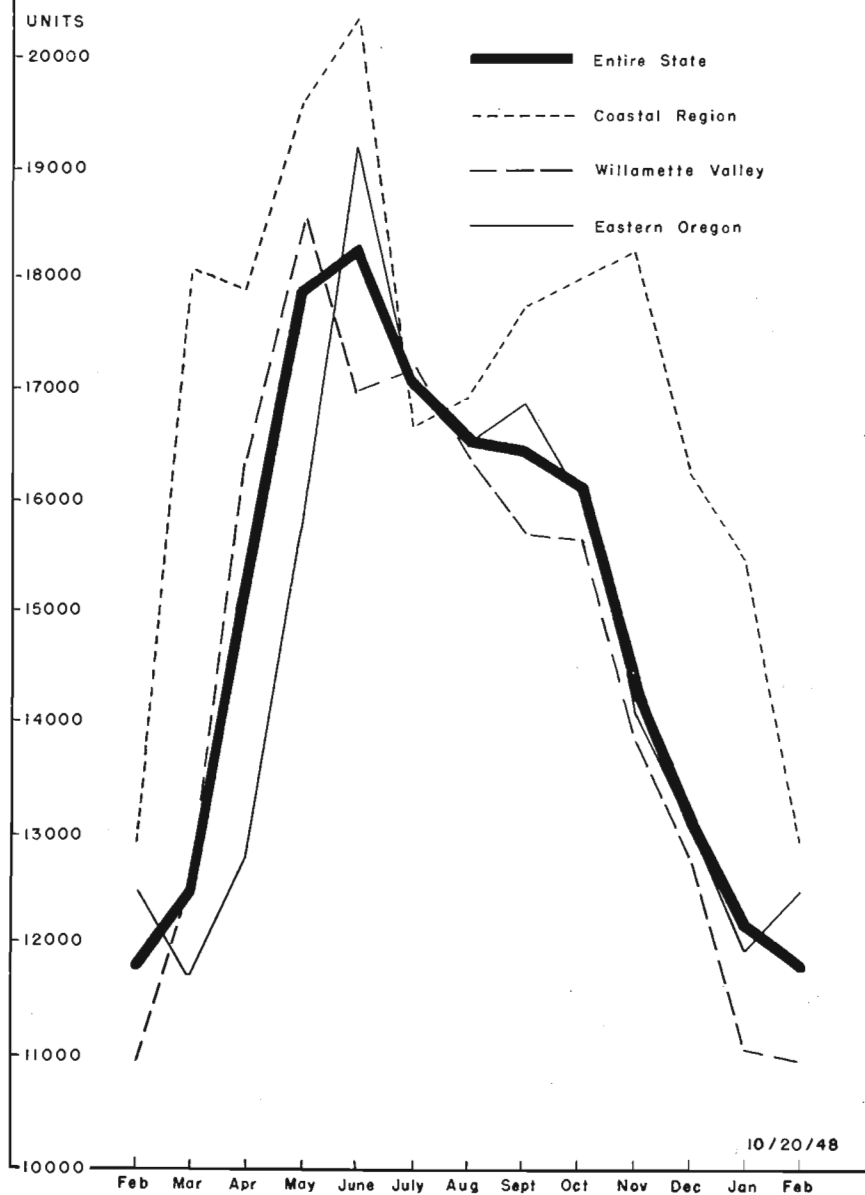
The findings from cheese-making research emphasize the need for greater care and technique in eliminating mold growth and loss from this source.

Methods of manufacturing cottage cheese were developed that will give uniform results from day to day. Readily applicable to commercial plant operations, the methods will insure a uniform product at all times.

Moisture content is important in flavor of cheese, it was found. Quality of raw milk must be high to avoid gas production. Pasteurized milk can be used for cheese making when necessary organisms are developed during the curing.

Wrapping, curing, and packing of cheddar cheese in pliofilm was found satisfactory, but it resulted in some trouble from mold growth. Although cheddar cheese made from high-temperature vacreated milk was inferior in some respects—especially after aging—it is expected that a fine quality cheese can be produced by modifying the heat treatment.

# SEASONAL VARIATION IN VITAMIN A POTENCY OF OREGON BUTTER



## **Vitamin A in Butter Varies with Season**

A distinct difference between the vitamin A potency of Oregon butter produced under winter feeding conditions and that produced under late spring and summer feeding conditions has been found to exist.

The highest concentration of this vitamin is found in butter produced in May, June, and July. The lowest concentration is found in December, January, February, and March. The rapid increase in vitamin A potency from the low winter level to the high summer mark is directly related to the carotene consumption by the cow and the change from winter feedstuffs which are low in carotene to summer pastures that are very rich in carotene.

The findings emphasize the need for evaluation of feeding practices, for it is not improbable that when the ration is low in carotene other essential nutrients may also be inadequate for the optimum well-being of the animals. Thus, for Oregon during the winter when the carotene content of the ration is low it may be that dairy cattle are actually receiving an inadequate ration.

## **Vacreator Aids Ice-Cream Mix Manufacture**

The value of the Vacreator as an aid in manufacturing ice-cream mix was demonstrated in tests last year.

Handling of the mix was reduced to a minimum by condensing the complete mix. This resulted in less labor, more efficient use of equipment, and a finer product because of higher quality ingredients used. The mix, containing all ingredients, was condensed to give a product of the desired total solids content with main emphasis on bacteriological results and flavor.

Results of the standard plate count and the phosphatase test showed the Vacreator to be satisfactory as a means of pasteurizing ice-cream mix.

## **Milk Solids Basis for Price Studies**

The variation in and the determination of the solids content of normal cow's milk are being studied in an attempt to furnish a basis for calculating equitable prices to the producer and for evaluating consumer milk with food value as a criterion.

The trend toward a greater appreciation of the food and usage value of the non-fat solids demands a knowledge of their content in milks of varying fat test. No simple method for analyzing for solids is available. A reliable conversion factor using fat as a basis would be valuable. This survey may provide it in coming months.



## Poultry

### CHICKENS

#### Chicken Nutrition Problems Studied

The value of alfalfa meal in chick rations, the comparative value of poultry mashes with various protein levels and free choice feeding of grain, and the possibilities of wood sugar molasses as a feedstuff for laying hens were studied last year under the chicken nutrition project.

Twenty per cent sun-cured and dehydrated alfalfa meal was fed in pelleted and non-pelleted form to chicks up to 10 weeks of age and was found to produce better growth than an equal amount of dehydrated alfalfa meal. Pelleting the ration containing 20 per cent sun-cured alfalfa meal improved its growth promotion value to the extent of approaching results obtained with the control ration.

At 10 weeks of age, there was little difference between chicks of the same sex fed a ration containing 20 per cent dehydrated alfalfa meal whether the ration was in mash or pelleted form. Chicks receiving the pelleted ration grew faster for the first nine weeks than comparable chicks on the same ration in the mash form. Pelleted rations were more readily eaten by the chicks.

Experiments the last two years with Leghorn pullets fed laying mashes with 20, 29, and 37 per cent protein show that those fed the

higher protein mashes or "concentrates" lay just as well. The grain or scratch feed was fed free choice with all three mashes.

On a 20 per cent protein mash, pullets laid a little better when the scratch grains were hand fed than when fed free choice. The system of grain feeding, however, appeared to have little or no consistent effect on hatchability.

Both of these experiments are being continued and the results to date are not presented as being conclusive.

Whole grain intake on free choice feeding varies directly with the protein level in the mash. On a 20 per cent protein mash, pullets consumed approximately 33 per cent mash and 67 per cent grain; on a 29 per cent protein mash, 24 per cent mash and 76 per cent grain; and on a 37 per cent protein mash, 18 per cent mash and 82 per cent grain.

Trials with wood sugar molasses as a feedstuff for laying hens have not progressed far enough to make recommendations possible.

### **Breeders Selected on Family Performance**

Selection of birds for egg production on the basis of individual performance is relatively ineffective, studies on the breeding improvement of chickens showed last year. Selection should be based



Experiments with growing chickens demonstrate inherited differences in rate of feathering. Both chicks are from the same brood but show widely different rates of feathering. Broiler growers demand chicks that are completely feathered at time of maturity.



on family performance, both sire and dam family averages being considered.

Cornish birds were found to have higher requirements for riboflavin in order to show a hatchability level comparable to that of other breeds. In hatchability tests without riboflavin added, the Cornish had a 70.5 per cent average hatchability of fertile eggs. In five later hatches when riboflavin had been added following observation of symptoms of riboflavin deficiency the average was 82.4 per cent.

Frequent renewal of the oyster-shell supply will help to maintain good shell quality, limited observations showed last year. Specific gravity testing was found to be a very practical method for measurement of shell quality.

Selection of breeding stock for improved meat production was found best made at marketing age although weights obtained at four and eight weeks of age provide relatively accurate values.

There does not appear to be much relationship between the 7- or 10-day wing and tail feathering and the feathering over the back at 12-week broiler weights. This means that breeders of strains of chickens used for broiler production should check their prospective bereders for feathering when they are at broiler age.

Analysis of weights of Cornish chickens at 12 weeks shows that growth as measured by body weight is highly hereditary and that breeders of meat strains of chickens can make rapid improvement in this character by selecting for breeding purposes those birds that are the heaviest at broiler weights.

### **Six to Seven Males Needed per 100 Hens**

Investigations with New Hampshires on the influence of the number of males to females on fertility of eggs shows only six to seven males are needed per 100 hens for consistent high fertility.

In the past, many hatching-egg producers have been using as many as 10 to 12 males per 100 females in their breeding flocks. By using fewer males, breeders reduce the costs of producing hatching eggs, can do a better job of selecting breeding males, and can increase the number of progeny sired by males of superior blood lines.

The ratio of males to females in breeding flocks was found to influence onset of fertility. The time required to approach the maximum level of fertility after putting the males with the females increased with a decrease in the number of males per 100 females—from 9 days when 9 males were used to about 16 days when 4 males were mated with 100 hens. Future work calls for study of recommended male-to-female ratios in cross-mated flocks.

Little or no increase in fertility of eggs will result from restricting matings of chickens to the afternoons, investigations on the management of breeding males show.

Age of female breeders has little influence on the fertility of their eggs. White Leghorn females in their first, second, and third laying years were artificially inseminated with .05 undiluted mixed semen at weekly intervals and no difference in groups was noted.

A new phase of the fertility and hatchability project dealing with predetermining the reproductive capacity of breeding males will be started next year.

### **"Open-air" Poultry House Shows Promise**

Second-year trials with the inexpensive "open-air" poultry house—wire sides and floors—again indicated that this type poultry structure has promise for the mild-climate sections of Oregon.

In laying and feeding tests conducted from October 1948 through February 1949, birds in the open-air house layed at a comparable rate but required more feed. Egg production of birds in the open-air house fell off decidedly in late January and February, however, when a period of unusually cold weather hit the Willamette valley.

Open-air house pullets consumed an average of 32.2 pounds of feed while pullets in the conventional type structure consumed 29.1 pounds from October through February. The pounds of feed required to produce a dozen eggs for the same period was 6.7 for the open-air and 6.3 for the other group.

### **Wet Litter Controls Investigated**

Wet litter is one of the biggest problems of Oregon poultrymen in the winter. It means more work changing the litter, more dirty eggs, and a greater danger of disease.

In trials conducted last year on various methods of controlling wet litter, floor ventilation and electric panel-heating methods both showed promise. Improvement of these methods and others are planned during the coming year.

Ventilation by blowing outside air at a low velocity directly over the litter appeared to be a cheap, practical possibility for controlling the wet litter. Results of one test where a fan was used from 9 a.m. until midnight to blow the outside air across the litter were promising.

Floor heating by electricity needs more extensive study before it can be recommended but preliminary work is encouraging.

## Controls Developed for Chicken Diseases

A broad program of research on chicken diseases was continued last year in an effort to reduce annual disease losses that run over \$1,000,000 in Oregon. Special emphasis is placed on pullorum disease, coccidiosis, fowl pox, and Newcastle disease.

For more than 20 years, the pullorum disease-control program has been making steady progress in the eradication of this serious poultry disease. The program of pullorum testing is still the basic means of control. Sulfamerazine, used recently in trials, does not eliminate pullorum from mature reactor chickens to an extent that it can be substituted for that program.

Work with the sulfa drugs as coccidiostatic agents has shown these drugs have value if properly used. Sulfaquinoxaline when fed for seven days in an all-mash ration at levels of 0.015 per cent, 0.03, and 0.05, had a definite coccidiostatic effect. Sulfamerazine and sulfaguanidine have limitations but are valuable when used as prescribed.

Fowl pox vaccination first developed at the Station is now extensively used both nationally and internationally. Vaccination of baby chicks 3 to 7 days of age is highly successful and saves time and labor as compared to vaccination at a later age.

The Newcastle-disease program is designed to eliminate the spread of the infection within the state. Oregon is one of the few states in which a program of eradication is in effect. Since the first case of Newcastle disease was diagnosed in January 1947, a total of 27 cases has been found in Oregon. Most of these cases were in birds shipped in from the Middle West or in birds that had been exposed to infected birds from that area.

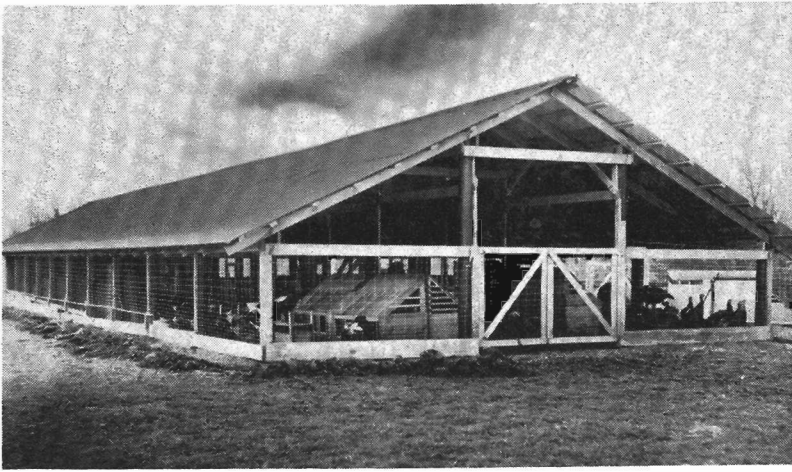
## TURKEYS

### Breeding and Management Factors Evaluated

Body weight and breast width are not major factors influencing reproductive efficiency of turkey hens, studies on breeding and management factors as related to hatchability in turkey eggs show.

In experiments with artificial insemination of turkeys, afternoon insemination was found more effective than morning. That was found to be true earlier with chickens. Presence of eggs in the egg-forming organs of the female is known to interfere with sperm passage in the oviduct and explains the difference.

No advantage was noted last year in rotating males as compared to leaving toms in the pen for the entire season. From similar experience and study, it appears that the mere practice of rotating



An inexpensive, pole-type turkey breeder shelter has been constructed to test the value of such a shelter in the economical production of turkey hatching eggs. The desirability of a shelter for breeding hens has been emphasized during the past two severe winters when flock owners had trouble obtaining egg production at the desired time. Some have lost birds from freezing and exposure.

or leaving toms stationary has little or no influence on fertility in turkey breeder flocks.

It has been observed that turkey hens are most receptive to mating just prior to the onset of egg production and that the frequency of mating decreases rapidly with the onset of egg production. Studies last year showed that increasing the ratio of toms to hens during the "peak" receptive period will bring some increase in fertility.

Inheritance was found to be an important consideration in fertility. Results with 10 families of full sisters showed that there are family differences in fertility of turkey hens. In one pen, four full sisters produced eggs averaging below 50 per cent fertility for the season.

Pauses in egg production due either to broody or non-broody causes also account for marked inefficiency in reproduction of turkeys. Breeding-flock owners not trap-nesting might make some progress by saving breeding stock from turkeys identified as being non-broody during the first half of the season. This would entail only the marking of the saddles of hens going broody early in the season and segregating these from non-broody hens at the time eggs are to be saved for replacing the flock.

## Clean Eggs Increase Hatchability

The desirability of using good management practices to get clean eggs from turkey breeding flocks was illustrated last year when it was found that clean eggs hatch approximately 15 per cent better than dirty eggs. Soaking and washing dirty eggs in warm water serve to spread bacterial contamination with a marked reduction in hatching quality. Use of a germicide in the water, dry cleaning, or setting dirty eggs resulted in about equal hatches.

## Pasturing Turkeys Lowers Feed Costs

To determine what pasture and forage crops could be harvested best by turkeys in eastern Oregon and to find out how much feed could be saved as compared to dry-lot methods of rearing, experiments were conducted at the Umatilla Branch Experiment Station last year for the third consecutive season.

During the three-year trials, four lots of turkeys were pastured on alfalfa, barley, sweet sudan grass, and annual and biennial sweet clover. Other lots were grown on alfalfa pasture during the summer and were used to harvest corn, sunflowers, sorghum, and soybeans in the early fall. Turkeys had free access to a commercial mash or pellets and scratch grains.



Sunflowers are a good summer range crop for turkeys. They provide shade, green feed, and the mature seeds produce additional feed.

Toms grown on alfalfa or barley pastures were significantly heavier at market time than those raised on a dry lot. There was not much difference in the size of hens. Pasturing on alfalfa resulted in a feed saving of 6 to 8 per cent as compared to dry lot. Barley pasture, while saving slightly more feed than alfalfa pasture, was not a fully satisfactory crop because of low yields of green feed and large acreage required.

Sweet sudan grass was found a satisfactory turkey pasture if an annual crop is desired but is not as good as alfalfa. Sweet clover, either annual or biennial, is not satisfactory.

Toms used to harvest sunflowers were significantly heavier than toms in other forage fields. There was no appreciable difference in weights of hens. Advance hybrid dwarf sunflowers saved substantially more feed than corn but sorghums saved less feed. Soybeans were not found to be a practical forage crop because turkeys will not harvest them readily.

The experiments indicate that a turkey grower can save considerable money by pasturing turkeys on alfalfa in the summer and using them in the fall to harvest a crop of corn or Advance sunflowers. If there is not sufficient land available for pastures, birds can be grown satisfactorily under dry-lot conditions but feed costs will be higher.

### **Early Pastures Save Feed; Egg Increase Slight**

Putting turkey breeding stock on early green pastures will mean a substantial feed saving for growers but will bring little if any improvement in egg production or hatchability if the feed ration was adequate before pasturing began, according to Umatilla Branch Experiment Station trials. Fertility of eggs is not affected by the use of pastures.

Three varieties of rye—Abruzzi, Rosen, and Common—were planted in trial plots last year to determine the amount of forage they provide and how well they would recover after pasturing. Rosen was found to be the best producer of green feed, but in all cases trials showed that if rye is used as early spring pasture it will recover after pasturing and a crop of grain may be harvested from the field.

### **Hens Differ Widely in Response to Lighting**

Improvement of Broad-Breasted Bronze turkeys through a selection program based on rate of response following artificial lighting will be attempted next year in a new research project.

Studies have shown that turkey hens differ widely in their rate of response to stimulation by artificial light. High-producing hens exhibit a faster response and a tendency toward less broody and non-broody pauses.

The new experiment will determine whether a method of selection based on rate of response can be used for improvement without trapnesting.

Objectives include attempting to improve egg production of turkeys by selection of breeding stock from hens laying earlier after lighting; determining if a relationship exists between rate of response to light and pauses in production; finding if there is any difference in fertility and hatchability in eggs from fast and slow responding hens; and attempting to decrease age to maturity through selection of earlier maturing turkeys for the breeding flock.

### **Turkey Shade Problems Studied**

A trial was conducted at the Umatilla Branch Experiment Station this past year to determine the actual value of shade in growing turkeys. One lot of turkeys was kept on a dry lot without shade from August through September, while a similar group of birds was provided with artificial shade. At the end of the experiment, the birds in the shaded pen were slightly larger, but this difference was not significant. There was little or no difference in feed consumption and no mortality in either pen. The incidence of pendulous crop was insignificant. Internal body temperatures were definitely higher in the no-shade birds. Further trials with shade are planned for the coming year.

### **Potatoes Tried as Turkey Feed**

Something new in turkey feed was tried at the Umatilla Branch Experiment Station last fall when raw, cooked, and dried cull potatoes were added to the turkey diet.

The objectives of the study are to determine whether growing turkeys can make efficient use of the potatoes in various forms as a replacement for part of the grain of the ration. The work is intended to be of a preliminary nature and if results warrant, further experiments will be conducted to determine the optimum amount of potatoes to be fed.

Raw and cooked potatoes proved unsatisfactory both from the standpoint of inefficient utilization by the turkeys and added labor. Dried cull potatoes showed sufficient promise that further trials will be conducted to determine optimum amounts to add to the ration.

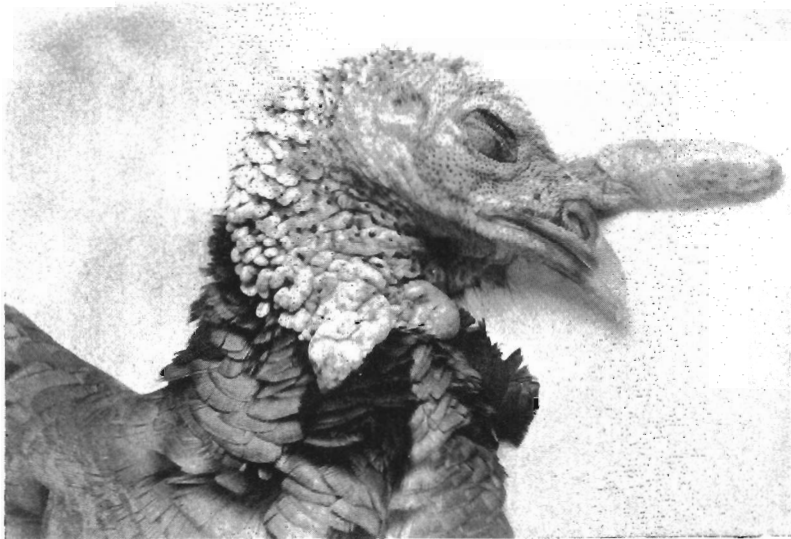
## Penicillin Cuts Erysipelas in Turkeys

Continued reduction in the already low incidence of pullorum infection in Oregon turkey flocks was achieved last year and the value of sodium penicillin in reducing erysipelas losses was demonstrated. Work with other turkey diseases also was encouraging.

The incidence of pullorum disease in Oregon turkeys, although never very high, has been reduced steadily under the Station program until last year all turkey breeder flocks of the Oregon Poultry Improvement Association participating in the national turkey program qualified for U. S. Pullorum Clean, the highest program rating.

Erysipelas has been found to be transmitted primarily through fight wounds, and improved management practices will greatly reduce this danger. Sodium penicillin consistently proved of value in reducing losses due to this infection and is a very satisfactory treatment for flocks already affected. Because there is need for a stable immunizing agent that can be used to prevent the disease, however, concentrated investigations in that phase of the problem are under way.

A program of diagnosis, quarantine, and slaughter in which the state department of agriculture has aided has resulted in a marked



Swelling and discoloration of the caruncle or tubular leader is highly indicative of erysipelas disease, which has become of increasing importance to turkey producers in Oregon. The value of sodium penicillin in reducing erysipelas losses was demonstrated last year.



reduction in the number of cases of salmonellosis (para-typhoid infection).

The program of moving "mud fever" birds to new ranges and confining sick birds so they may be force-fed two or three days continued to produce remarkable results. Penicillin was found to be of no value in eradicating staphylococcosis infection.

### **Turkey Marketing Problems Surveyed**

The competitive position of the eleven western states in the production of market turkeys is being investigated. Production and transportation costs and quality of market product are being considered. This information will be helpful to western turkey growers in planning future production.



## **Wildlife and Marine**

### **WILDLIFE CONSERVATION**

#### **State Wildlife Problems Investigated**

A broad program of research on wildlife problems of the state is being conducted by the Oregon Cooperative Wildlife Research Units fostered by the Oregon Game Commission in cooperation with the Experiment Station, the U. S. Fish and Wildlife Service, and the American Wildlife Management Institute.

Aimed at finding an effective and economical ration for adult pheasants held on game farms, feeding experiments showed that waste weed seed from cleaning mills may be used to advantage. At least a 60 per cent reduction in feed costs can be realized, trial studies showed, and fertility and hatchability of eggs is not impaired. A full-scale field test is planned to check results.

The pheasant hen was found very vulnerable to the usual hazards of life in the study of upland game birds on the research center at Eliza Island. The Unit has shown that the hen is not getting adequate attention to be most productive. The cock is quite self-sufficient. Predation was the biggest factor, with hawks, horned owls, and a feral cat accounting for most of the deaths. The severe winter with temperatures down to 10° F. had little effect on the birds. No birds were found dead from malnutrition or exposure.

Deer foods deteriorate rapidly with the coming of dull weather and a critical point is reached when the crude-protein levels fall below 5 per cent, studies of management problems of Columbian black-tailed deer revealed. Closed canopy areas produce very mediocre food supplies for the black-tailed deer throughout the coastal range. This finding has changed the concept that in the heavily vegetated coast habitats, deer foods are not a problem.

One hundred partridge eggs were flown in from Denmark for use in founding a Hungarian-partridge program. Seventy chicks were hatched from the eggs and will be used in field and breeding-farm rearing trials. Apparently air-borne shipments are not affected by the high altitudes in transit and the test proves this method of procuring eggs entirely satisfactory. Additional eggs are being purchased from Denmark as part of the study of the possibilities for the restocking of partridge in certain low-lying areas of the state. The need here is for stock from sea level areas. Former importations have been from the higher elevations and success in the dissimilar Willamette Valley has not been encouraging.

A game-management program is being drafted for the newly irrigated Madras section. Pheasant chick rearing projects are already underway, and the pheasant and gray partridge populations have shown sizable increases. This is one of the first areas of reclaimed lands to have game-management attention timed to coincide with other management plans. It is designed to fit the agriculture program.

The bobwhite quail has made a phenomenal comeback in the Soap Creek area. Surveys of the quail are being made by the Unit along with other work on the upland game birds.

## Nutrition, Diseases of Mink Studied

Fur-farming research, discontinued during the war, was resumed this year under an expanded, long-range program. The first studies launched under the new program deal with the nutritional aspects of feeding fish to mink and with mink diseases.

The future of Oregon's mink-farming industry, which produced more than \$1,000,000 worth of furs last year, depends largely upon an economical and adequate source of animal protein. At the present time, this is largely supplied by fish. Little is known as to the best kinds of fish to use in mink rations, however, and the new project is designed to answer many of the questions on mink nutrition.

Feeding trials will be conducted to check the difference in nutritive value of the various kinds of fish readily available to Oregon that



Fur-farming research was resumed last year after a war-enforced layoff and 50 dark mink were brought to the fur farm to be used in nutrition and disease investigations.

are not heavily utilized as human food. The value of fish wastes will also be studied, along with research as to which fish have detrimental nutritional effects upon the animals. Some are known to inhibit the proper utilization of vitamin B and some are suspected of being toxic during some seasons.

Other objectives of the project include determining the amount of the various kinds of fish that may be used satisfactorily in an economical feeding program; studying the effect of season of catch, storage conditions, and handling treatment on the feed value of the fish; and checking the kinds and amounts of materials needed as supplements to the fish diet.

Approximately 50 dark mink are being used in the beginning phases of the work. Other fur-farming problems will be investigated in future years.

### Controls Sought for Rabbit Diseases

A rapid increase in the production of rabbits for meat and fur in Oregon has intensified the need for study of rabbit diseases. In investigations of diseases of fish, game, and fur animals last year,

special attention was paid to control of coccidiosis and vent disease in rabbits.

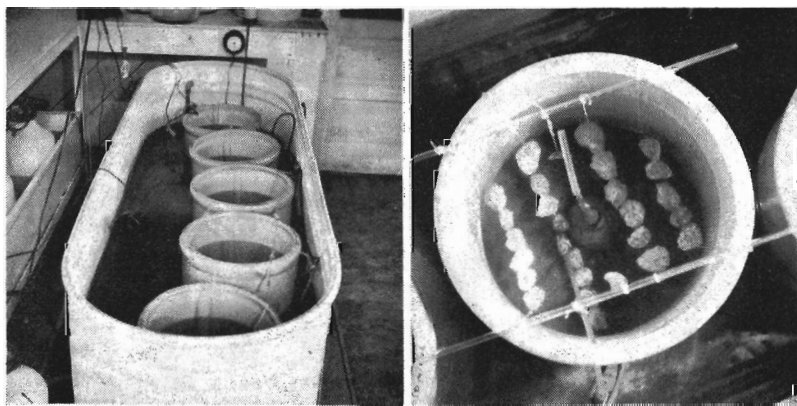
Immunity to coccidiosis was produced in experiments with rabbits and it was learned that the extent of the disease depends upon the species present and the size of the initial infestation. The new sulfa drug, sulfaquinoxaline, has proved effective in controlling the liver species of coccidia but has not been successful when used against the intestinal forms. Successful treatment of vent disease with penicillin has been accomplished.

## FISH AND SEAFOODS

### Oyster Larvae Reared to Setting Stage

Progress made last year in developing artificial methods of raising larvae for seed oysters has brought the establishment of successful native oyster farms in Oregon coastal waters nearer to reality.

Studies have shown that the native oyster can be grown in Yaquina Bay on an agricultural basis provided that a sustained supply of seed oysters can be obtained yearly. Extensive plantings of Japanese oyster seed during the past two years have already resulted in a number of new oyster farms in the state.



Native oyster larvae were reared to the setting stage in the laboratory at Yaquina Bay last year for the first time, bringing the possibilities for establishment of an oyster farm industry nearer to reality. Larvae were reared in culture tanks in the laboratory under controlled conditions.

During the summer of 1949, native oyster larvae were reared to the setting stage in the laboratory under controlled conditions for the first time. This was made possible through the development of improved rearing methods in which oyster larvae were fed organisms grown in special media. Rearing of the larvae under experimental conditions now opens the way for research on large-scale seed production.

The problems of artificially rearing the native oyster larvae are being thoroughly investigated. A study of the effects of light on the larvae has shown this factor to be only of indirect importance. Control of light has proved necessary in limiting the multiplication of some plant and animal forms which may be highly detrimental to oyster larvae. Mild changes in temperature and salinity produce no ill effects on the oyster larvae.

The possibilities for the use of bacterial and protozoa forms of food for oyster larvae are being investigated. Techniques have been developed to induce native oysters to spawn and produce free-swimming larvae in the winter which will allow year-round studies of artificial propagation methods.

### **Toxicity of Mill Effluents Determined**

For the past 2½ years, studies have been made of the effects of Kraft mill effluents on salmonoid fishes and their food organisms. This work is being carried on in cooperation with the National Council for Stream Improvement under a cooperative agreement with the Engineering Experiment Station.

The investigations involve the subjection of fish and their food organisms to the toxic materials known to be present or suspected of being present in the waste from the mills. The fish that have been tested include king salmon, silver salmon, rainbow trout, and cutthroat trout. Minimum concentration levels of the toxic materials have been established for these fish. Further studies are now under way regarding various other aspects such as water volumes and temperatures. Attention is also being given to the long-term effects on fish of the suspected toxic materials.

These investigations should, in time, serve as a measurable basis for the mills in the discharge of the liquors so as not to be toxic to the important fish of this area.

### **Electric Fish Collector Developed**

An electric fish-collecting device which will be useful in the collection of live, uninjured specimens of cutthroat trout and in making fish-population counts was developed last year.

Collection of fish in western Oregon is difficult during most of the year. High-water conditions interfere with collection in lower streams during the fall, winter, and spring, and heavy vegetation along the banks of the small streams prohibit ordinary use of the seine.

The electric device uses a six-volt "hot shot" dry battery as its source of power. Extension wires are carried to two 9-foot bamboo poles which are used by the operator in working the stream. When collecting, the operator holds the two poles 2 to 5 feet apart upon entering a pool and works downstream. Fish caught between the electrodes of the poles are stunned for a short period but are not injured permanently. While stunned they are carried by the current into a seine stretched across the riffle downstream, permitting collection and counts. The device can be easily carried and operated by one man.

## MARINE PROCESSING

### New Uses Found for Fishery Byproducts

Greater utilization of fishery byproducts and unused fish is being studied at the Seafoods Laboratory.

Synthetic egg-white production from byproducts has moved into pilot-plant study. A new freezing approach to the concentration of fish solubles in fish-stick water has been made and a mechanical oil-separation procedure devised to recover more tuna oil from precooked tuna than was previously possible. A new method of separating the crab shell from crab meat also has been discovered.

Improved transportation facilities for fresh and frozen fish are being studied in an effort to make a quality marine product available to the consumer. Conferences with industry and transportation agencies are being held to work out an improved program of shipping.

### Preservation of Dungeness Crab Studied

The preservation of Dungeness crab by freezing may be improved by shortening the precooking period. The apparent advantages of reducing the precooking time include increasing the volume of production, lowering the susceptibility of the meat to toughening during freezing storage, maintaining more of the natural fresh crab flavor, prolonging the acceptable frozen storage period of the meat, and reducing the cost of heating a unit quantity of crabs.

Radio frequency heating was tried in an experimental study last year and indicates promise for the future. At the present time its introduction into the crab-processing industry does not appear to be practical.

Further study on this important problem to Pacific Coast processors is planned. The use of boiling water and steam as the heating media will be included in future investigations to determine their effect on the quality of frozen crab meat.





## Home Economics

### FOODS

#### Frozen Pastries, Taste Standards Studied

Research on behavior of fats and oils in baking was expanded last year to include studies of frozen cakes and batters.

Chocolate cakes made with different fats and with three different pH—or degree of acidity—values were frozen and stored at 0° F. Scoring of the cakes was made monthly for six months. Preliminary study of the scores indicates that the judges were not able to distinguish consistently between the fresh and frozen cakes. Chocolate cake batters were frozen and stored at 0° and —30° F. At 0°, the cake batters held up to two months if made with phosphate baking powder and containing added sodium bicarbonate. At —30°, batters made good quality cakes up to two months either plain or with added sodium bicarbonate. Cake volume was found to be affected by the fat used. Work on pastry showed that soft, oily lards, such as that from corn-fed hogs, yield pastry which is more tender than that made with harder lards.

The project, which is aimed at developing definite standards and procedures for setting up “tasting panels”—used by food-research laboratories for evaluation of food quality—was continued. Infor-



Studies of frozen cakes and batters were included in the foods research program last year. Judges were not able to distinguish consistently between the fresh and frozen cakes in monthly tests.

mation to be obtained under this project will be valuable as a guide for these laboratories in developing, improving, and testing foods and will be useful in product development since it will indicate which characteristics are of major importance in determining food quality.

Past work has emphasized evaluation of basic taste characteristics—sweet, sour, bitter, and salt. Next year, odors, flavors, and texture differences in food will be studied.

## NUTRITION

### Dental Health Varies in Oregon Regions

A pronounced difference in the incidence of dental caries among school children living in selected coastal and central region counties was noted last year in studies on dental health. The work is part of a comprehensive western regional project.

Nearly 750 native-born and reared 14-, 15-, and 16-year-olds were examined by dental workers using a mobile field laboratory in two coastal counties—Clatsop and Coos—and two central counties—Deschutes and Klamath. It was found that children from the coastal region showed a higher incidence of dental caries than those from the central region with the most pronounced difference between Clatsop and Klamath counties. Other findings:

Dental caries rate of school children in both regions was found to be higher than that of subjects of the same age groups examined in other parts of the country.

Boys experience a lower rate of caries attack in general than girls of the same chronological age.

The teeth of girls have received greater dental care although their dental caries attack rate was higher than that of boys.

Availability of dental services in the two geographic regions does not seem to have influenced the caries experience of the subjects.

The amount of sunshine in the two regions and the dental decay rate were inversely related. Since this observation is based on the quantity and not on quality of the sunlight, however, the findings are not conclusive.

Fluorine content of water samples collected in home towns of children examined ranged from 0.0 to 0.3 parts per million, considerably below optimum for dental health, according to some investigators.

There was no appreciable difference in the amount of candy bars and carbonated beverages consumed by children in the different areas.

Other data collected on children examined will be analyzed statistically and findings released.

## **Ascorbic Acid Needs of Adults Studied**

The first controlled study on the ascorbic acid (Vitamin C) requirements of adolescents was made two years ago. Last year, research in this vitally important phase of vitamin work included a study of the ascorbic acid metabolism of adults.

The findings on ascorbic acid—the anti-scurvy acid found in abundance in fresh fruits, especially in citrus fruits—mark a real contribution to the knowledge of nutrition. Standards for ascorbic acid requirements of children which were adopted earlier by the National Research Council were based on judgment relative to studies on adults rather than on experimental evidence with adolescents.



Dental workers examined nearly 750 school children last year as part of a comprehensive study of dental health in the state. Children from the coastal region showed a higher incidence of dental caries than those from central region counties.

Experiment Station studies showed that the daily allowance of ascorbic acid recommended by the Council were well above the quantity considered adequate. In the normal type of family food service it is not difficult to obtain sufficient ascorbic acid because of the popularity of food containing high amounts of ascorbic acid.

The work with adults which was started last year is designed to compare values for the concentration of ascorbic acid in serum, plasma, and the white cell-platelet layer of the blood. The ascorbic acid content of the serum and plasma reflects the previous intake of the vitamin whereas the concentration of ascorbic acid in the white cell-platelet layer more nearly reflects the concentration of the vitamin in body tissue.

## CLOTHING

### Practical Designs Sought for Work Dresses

The design and construction of functional work dresses for rural homemakers is being studied as a means of developing designs for dresses that are suitable from the standpoints of freedom of motion, safety, comfort, and good fit. Fabric and construction standards that should be considered by manufacturers in making work dresses and work-dress patterns also will be formulated.

To find out what Oregon homemakers want in the way of work-dress design and construction, questionnaires were completed at unit home demonstration meetings. Homemakers were asked to give their opinions on such items as best sleeve length, desirability of belts and buttons, and faults they have noted in the construction of ready-made dresses.

Later on, housewives will be observed at work in their home to find what parts of the dress get the most wear and strain during the normal household tasks requiring bending, reaching, etc. Another phase of the program calls for the home economists to make figure-type descriptions as a means of better adapting dress designs to women of various proportions. Many of the dress patterns now available on the market are designed primarily for young women and for the average figure and are not suitable for mature figures.

Dresses of various designs and for various figure types will be made on the basis of these findings and will be sent to from six to twelve selected homemakers for six-month wearing tests. Once the final designs have been approved, the patterns will be made available to commercial pattern companies and dress manufacturers.

### Linen Fabrics Made from Oregon Flax Yarns

Last year's development of designs and methods for weaving flax yarns into draperies, rugs, table linens, and upholstering materials may lead to a new major outlet for Oregon-grown fiber flax.

Linen fabrics are long-wearing, moth proof, fire resistant, and easily cleaned. If fabric production can be put on a commercial scale, it may open untold possibilities to Oregon's flax industry which has been hampered by lack of suitable marketing outlets.

Oregon linen is known to possess fine qualities comparable to linens grown in Europe, but the industrial use of the fiber has been limited primarily to strings, twines, and ropes.

The materials made to date are of interesting "three dimensional" patterns of the types that are popular in modern furniture

making and house decorating. They may be made entirely of flax yarn or may be combined with other fibers. The Oregon Flax and Linen Board is cooperating in project work as part of the attempt to develop this new outlet for the state flax industry products.

## HOUSING

### Home-Built Freezer Plans Published

Home freezers offer a convenient, easy, and safe way to keep all kinds of food for long periods of time. Plans for a freezer that can be built at home have been drawn up and published.

The home-built freezer has front-opening doors to facilitate the placement or removal of food; has a 14-cubic-foot capacity; and is relatively inexpensive to build and operate.



Plans for a freezer that can be built at home were completed and published last year. The 14-cubic-foot freezer has front-opening doors that the homemaker will find convenient for putting in and taking out food. It is relatively inexpensive to build.

### Ironing, Housing, Storage Problems Studied

Research was conducted last year on the planning of the ironing center in the home, housing requirements of rural Oregon families, and storage facilities for areas of the farm house other than the kitchen.

One of the best ways to make ironing easier is to plan a special center or location in the home for doing this work. As part of the study of the use of electricity in the home, patterns for the arrangement of such a center were developed. Suggestions on ironing equipment needed and points to be remembered in purchasing equipment were outlined and published.

Improvement of rural housing in the western section of the nation is the objective of the study on housing requirements of rural families. As a cooperator with the other western states in this regional study, the Oregon Experiment Station collected information in various parts of the state on housing needs. Data collected are now being analyzed. The results will be used in developing house plans that will better serve the purposes of farm families.

Progress was made also on the planning of storage facilities outside the kitchen in the farm home. Findings will be used in recommendations for house planning and remodeling.

# **General Research**

## **Work Continued on Air-Pollution Problem**

Investigations were continued last year on the problem of air pollution from industrial effluent gases and of their effects upon plants and animals. Research was carried on in the Oregon area surrounding the aluminum factories at Troutdale, Oregon, and at Vancouver, Washington, where some farmers have suffered damage to certain crops and animals from air-borne fumes.

In preliminary surveys of the extent of damage to livestock, fluorosis was found to be present in dairy cattle in a rather limited area surrounding the aluminum factories. The area boundaries varied considerably according to normal direction and velocity of winds in relation to aluminum factory sites.

Plant investigations centered around finding suitable methods of sampling plant materials for fluorine analysis and determining the extent to which certain plants were injured. Air-borne fluorine absorbed by plants was found to concentrate in the tips of the leaves and to vary according to age of leaf. Leaves of gladioli plants showed injury with some variation between varieties grown. The collection and analyses of rain waters indicated the presence of noticeable quantities of fluorine at test stations located throughout the area.

## **Rural Building Plans Developed**

An intensive program designed to develop efficient construction plans as an aid in improving Oregon farm buildings and farmsteads has been carried on by the Experiment Station in recent years. Last year, preliminary drawings were made and plans completed for several dairy buildings, a poultry building, some storage facilities, and two community buildings.

Plans were prepared for a concrete-block milk house, two different types of one-story milking parlors, two types of one and one-half story milking parlors, a four-cow walk-through milking parlor, and a combination milking parlor and milk room. Plans were also completed for several dairy farmstead layouts, a milk-can rack, and a concrete-block lounging shed.

Working drawings were prepared for the second unit of the Oregon State College turkey brooder house and the Experiment Station dairy shed. Other miscellaneous plans prepared include those for a covered hay rack and a wood stave silo.



## Controls Devised for Household Insect Pests

Control measures for cockroaches and other household insect pests were demonstrated last year in five Oregon State College buildings.

Application of 10 per cent chlordane with an aerosol generator which pumps a fog into the building resulted in virtual eradication of cockroaches. It is estimated that a single application will endure for more than a year.

A 5 per cent application of chlordane in other campus buildings gave good temporary control of cockroaches and silverfish but in several instances it was necessary to spot-treat certain rooms within two months.

## Branch Stations

The Oregon Agricultural Experiment Station was organized July 2, 1888, in accordance with the Act of Congress of 1887 known as the Hatch Act. The Experiment Station includes the Central Station at Corvallis and eight Branch Stations and eight Experimental Areas located so as to cover the varying agricultural conditions of Oregon.

The work of the Experiment Station is fundamental in the agricultural development of the state. Oregon's soil and climatic conditions present many problems that are unique and that must be solved before the state can fully develop its great potential agricultural wealth.

The Branch Stations and the Experimental Areas conduct experiments on the major agricultural problems of their respective agricultural sections of the state. The location of these Stations and Experimental Areas and their program of work is as follows:

*The John Jacob Astor Branch Experiment Station* at Astoria has as its major problems of investigation: dairying; improvement of forage crops; soil fertility; soil management for Coast conditions; and the drainage, improvement, and cultivation of tidelands.

*The Umatilla Branch Experiment Station* at Hermiston, conducted cooperatively with the United States Department of Agriculture, is studying problems of agriculture under irrigation on the Umatilla Reclamation Project and similar lands of the Columbia River Basin.

*The Hood River Branch Experiment Station* at Hood River deals with orchard pests, pollination, varietal testing, fertilizing, soil management, and other problems to reduce cost of producing fruit in this important orchard section.

*The Sherman Branch Experiment Station* at Moro, operated cooperatively with the United States Department of Agriculture, is conducting investigations on the major problems of cereal production under eastern Oregon dry-land conditions with special reference to the development of new and improved varieties, rates and dates of seeding, summer fallow, fertility, and soil conservation.

*The Southern Oregon Branch Experiment Station* at Medford, conducted cooperatively with the United States Department of Agriculture, is centering attention on problems of fruit production. Irrigation water forecasting activities of the Oregon cooperative snow surveys are located at this station. The station cooperates with the soil Conservation Service and other agencies in this work.

*The Eastern Oregon Branch Livestock Experiment Station* at Union is conducting experiments in fattening, wintering, grazing, breeding, and management of livestock; in the production of home-grown livestock, feeds, and cash crops; and in developing proper land utilization, soil conservation, and fertility maintenance.

*The Pendleton Branch Experiment Station* at Pendleton is situated in the heart of an important wheat and pea production area. In cooperation with the United States Department of Agriculture it has concentrated on the development of improved wheat varieties and crop practices, including crop rotation, weed eradication, and control of soil erosion. Recently an intensive project on erosion control has been initiated in cooperation with the United States Department of Agriculture.

*The Squaw Butte-Harney Cooperative Range and Livestock Station* at Burns consists of 16,000 acres of intermountain arid range lands used for experimental grazing work under controlled conditions with the object of rehabilitating depleted and worn-out ranges; 183 acres of irrigated land used in conducting experiments in the production of alfalfa hay, legumes, and forage for livestock feeding and in introducing, testing, and developing cash crops adapted to the high altitude areas of the Harney Basin; and 661 acres of native meadow land used for experimental fall and winter pasture and for the production of native hay for feeding experimental livestock. The combination of range and meadow land makes a complete experimental unit conducted cooperatively with the Bureau of Land Management, Department of the Interior.

*The Northrup Creek Experimental Area* located near Birkenfeld, Oregon, is conducting investigations in the utilization of logged-off timber lands by experimenting with sod-forming legumes and grasses on such lands and the utilization of the forage by livestock.

*The Klamath Experimental Area* consists of two experimental tracts, one located southeast of Klamath Falls on mineral soil and the other located south of Klamath Falls on muck soil. In addition to research on reclamation of problem soils in this irrigated district this experimental area is engaged in research on production problems with potatoes, cereals, and forage crops in the Klamath Basin.

*The Malheur Experimental Area* at Ontario is experimenting to find the best methods of crop production and the crops best suited to the areas of the Vale-Owyhee irrigation project. Major emphasis is given to studies of production and utilization of forage crops for livestock. The United States Department of Agriculture and Department of Interior cooperate actively in certain phases of the program.

*The Red Soils Experimental Area* at Oregon City is centering attention on rebuilding worn-out red hill soils, of which there are approximately 800,000 acres in the Willamette Valley. Utilization of grasses and legumes for seed production and forage has been emphasized in the station's soil-building program.

*The Dalles Experimental Area* at The Dalles is concerned with problems affecting the stone-fruit industry of that area. Principal fields of research are virus diseases and insect control, and soil management and cultural practice improvement.

*The Deschutes Experimental Project* located at Redmond conducts research on general farming problems in Crook, Deschutes, and Jefferson Counties. Current emphasis is on problems related to production of potatoes, alsike, and Ladino clover seed, cereals, and hay. All research is conducted on privately-owned land under co-operative agreements with the owners.

*The Southern Oregon Agronomic Project* at Talent is engaged in research on problems related to production of pasture and hay, grass and legume seed, and cereals in southern Oregon, including Josephine, Jackson, and Douglas Counties.

*The Milton-Freewater Experimental Area*, operated from the Umatilla Branch Experiment Station, is seeking solutions for problems faced in the production of fruit and vegetables in the eastern part of Umatilla County. Special emphasis is placed at present on control of insect pests of fruit trees.

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- 458—Relationship of Maturity and Weathering to Yield and Quality of Peppermint Oil. D. E. Bullis, F. E. Price, Dale E. Kirk.
- 459—Oregon's Capacity to Produce. M. L. Upchurch.
- 460—Trial Shipments of Oregon Late-Crop Potatoes. D. B. DeLoach, J. C. Moore.
- 461—Oregon's Agricultural Progress Through Research. Annual Report. Director, Oregon Agricultural Experiment Station.
- 462—Supplementing Alfalfa Hay with Succulents. D. H. Sherwood, I. R. Jones.
- 463—Sprinkler Irrigation Costs for Vegetable Crops in the Willamette Valley. M. H. Becker, D. C. Mumford.
- 464—Feeding for Milk Production. I. R. Jones, R. W. Morse.
- 465—Cost of Producing Sweet Corn in the Willamette Valley, Oregon. G. B. Davis, D. C. Mumford.
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- 467—Cost of Producing Carrots in the Willamette Valley, Oregon. G. B. Davis, D. C. Mumford.

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- 16—Filbert Bacteriosis and Its Control. P. W. Miller, W. B. Bollen, J. E. Simmons.

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- 433—Progress of Studies on Wax Content of Fiber Flax. D. E. Bullis.
- 434—Cost of Producing Apples and Pears, Hood River Valley, Oregon. Progress Report No. 1. G. W. Kuhlman, A. E. Irish, D. C. Mumford.
- 435—Spray Program for the Control of Diseases and Insect Pests of Peaches in Western Oregon. S. C. Jones, A. P. Steenland, S. M. Zeller.
- 436—Control of Common Insect Pests of Indoor Plants. R. G. Rosenstiel.
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- 438—Cost of Producing Strawberries. G. W. Kuhlman, D. C. Mumford.
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- 440—Cost of Producing Red Raspberries (for Processing) in the Willamette Valley, Oregon. G. W. Kuhlman, D. C. Mumford.
- 441—Cost of Producing Black Raspberries (for Processing) in the Willamette Valley, Oregon. G. W. Kuhlman, D. C. Mumford.
- 442—Drying and Bleaching Walnuts. E. H. Wiegand.
- 443—Cost of Producing Loganberries (for Processing) in the Willamette Valley, Oregon. G. W. Kuhlman, D. C. Mumford.
- 444—A Disposal Pit for Dead Chickens and Turkeys. E. M. Dickinson.

- 445—A Preliminary Report on Experiments to Control Quackgrass. V. H. Freed, H. E. Bierman.  
446—Testing Acceptability of Food Products—Taste Test Procedure. George Loran, E. H. Wiegand.  
447—Controlling Damping-Off in Vegetable Seedlings. E. K. Vaughan.  
448—Spray Program for the Control of Diseases and Insect Pests of Cherries in Western Oregon. Departments of Plant Pathology and Entomology.  
449—A Circular Haykeeper. Dale E. Kirk.  
450—Gorse Control. D. D. Hill.  
451—Urinary Calculi in Cattle. O. H. Muth.  
452—Hybrid Corn Trials in Oregon. R. E. Fore, E. N. Hoffman, C. A. Larson, J. T. McDermid, H. H. White.  
453—The Control of the European Earwig. D. C. Mote, H. H. Crowell.  
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455—Control of Insect Pests of Dairy Cattle. D. C. Mote, H. E. Morrison, R. W. Every.  
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177—Blind Seed Disease of Perennial Ryegrass. J. R. Hardison.  
178—Poultry House Equipment. W. T. Cooney, H. R. Sinnard.  
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- 550—Brucellosis Control in Oregon. O. H. Muth. Proceedings of Inter-American Congress on the Control of Brucellosis Held in Argentina.
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- 555—Pear Breeding Work in Southern Oregon. E. S. Degman, F. C. Reimer. Proceedings of American Horticultural Society.
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## PUBLICATIONS

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