Dr. A. L. Strand, President
Oregon State College
Corvallis, Oregon

Dear Dr. Strand:

I transmit herewith the 1942-44 biennial report, "Oregon's Agricultural Experiment Station Performs in War and Prepares for Peace." In it may be found a summary of progress made in research having a direct application to the war effort. It will serve as a wartime review of agricultural and home economics research in Oregon. Wartime conditions compelled brevity in its preparation and publication.

Respectfully submitted,

Wm. A. Schoenfeld, Director
Agricultural Experiment Station
Agricultural research during this biennium (1942-44) has been an integral part of the war program. Practically all projects have been adjusted and geared to a war basis. Agricultural research is a potent weapon in war as well as an effective builder in peace. Its immediate function is to discover and create new principles and information that can be translated into more food production to meet war needs now and into more economic production practices to meet the need for farm and home improvement when the war is over.

The huge backlog of research results, together with those currently achieved, have made it possible for Oregon farmers to meet their unprecedented war production goals. The farmer's ability to produce today the immense quantities of food that he has provided is largely a result of the combined cooperative and joint research of the United States Department of Agriculture and the Oregon Station working together. These results cannot be restricted to a single biennium although progress can be reported on all of the projects now under investigation.

The 267 projects that are under investigation at this station are grouped in accordance with their respective war functions as follows:

1. Increasing war food production.
   a. By controlling diseases and pests of food, fiber and feed crops and of livestock.
   b. By improving and developing superior strains of food, feed and fiber crops.
   c. By improving methods of producing war food crops.
   d. By providing better livestock feeding and management practices.
   e. By maintaining and improving soil fertility and irrigation.
2. **Converting food crops into form required by the Army and Navy.**
   
   a. By dehydrating, canning, freezing and other food processing.
   
   b. By packaging.

3. **Helping relieve war manpower shortage.**
   
   a. By aiding in developing more efficient use of farm labor and equipment.

4. **Measuring nutritive values of Oregon-grown food crops and determining factors that reduce vitamin content.**

5. **Helping provide critical war materials or substitutes.**

6. **Preparing for post-war reconstruction.**

The production of the huge quantities of food required for Army, lend-lease and domestic use has taxed the farmer's ingenuity to the utmost. He has found that diseased or dead plants or animals contribute nothing to winning the war; that low-yielding, inferior quality plants retard his ability to meet war production goals; that a receding soil fertility and inefficient production methods delay victory and defeat his efforts. In this struggle for maximum production the farmer has found agricultural science to be his close ally and his indispensable partner.

A few examples will serve to illustrate some of the significant achievements of research and their relation to war needs and farm economy.

**Increasing War Food Production:**

- **Diseases and pests defeated.**
  - Controlling the pea weevil, the hop red spider, the onion maggot, flea beetles, prune thrips, filbert worms, potato nematodes, the cherry fruit fly and many, many other insect pests and diseases made possible the harvesting of large quantities of essential food crops.

- **Worms driven from ripe fruit.**
  - During the biennium an emergency problem arose which directly affected the availability of packed raspberries. The oblique-banded leaf-roller appeared in epidemic numbers in the raspberry fields of Western Oregon about the middle of the harvest season. The worms were so numerous that the processors ceased packing the berries as they were not usable. The investigation of the problem made by the Experiment Station Departments of Entomology and Food Industries has assisted growers and processors in combating this pest and in controlling the worm in the packed fruit.

- **Livestock diseases curbed.**
  - The control of fowl pox, coccidiosis, pullorum and other poultry and turkey diseases has made available large amounts of poultry and turkey products that otherwise would have been destroyed.
The progress made in developing methods of reducing losses from diseases of beef cattle, sheep and hogs has provided large quantities of beef, mutton and pork for Army and domestic use. In addition to its regular investigations on disease problems during the biennium the Department of Veterinary Medicine has examined 450 animals and 4,929 poultry specimens for disease diagnosis. It has conducted 578,255 agglutination tests for pullorum disease and tested 24,800 blood samples for Bang’s disease. During this period the department has distributed 2,568,270 doses of fowl-pox vaccine and has answered 2,519 letters concerning poultry diseases attacking Oregon flocks.

Many of the low yielding, disease susceptible, inferior quality plants have been replaced by improved higher yielding, winter hardy strains that not only produce larger crops but also aid the farmer in his labor program. The higher yielding sorts require no more labor than the low yielders. Many crops now grown in Oregon got their start in the research laboratory. Even the top yielders cannot be sure of that position permanently. For example, Federation wheat that was introduced by the Sherman Branch Experiment Station and widely accepted by the farmers because it outyielded other varieties by several bushels an acre has now itself been largely replaced by the still higher yielding Rex variety recently bred and developed by that station. Even Rex may soon be replaced by one of the many other crosses now under test.

Large acreages in the Willamette Valley that formerly produced only wheat, oats and barley have been converted into the production of forage seed, small fruits, vegetables, nuts, fiber flax, peppermint oil, eggs, turkeys, dairy products and many other specialty crops that now provide large quantities of vitamin-rich foods for war and domestic use and also increase the farmer's income. Much of the crop improvement program of the station is conducted cooperatively with the U. S. Department of Agriculture.

During the past several years the production of alta fescue, red creeping fescue, subterranean clover and Willamette vetch has developed from the experimental to the commercial stage. These crops appear to have great possibilities for both forage and seed production. A new strain of meadow foxtail much superior to the older strains has been developed.

The branch experiment stations and the central station are constantly testing, breeding and introducing new varieties of food, feed, forage and condiment crops in an effort to improve production quality and quantity at reduced cost. Many varieties of soybeans are under test at three of the stations. A new wilt-resistant alfalfa variety, Ranger, has been encouraged. A new rust-resistant timothy variety, Lorain, has been obtained and seed production of this strain has been started.

In the problem of corn production many new hybrids are being produced and tested to determine those most suitable to Oregon’s wide range of conditions. A new hybrid corn, Oregon 100, is a result of some of these tests. The station now supplies enough single crosses for the production of all hybrid seed corn grown in the state.
Cooperatively with the U. S. Department of Agriculture many varieties of hops are being tested in an effort to find strains of superior yielding quality. Factors influencing products such as irrigation, vine cutting, suckering and stripping, cover cropping and fertilizing are also under test.

Two new barleys, one winter and one spring variety, have been developed and will be ready for distribution within the year. Both are superior to any variety now grown in Western Oregon. A new winter oat strain and a new spring oat strain have also been developed. Two new rye varieties have been distributed in Western Oregon. The testing of vegetable seed production, including varietal trials, cultural practices and fertilizer treatments are underway. Who can estimate the future of the vegetable seed industry? It is today in about the same position that Oregon's $12,000,000 forage seed production was 25 years ago.

Inefficient, expensive, labor-wasting, obsolete practices in production are being replaced by improved methods as rapidly as such methods can be tested and verified by research. For example, it is estimated that noxious weeds are responsible for a serious reduction in food crops and a loss to the farmer in excess of $3,000,000 annually. Experiments on the control of wild morning-glory in the Columbia Basin on wheat fields that had been abandoned for the production of wheat developed methods for economic practical control. These formerly abandoned fields under the experimental tests produced from 40 to 50 bushels of wheat per acre.

In contributing to the supply of beef, pork and mutton, the Production from livestock feeding and management practices. The balancing of feed pastures supplies with available livestock is an important problem. Animal nutrition has a prominent place in this program. The development of a practical method of artificially drying hay under the humid conditions on the coast, the testing of forage plants at the several branch stations, the improvement and rehabilitation of depleted ranges in the high desert areas, the irrigation of pastures in the Willamette Valley, the grazing of logged-off stump lands and the utilization of the large areas of hill lands in the Willamette Valley for forage production are among the research projects now producing results.

A feeding trial has shown that the nutrients in Austrian winter field peas are well utilized by dairy cattle. The peas contain approximately 20 per cent of digestible crude protein and 80 per cent of digestible nutrients and can be satisfactorily substituted for high protein concentrates. Feeding tests also show that satisfactory milk production can be obtained by the wise use of grain rations of lower protein content than customarily fed. This is especially important under war conditions when protein concentrates are difficult to obtain.

In the poultry field experiments show that:

1. Feeds low in animal protein but supplemented with vegetable proteins can be satisfactorily used in all phases of feeding.

2. Distillers dried solubles, dry yeast, etc., can replace milk products in poultry rations.
A complete set of feed formulas was developed and printed for wide distribution to the industry based upon the results obtained in the emergency experimental trials.

Maintaining and improving soil fertility and economic irrigation are problems that not only affect food production for war needs but also influence adjustment to a sound agriculture in the post-war period. Many tests are underway to determine methods of maintaining soil fertility while obtaining maximum production and without resting the land. Every acre is called upon for maximum production which draws heavily upon fertility unless scientific methods for sustaining fertility can be developed. The testing of the minor and major fertilizer elements in the field, the greenhouse and the laboratory to determine economic methods of increasing yields and the nutritive value of food plants produced is being given attention.

During the biennium an invoice was taken through the soil survey method of the soils in the Deschutes area. The Umatilla soil survey and chemical invoice were sent to press for publishing and the Baker County soil survey report is nearing completion. The total area of the state on which soil survey data have been completed during recent years is approximately 9,500,000 acres.

Decreasing soil erosion by proper methods of soil handling and the distribution of the crop residues is under investigation. Station bacteriologists have found that under trashy fallow practices decomposition proceeds as effectively as under normal plowing. Studies on the rate of decomposition and change in composition of wheat stubble under various tillage procedures practiced in the dry farming regions of the state are being carried on in cooperation with the Soil Conservation Service.

Converting Food Crops into Form Required by Armed Forces:

To supply the Armed Forces with palatable and nutritious food in form and package suitable for use in both hot and cold climates, tests have been conducted in many processing methods, including dehydration, freezing, canning and preserving of fruits and vegetables. In an effort to increase the variety of the diet for its troops, the War Department has assisted in financing this research.

Likewise, methods are under investigation for converting seafoods heretofore not utilized into high protein, edible products for war use. For this purpose the Seafoods Laboratory, a branch of the Food Industries Department, has been established at Astoria. The Food Technologist and Bio-chemist in these investigations are developing a fish loaf that has met with considerable favor of Army officials from the Quartermaster General's office.

Methods of dehydration of foods in the home to partially relieve the competition for foods required by the Army have been investigated and a family-size homemade type of electrical dehydrator has been developed. These trials have been demonstrated extensively throughout the state at various food preservation meetings and Experiment Station Circular 149, "Home Fruit and Vegetable Dehydration," has been published.
Helping Relieve War Manpower Shortage by Aiding Farm Labor and Equipment Situation:

Because of the shortage of manpower and equipment on the farm, investigations were conducted to determine methods of reducing labor and improving machinery. A project, "The Amount, Distribution and Timing of Farm Labor Necessary for the Attainment of Oregon's War Production Goals," was carried on by the Department of Farm Management. Progress has been achieved in making available labor go farther, especially during peak seasonal demands. The labor requirements by months, by localities, by enterprises and by operations are forecast as a result of these tests. Two publications, "Harvest Labor Efficiency on Cane Fruits in Oregon," and "Harvest Labor Efficiency on Strawberries in Oregon," have been published. Six other manuscripts are in preparation as follows:

"Man Labor Requirements for Apples and Pears in the Hood River Valley."

"Man Labor Requirements for Potatoes in Klamath County, Oregon."

"Man Labor Requirements for Cane Fruits and Tomatoes in the Willamette Valley, Oregon."

"Harvest Labor Efficiency on Hops in Oregon."

"Man Labor Requirements for Harvesting Pole Snap Beans."

"Harvest Labor Efficiency on Sour and Sweet Cherries in the Willamette Valley."

Methods and costs of renting farm machinery were worked out and published to aid farmers to obtain equipment that might be found available in the community.

Plans for farm equipment that could be constructed in farm shops to enable farmers to put up hay with a minimum of labor were developed by the Experiment Station Department of Agricultural Engineering. The results of these investigations were published.

Measuring Nutritive Values of Oregon-grown Food Crops and Determining Factors That Reduce Vitamin Content:

The Army is concerned about the vitamin content of its food supply. Cooperative investigations have, therefore, been carried on by the Station departments of Home Economics, Food Industries and Horticulture to determine the extent to which the major vitamins are affected by dehydration, freezing and other processing methods. Determining the factors that affect the manufacture of vitamins in food plants such as light, heredity, plant vigor, maturity, temperature, moisture, storage and artificial ripening are also under investigation.

The nutritional status of 4-H Club children and other rural youth to point out dietary deficiencies is being studied. The results thus far have focused the attention of young people on the value of good nutrition. The ascorbic acid metabolism of college students shows that greater care is needed in getting sufficient vitamin C in the diets to meet daily standard needs.
Helping Provide Critical War Materials or Substitutes:

The production of fiber flax, a critical material needed in the war program, has been increased as a result of investigations on production and processing problems and other services rendered the industry. Extensive research has been conducted on varieties and methods of producing the crop for maximum fiber content. The problems of retting and scutching are being investigated in an effort to improve the process and decrease the cost. These studies are conducted cooperatively with the U. S. Department of Agriculture.

The Department of Agricultural Engineering assisted in securing priorities for critical steel supplies for the construction of 50 flax pullers required in harvesting the additional fiber flax acreage. It also worked out lists of critical materials and plans for the construction of a number of fiber flax plants in Oregon and assisted those plants in the supervision of construction. This resulted in a total of 14 flax plants in the state (as of May 1944) with an output capacity of approximately 3000 tons of long fiber annually.

Large quantities of nitrates were saved by the research work of the Departments of Farm Crops and Entomology cooperatively with the U. S. Department of Agriculture in the production of legume forage seed for shipment to the southern states where the seed was used to grow cover crops, thereby replacing nitrate fertilizers formerly used. These investigations included the testing and developing of many new legume forage crops and the control of slugs, weevil, aphids and other pests in their production.

The imports of many of the oil, drug, rubber and condiment crops have been reduced or eliminated. The Experiment Station is endeavoring to find varieties and methods of production for many of these crops that will help in meeting present war needs and establish new industries for permanent development. Such crops as pyrethrum, high nicotine tobacco, caraway, colianer, fennel, Belladonna, safflower, digitalis, sainline, kok-saghyz, guayule and soybeans are under investigation at several of the branch stations and at the central station.

The Department of Horticulture has conducted a survey on the amount of materials required in packaging Oregon vegetable and fruit crops. The Dairy Department determined the needs of Oregon dairy manufacturing plants for tin to be used in retinning essential equipment and maintaining that equipment in good condition.

The Department of Agricultural Engineering gave major assistance in securing 300 additional combine harvesters for the harvesting of 100,000 acres of peas and vetch. It also aided many farmers in securing electric service on their farms and provided written plans and specifications to wheat growers for the construction of wood grain bins that formerly were built with steel.

The Soils Department has tested methods of utilizing farm wastes and legume crops to replace the use of commercial fertilizers.
Priorities and Army needs for certain essential materials have reduced the availability of many of the insecticides and fungicides formerly available for disease and pest control. A part of the research program includes the development and testing of substitute and improved insecticides that may be used to replace standard sorts formerly available.

The Department of Bacteriology assisted Camp Adair in the testing of the condition of the Willamette River water at the Camp water-supply intake. Tests were made weekly over a considerable period of time in cooperation with the chemist and bacteriologist from the Camp. It was determined that the filtered, treated water used in the Camp is sterile.

Designing Low Cost House and Farm Building Plans:

Plans for farm home construction with special emphasis on space requirements and maximum service to the farm family have been developed by the Department of Home Economics cooperatively with the Department of Agricultural Engineering. The functions of the different rooms, closets, storage and other spaces of the house have been given consideration. The equipment, arrangement and minimum dimensions of kitchens that provide for the needs of the Willamette Valley farm family have been determined.

Many blueprints of designs of farm buildings prepared by the Department of Agricultural Engineering have been distributed.

Preparing for Post-War Reconstruction:

While the major efforts of research during the current biennium were focused on a war research program, the Station is not losing sight of the needs for the years of peace. Fortunately a considerable part of the results of a war research program may be converted into methods and practices essential to post-war rehabilitation. The current program is, therefore, of dual purpose - first, to render maximum assistance in winning the war; and second, to assist in rebuilding a sound economic agriculture when the war is over.

At the end of the war the emphasis and objectives of the program will be shifted from that of war needs to that of economy of production. The farmer's need for disease and insect control; his need for better producing strains of plants and animals; his need for knowledge of better feeding of both plants and animals will continue as essential problems requiring research. The problems of credit, transportation, marketing, storage, price levels and Agriculture's position in the general economy will also need attention. Problems of particular interest to farm women such as food, housing, clothing, farm-home conveniences and family nutrition will no doubt receive action.

Staff Reduction Reduces Research Output:

The loss of 21 staff members of the Experiment Station to the Armed Forces of the country and the inability of the Station to employ graduate assistants in any of the fields of research have materially increased the load of the available staff and reduced the total output of the station. Despite this condition notable progress has been made in solving farm problems that aid in the war program.
From the economy standpoint, the reduction of losses and the increase in wealth resulting from the investigations as applied to the farms of the state are estimated to exceed $12,000,000 annually.

Research Findings Promptly Made Available:

The findings of research as rapidly as acquired have been made available to the Extension Service County Agents and Specialists who carry the information to the farmer for his immediate use. The research results are also published in the form of bulletins, circulars and mimeographed progress reports. Results of a technical nature are published as technical bulletins or submitted to scientific journals for publication. During the biennium 243,990 copies of 132 such publications were issued reporting the results of investigations conducted as indicated in the following table:

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<th>Kind of Publication Issued</th>
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