Research promotes prosperity.................................................. 74

As a result of the research program of the Utah Agricultural Experiment Station the economy of the entire state has benefited.

Research has dealt with the basic resources of Utah—their use and preservation—the water, the soil, the people, and their ability to make a better living.

Agriculture is fundamental to the state and its peoples. While only a small portion of the land of the state is irrigated, 85 percent of the area produces water for culinary purposes, for irrigation, and for industry; livestock and livestock products for food; forest products for homes and industry. These products plus those produced on the irrigated farms are the raw products used by many industries.

In this issue of Farm and Home Science an attempt is made to point out how the research of the Utah Agricultural Experiment Station extends into every area of the state to help solve the people's problems. The issue will serve as the biennial report for 1954-1956.
Research on problems related to agriculture, range, and water resources is conducted at eleven field stations and on more than 200 experimental plots in various parts of the state as well as in the research laboratories, greenhouses, and farms on and near the USAC campus at Logan.

A report of the research program of the Utah Agricultural Experiment Station in the counties of the state

Research Promotes Prosperity

Research at the Utah Agricultural Experiment Station is planned to help solve the problems of farmers in every part of the state—to point the way to a more prosperous agriculture. The problems change with our changing world. Today the rising costs of labor and materials make efficiency of operation especially important in farm profits. New insect pests and plant diseases threaten the farmers’ crops. Mechanization increases the need for larger units of operation. Surplus supplies of some farm crops create a demand for substitute crops. Problems of marketing are of increasing concern.

The research program of the Agricultural Experiment Station is centered at the Utah State Agricultural College in Logan. Technical aspects of problems are investigated in the laboratories, greenhouses, barns, and farms on the college campus and the surrounding area.

Much of the research conducted at Logan may apply equally well to all parts of the state. A feed mixture for dairy cows or laying hens that is successful at North Logan will also be valuable on most dairy or poultry farms. A vaccine for synovites of turkeys developed in the college laboratories is useful in Sanpete or Box Elder County.

Applied phases of the research are conducted in all parts of the state. Many investigations such as fertilizer tests, crop variety trials, livestock investigations, and forage production on saline soils are conducted on land belonging to farmer cooperators in various parts of the state. Other studies needing closer supervision are carried out at one or more of the 11 farms and field stations owned by the state or the federal government. Studies conducted in the counties are emphasized in this report.

Research scientists are generally quiet and busy workers. They come and go as their work demands in all parts of the state. Often only the few with whom they cooperate are fully aware of the work under way. This report is prepared so that the people in each county can see some of the work being conducted for their benefit. Space is inadequate for complete reports or even for a listing of studies under way in many counties.
Cooperative milking barns, such as the one at Minersville, reduce costs to individual farmer.

Individual records may be kept on the production of each cow.

**BEAVER . . .** Research has benefited agriculture in this county by

Surveying the soil

As a basis for agricultural planning and to help farmers with their cropping and fertilizer programs, a soil survey of the arable land in the Beaver area has been made by Soil Conservation Service and Experiment Station soil surveyors. The total area covered is 29,309 acres. Soil maps and a report of the survey are being prepared for publication.

Studying consumptive use of water

Milford Valley contains large supplies of ground water, but these supplies are exhaustible. After a period of continuous decline in the level of the ground water table, the State Engineer closed this basin to further well drilling and appropriation of water.

Because of this the Utah Agricultural Experiment Station began a study of the consumptive use of water in the valley. Engineers found that about 64,000 acre feet of water are used annually by vegetation on some 34,000 acres, or an average depth, including rainfall, of 1.9 feet over the surface of the land. Of this water, 44 percent came from precipitation and 35,000 acre feet from surface and ground water sources.

Groundwater levels have been going down since 1951. The annual overdraft from 1951 to 1954 averaged 11,600 acre feet. However, about 10,000 acre feet per year might be salvaged through further lowering the water table in certain areas, and using flood waters to recharge the basin.

Consumptive use of water figures are basic in determining watershed yields and in all phases of irrigation and drainage planning. They are essential in determining the proper size of canals, ditches, flumes, and other structures; to applying water to the land, both as to frequency and amount; and to determining the amount of excess water that must be removed by natural or artificial means if the land is not to become waterlogged.

Studying problems in growing alfalfa

Recommended varieties of alfalfa for Beaver County include Ranger and Buffalo. Lahontan should be grown wherever stem nematode or spotted aphids damage the crop.

During the past two years plant pathologists have surveyed alfalfa fields in the county for disease. A study has also been made on the economics of alfalfa seed production.

Analyzing costs of cooperative milking barns

Beaver County has two of the six cooperative milking barns in
Utah. These are located at Beaver and Minersville. To reduce the high costs of each dairymen building and operating a milking plant to meet requirements for market milk production, and to reduce labor requirements on farms, dairymen organized cooperative milking barn associations to provide milking facilities for their members.

A study has been made of 5 of the 6 cooperatives by the Experiment Station. These had a total membership of 90 with a range of 8 to 30 members in each association. They averaged 195 cows milked. Capital investment averaged $15,066 and ranged between $6,625 and $24,375. The average capital per member was $837, with a range of $485 to $1,937. Capital per cow averaged $86, with a range of $66 to $163. Members' investments accounted for 87 percent of the capital, 12 percent was borrowed, and 1 percent was retained from net earnings.

In 1953 the average cost of operating the dairy milking barns was $9,160 for each association, $32 per cow or 17 cents per cow per day. The lowest cost per cow, 15 cents, was in the association that milked 340 cows daily.

Studying other problems

Other tests made in the county include variety tests of new corn hybrids and small grains and tests for crop response to fertilizers.

Research has benefited

Breeding smut resistant varieties of wheat

Disease resistant and high yielding varieties of small grains are of major importance to the farmers of Box Elder. A large part of the dryland wheat grown in the state is grown in this county. Relief, Cache, and Wasatch wheat, smut-resistant varieties developed by the Utah Agricultural Experiment Station, have saved wheat-growers from the scourge of dwarf smut which was taking as much as 90 percent of the crop on many farms prior to the release of these varieties.

Breeding Alpine, a new spring barley

Velvon and Bonneville barley, higher yielding disease-resistant varieties, developed by Experiment Station and USDA scientists, have led to increased acreages and yields of barley not only in Box Elder County, but throughout the state. In 1956, the Station released a new winter barley, Alpine, as a substitute crop for winter wheat acreage withdrawn because of acreage allotments. This new and superior variety of winter barley will provide considerable feed either on dry or irrigated land and is a good substitute for winter wheat. Yields ranging from 20 to 35 bushels an acre have been obtained on dry land. A top yield of 128 bushels per acre was obtained on fertile irrigated land.

Determining value of fertilizers for dryland wheat

The yield of dryland wheat has been increased up to 10 bushels per

Safflower, a substitute crop for winter wheat, is a spring planted oil-seed crop

Safflower is easily harvested with a combine. The seed may be used as a supplement to grain for livestock feed.
Station scientists are studying the problems of salty soils from many angles—methods of draining and leaching, management practices to bring them into production, crops that are relatively salt tolerant. The picture shows the salinity plots on the Evans Farm.

Testing safflower as a substitute crop for winter wheat

Safflower is another substitute crop for winter wheat that has been tested in Box Elder for a 6-year period. Safflower is a spring planted annual oil-seed crop producing an oil adapted for paint and a press cake or meal residue which is a good protein supplement for livestock. The seed may be used as a supplement to other grain as a stock feed. Yields of seed have varied from 1360 to 3000 pounds an acre with one irrigation, and up to 1340 pounds on dry land. A breeding program is being initiated in cooperation with the U. S. Department of Agriculture to develop higher yielding safflower varieties better adapted to local conditions.

Testing alfalfa seed as a crop for dry land

Extensive trials have indicated that alfalfa seed is an additional substitute crop for wheat in the more favorable soil and moisture locations. Yields of about 150 pounds per acre have been commonly obtained in the Collinston area.

Studying diseases of fruit trees

A number of fruit diseases have been studied in the area around Brigham City. Winter injury was found to be less severe where orchards were well cared for. Field trials have been made on top working trees on mahaleb rootstock to control wilt and decline and little cherry in sweet cherries.

Finding a way to eradicate chokecherry

Chokecherry is an important carrier of western x- disease of stone fruits in the county. Experiments have shown that chokecherry can be killed by repeated spray applications of low volatile esters of 2,4-D or mixtures of 2,4-D and 2,4,5-T at a concentration of 0.2 percent in water. Treatments made each year at the full leaf and blossom stage early in June will kill 90 percent of the trees in 2 years and eventually completely eradicate the chokecherry.

The experiments also show that basal applications of a low volatile ester of 2,4,5-T at 2 percent acid equivalent by weight in diesel oil applied in early spring killed all trees after 2 treatments in 2 years. Basal and spray treatments should be applied when the trees are in full leaf.

Investigating the nutrition of school children

Studies on the nutritional status of school children in Box Elder were made in the fall of 1955. Blood samples and dietary records were obtained from 423 school children between the ages of 7 and 11 years. The State Department of Health gave the children complete physical examinations.

Letters have been sent to the parents giving them an evaluation of their children's diets. Final results of the study are now being analyzed.
At the Dairy Experimental Farm, open sheds house the dairy herd. When sheds and yards are carefully planned, man-labor can be saved by using farm machinery. For this unit of 32 cows cleaning yards and shed and spreading the manure on the land required 1½ minutes per cow per day or 9 hours per cow year. Sheds only need to be cleaned once each year.

Investigating methods of reclaiming salty soils

Methods of reclaiming saline and alkali land are being investigated in Box Elder County. Preliminary trials indicate that ferric sulfate is from 5 to 7 times more effective than gypsum for improving saline-alkali soils.

Another phase of this work is to find plants tolerant to salt and at the same time palatable to livestock. Tall wheatgrass has failed to grow on soils containing more than 23 percent exchangeable sodium. Barley is more sensitive to calcium chloride than sodium chloride.

Determining factors responsible for yield and quality in sugar beets

Studies of yield and quality in sugar beets as affected by plant population, soil moisture condition, and soil fertility show that sugar beets will yield at least 20 tons an acre if early planting, proper plant spacing, and weed control are combined with adequate irrigation and fertilizer programs.

Studying other problems

Other studies include responses of crops to fertilizers, the control of halogeton and sheep management practices to prevent halogeton poisoning, need for supplemental feed for sheep and cattle on the range, and methods of control of zinc and manganese deficiencies in fruit trees.

CACHE . . . Research has benefited agriculture in this county by

The research program of the Utah Agricultural Experiment Station centers in Logan and the surrounding area of Cache County. Here most of the laboratory and greenhouse studies are pursued. Near the College campus are located the agronomy and animal husbandry farms, the dairy, poultry, turkey, and animal disease farms. Here a staff of 140 technically trained research scientists investigate the problems confronting agriculture in Utah. Most of these studies have state-wide application. A few are limited in their application to specific areas.

Determining most productive dairy practices

Hundreds of people from all
Improving dairy stock

At the Dairy Experimental Farm the problems of dairy production are studied. Through the selection and proving of sires, proved bulls have been made available to Holstein and Jersey dairy farms in many parts of the state. Others are used in artificial breeding programs.

Increasing pasture yields

Pasture studies during the past 9 years have shown the best pasture mixtures, management, and fertilizer practices for high milk production. Yields from strip grazing during 1955 averaged 7,248 pounds of milk containing 280 pounds of butterfat per acre. In addition, 648 pounds of hay were harvested from the pasture. Some pastures yielded 8,694 pounds of milk containing 334 pounds of fat per acre. From 65 to 82.5 percent of the nutrients fed came from pasture.

Mixtures containing alfalfa yielded the most forage; those containing orchardgrass also yielded well. Data from a 3-year study indicate that reduction of grain feeding is possible when cows graze improved irrigated pastures.

Determining the most economic feeds

In other studies at the Dairy Farm the feeding value of alfalfa hay and alfalfa silage was com-
Research in practices in crop production under irrigation farming has demonstrated that crop rotation is essential in maintaining soil fertility.

Providing information basic to crop production under irrigation

On the Agronomy Farm a longtime study is under way on soil, water, and plant relations which is providing much information basic to irrigation agriculture. Each year's results demonstrate more clearly the soundness of crop rotation in maintaining soil productivity.

These studies have shown that for potatoes, furrow irrigation requires 20 to 50 percent more water than sprinkle irrigation when soil is maintained in a moist condition. Russett Burbank potatoes yielded 20 percent higher under sprinkle irrigation than under furrow. More frequent light irrigations alone should increase yields of potatoes in Utah by at least 100 bushels an acre. Harvested acreage of potatoes in Utah is around 14,500. At $1 a bushel, an increase of 100 bushels would add nearly $2,000 annually to the farm income of Utah.

Average yields of peas could be increased about 800 pounds an acre by use of nitrogen fertilizer and another 500 pounds by more frequent irrigation. Furrow irrigation is superior to sprinkle irrigation for peas. Sprinkling causes pea vines to lie down and become moldy. If farmers used both these practices, they could expect at least a 1,000 pound increase an acre. Such an increase would add $370,000 to the farm income of the state.

Irrigation furrows should be no farther apart than twice the depth of the principal plant roots, hence furrows should be closer in shallow rooted than in deep rooted crops. With closer spaced furrows the water will move laterally and wet the soil in the middle of the row while it is moving vertically to the moist soil below.

Both corn and alfalfa use phosphorus fertilizer near the surface soil more than that placed in the lower soil zone. When the surface is allowed to become dry, even
though there is sufficient moisture at a lower depth, the phosphorus applied in the dry soil is of little value to the plant.

Investigating the harmfulness of the newer insecticides to animals and man

New and more powerful insecticides are introduced every year. While these have proved their worth in the control of harmful insects, health authorities wonder if they are also harmful to man, especially when used on crops eaten by domestic animals and by human beings.

For a number of years scientists at the Utah Station have been trying to answer these questions. Hay dusted with these various insecticides—DDT, methoxychlor, toxaphene, chlordane, aldrin, dieldrin, endrin, heptachlor, systox—in different amounts, has been fed to domestic animals and rats and their tissues and products analyzed. Results of these tests have been the basis for spraying recommendations for use of the various insecticides on crop plants to avoid harmful residues.

Testing canal lining materials

Water for irrigation and industrial and culinary use is the limiting factor in the development of the western states, yet approximately a third of all water diverted for irrigation purposes is lost in con-

veyance. Lining of canals and ditches would conserve much of this water. The need for lining is widely recognized; the fact that only 5 percent of the canal mileage is lined is because of the lack of cheap, permanent lining materials.

At the River Irrigation Laboratory in Logan, scientists are testing the effectiveness of plastic film for both canal and reservoir lining. Polyethylene and polyvinyl chloride films have been under test for two years. Using these films, losses from seepage have been less than those from evaporation when 8 mil (thickness) material was used. Losses from 4 mil material were considerably greater.

CARBON . . . Research has benefited agriculture in this county by

Surveying soil resources

A soil survey of the Price River Valley by U. S. Department of Agriculture and Station soil surveyors published some years ago gives basic information on the soils of the area. Such information is preliminary to all land use planning both by public agencies and by individual farmers.

Testing corn varieties

Corn variety tests have shown that Portwalco 90 or 100, Utahhybrid 544 or 680, Kingscroft KY 7 or K3A, Keystone 38, and Ohio C 38 are the best varieties for silage. These tests were made in Price and Wellington.

Experimental cows are fed individually. Accurate records of the feed intake of each animal are used to determine the effect of the different rations on production.
Research has shown that in range seeding to insure a good stand of grass, sagebrush must first be eradicated.

**Studying nutrient deficiency diseases in crops**

Surveys of nutrient deficiency diseases of ornamentals and horticultural crops in the area show that chlorosis is prevalent in the vicinity of Helper. Iron chelates are proving useful in controlling the disease.

**Studying problems of saline soils and irrigation water**

Saline soils are a major problem in Carbon County. Studies on leaching saline soils made in Millard County are applicable to this county. The Station is also testing crops better adapted to saline soils. Irrigation water taken from the Price River below Price is of poor quality. Precautions should be taken to limit salt and sodium accumulation in the soils by leaching and drainage.

**DAGGETT . . . Research has benefited agriculture in this county by**

**Surveying the soils**

Experimentation Station and the U. S. Department of Agriculture soil scientists have completed a soil survey of the arable land in the county, about 26,700 acres.

**Studying improvement of range resources**

Range research conducted in similar areas in the state will find application here. Such studies have dealt with (1) sagebrush control by herbicides, burning, and mechanical means, (2) adaptability of introduced species to artificial seeding on foothill ranges, (3) method of soil preparation and seeding, and (4) method of management and livestock responses.

The studies show that sagebrush prevents establishment of grass seedlings and must be eradicated for successful seedings. Several introduced species are adapted for rehabilitation of foothill ranges—crested, pubescent, intermediate, and tall wheatgrasses.

If the site for seeding has good soil and average rainfall of 12 inches or more, it pays to prepare the seedbed with the same care as for dryland wheat. Seeding with a drill in the fall has produced better results than other methods or other seasons.

**Study of nutrient deficiency diseases of ornamentals and horticultural crops in the area show that chlorosis is prevalent in the vicinity of Helper. Iron chelates are proving useful in controlling the disease.**

**Studying problems of saline soils and irrigation water**

Saline soils are a major problem in Carbon County. Studies on leaching saline soils made in Millard County are applicable to this county. The Station is also testing crops better adapted to saline soils. Irrigation water taken from the Price River below Price is of poor quality. Precautions should be taken to limit salt and sodium accumulation in the soils by leaching and drainage.

**DAGGETT . . . Research has benefited agriculture in this county by**

**Surveying the soils**

Experimentation Station and the U. S. Department of Agriculture soil scientists have completed a soil survey of the arable land in the county, about 26,700 acres.

**Studying improvement of range resources**

Range research conducted in similar areas in the state will find application here. Such studies have dealt with (1) sagebrush control by herbicides, burning, and mechanical means, (2) adaptability of introduced species to artificial seeding on foothill ranges, (3) method of soil preparation and seeding, and (4) method of management and livestock responses.

The studies show that sagebrush prevents establishment of grass seedlings and must be eradicated for successful seedings. Several introduced species are adapted for rehabilitation of foothill ranges—crested, pubescent, intermediate, and tall wheatgrasses.

If the site for seeding has good soil and average rainfall of 12 inches or more, it pays to prepare the seedbed with the same care as for dryland wheat. Seeding with a drill in the fall has produced better results than other methods or other seasons.

About the same amount of forage was produced by each of the wheatgrasses. Crested and pubescent wheatgrasses start growth relatively early in the spring, but mature much more rapidly than tall and intermediate wheatgrasses. As a result, crested and pubescent do not furnish adequate nutrients for lactating animals during the latter part of June. Intermediate and tall can be used to make up this deficiency. Animals can be grazed early on either crested or pubescent wheatgrass or native grasses and later on pastures of intermediate or tall wheatgrass before going on to higher mountain ranges July 1.

As a basis for study of range vegetation, especially poisonous plants, samples of the plants from this county have been collected and are available in the Intermountain Herbarium at Utah State Agricultural College.

**Studying wildlife resources**

The development of the Colorado River Project will increase the recreation possibilities of this area which is already known for its deer and antelope.

Distribution, population, and productivity studies have been made on the antelope of the area in cooperation with the U. S. Fish and Wildlife Service. These studies are for the purpose of determining the numbers on the range, the numbers killed by hunters, and other causes of death.

Preliminary investigations have been made on the numbers, distribution, and wintering losses of mule deer in Daggett County. Deer
migration studies have also been made. Ranges of the area and their ability to produce feed for wild game as well as livestock have been evaluated.

A preliminary study of the marten as a furbearer has been made.

**DAVIS . . . Research has benefited agriculture in this county by**

Analyzing the effects of urbanization

The Station has conducted an extensive study of the process of urbanization in Davis County, Utah's fastest growing county. Between 1938 and 1954, 8,505 acres of land were shifted from agricultural to nonagricultural use. Of these, slightly less than half has been irrigated. The major part is being used for military purposes.

The county changed from a rural to an urban area, industrial workers and professional and business people increased, people of varying nationalities and religious beliefs moved in, crime and the number of formally organized groups increased. The number of businesses doubled; specialized services were established and became accessible in both rural and urban areas. A consolidated library with many branches developed. Urbanization brought a higher standard of living in the area. More women worked outside their homes.

There was large expansion in school facilities and numbers of teachers and students. The effects of the changes in land use on problems of financing the school district with increased school enrollment were studied by Station economists. The financial problem of the schools has been reduced by state equalization and assistance from the federal government.
Conducting investigations in vegetable crops, floriculture, and fruit diseases

The Experiment Station maintains a field station at Farmington where much of the research in vegetable crops, floriculture, and virus diseases of stone fruits is conducted.

Providing information on flowers and shrubs

Home owners are requesting a wide variety of information on flowers and ornamental shrubs for home beautification. To find the answers to many of these questions an experimental garden was started at Farmington in 1954. Many varieties of petunias, delphiniums, gladioli, calendula, larkspur, lupine, stocks, roses, and other flowers provide a wealth of information to flower lovers on their adaptation to this area. Information is also being obtained on winter hardness of varieties, irrigation requirements, and best management practices.

Studying virus diseases of stone fruits

A plot connected with the Farmington Station is used for virus disease studies on stone fruits. These studies have shown that many of the previously unexplained disorders of stone fruit trees in Utah are infectious diseases caused by viruses. Seven virus diseases have been isolated on peach, 12 on sweet cherry, 9 on sour cherry, and 2 on plum and prune.

The discovery that western x disease was transmitted from chokecherry to peach and to sweet and sour cherry by the geminate leafhopper was made at the Utah Station. Recent spraying and other practices have greatly reduced the population of leafhoppers and reduced the spread of western x disease.

Developing verticillium-wilt resistant tomatoes

Much of the selection and testing in the development of two verticillium-wilt resistant tomato varieties, Loran Blood and V-R Moscow, was done in Davis County. These varieties are grown almost exclusively in all the canning areas of the state at present. They yield from 10 to 20 percent more marketable tomatoes than the older varieties.

Scientists are now making considerable progress in breeding a commercial variety of tomato resistant to curly top.

Breeding better varieties of other crops

At Farmington research is also under way to develop hybrid onions and a green lima bean that are well adapted to Utah growing conditions. Other studies have shown that popcorn for commercial production has possibilities in this area.

Investigating best practices for commercial seed production

Recent studies have shown that peas grown for seed do best with a high moisture supply. Carrot seed yields have benefited less by high

Studying cultural practices in raising tomatoes

In studies of cultural practices in raising tomatoes, yields were dou-

Urbanization, land use, disease-resistant tomato tomatoes and other vegetables, vegetable seed subjects for research in Davis County

84
bled on high moisture plots over those with low moisture and increased 20 percent when starter fertilizer was used. Such practices would be of considerable value if used on the 7,500 acres of processing tomatoes grown in Utah.

Evaluation of sprinkler irrigation

Much of the land in Davis County is operated by "part-time" farmers who also work in industrial plants. Having the water under control and the irrigation schedule worked out to fit their needs can be of great value.

Such farmers will find value in a study of sprinkler irrigation systems in northern Utah made by the Experiment Station. Some of the systems studied were in Davis County. All the conclusions made are applicable to the area:

1. Suitable sprinkler systems will cost from $75 to $85 per acre, based on 1956 prices.

2. Nearly half of the systems now in use are inadequately designed to meet peak water use requirements. About 15 percent of the systems do not meet peak water use requirements because of improper operation.

3. Farmers do not apply sufficient water at each irrigation for optimum crop growth or minimum water application cost.

Duchesne . . . Research has benefited agriculture in this county by

Testing alfalfa varieties and fertilizer needs

Alfalfa is grown extensively in Duchesne both for forage and for seed. For areas below 5,500 feet in elevation the Experiment Station recommends Ranger and Buffalo unless the stem nematode or spotted aphid is prevalent. For these areas Lahontan, which is resistant to these pests, is recommended. For areas above 5,500 feet elevation Ladak, Ranger, and Vernal are recommended.

Sprinkler irrigation especially fits the needs of part-time farmers and farms on steep hill-side slopes

(4) A sprinkler system must be capable of delivering a water supply of about 10 gallons per minute per acre constant flow during the hottest part of the summer for the crops and conditions of northern Utah. A major reason for the large flow requirement is the irregular shape of the fields.

(5) Total labor requirements are a minimum of one man-hour per acre per irrigation.

Yields of alfalfa hay have been increased as much as 200 percent in Duchesne when phosphate fertilizer was used on the land. Applications equivalent to about 200 pounds of triple superphosphate per acre are recommended every third year to maintain high yield.

Developing practices for increased production of alfalfa seed

Practices for the growing of alfalfa seed have been worked out by the Experiment Station and
Duchesne County has a land area of 2,086,500 acres, 94,883 acres of which are irrigated. Duchesne is fifth among the counties of the state in number of dairy cows and in acreage of silage corn.

Farm income in 1955 amounted to $4,340,000. Income from dairying was $1,886,000, from all livestock and livestock products, $3,556,000. Income from alfalfa seed was $382,000, from alfalfa hay $156,000, and from grains $130,000.

have been brought together in circular 135, “Growing Alfalfa for Seed.” This information should be of special value to the growers of certified seed. There were 20 producers of certified seed in 1956 in Duchesne County. Marketing practices for alfalfa seed have also been studied in this county. The need for more production of certified seed of the new varieties. The demand for Utah Common alfalfa seed has almost disappeared during the past five years.

Duchesne County is fifth among the counties of the state in number of dairy cows and in acreage of silage corn.

Farm income in 1955 amounted to $4,340,000. Income from dairying was $1,886,000, from all livestock and livestock products, $3,556,000. Income from alfalfa seed was $382,000, from alfalfa hay $156,000, and from grains $130,000.

have been brought together in circular 135, “Growing Alfalfa for Seed.” This information should be of special value to the growers of certified seed. There were 20 producers of certified seed in 1956 in

Duchesne County. Marketing practices for alfalfa seed have also been studied in this county. The need for more production of certified seed of the new varieties. The demand for Utah Common alfalfa seed has almost disappeared during the past five years.

Duchesne County is fifth among the counties of the state in number of dairy cows and in acreage of silage corn.

Farm income in 1955 amounted to $4,340,000. Income from dairying was $1,886,000, from all livestock and livestock products, $3,556,000. Income from alfalfa seed was $382,000, from alfalfa hay $156,000, and from grains $130,000.

have been brought together in circular 135, “Growing Alfalfa for Seed.” This information should be of special value to the growers of certified seed. There were 20 producers of certified seed in 1956 in

Duchesne County. Marketing practices for alfalfa seed have also been studied in this county. The need for more production of certified seed of the new varieties. The demand for Utah Common alfalfa seed has almost disappeared during the past five years.

Duchesne County is fifth among the counties of the state in number of dairy cows and in acreage of silage corn.

Farm income in 1955 amounted to $4,340,000. Income from dairying was $1,886,000, from all livestock and livestock products, $3,556,000. Income from alfalfa seed was $382,000, from alfalfa hay $156,000, and from grains $130,000.

have been brought together in circular 135, “Growing Alfalfa for Seed.” This information should be of special value to the growers of certified seed. There were 20 producers of certified seed in 1956 in

Duchesne County. Marketing practices for alfalfa seed have also been studied in this county. The need for more production of certified seed of the new varieties. The demand for Utah Common alfalfa seed has almost disappeared during the past five years.

Duchesne County is fifth among the counties of the state in number of dairy cows and in acreage of silage corn.

Farm income in 1955 amounted to $4,340,000. Income from dairying was $1,886,000, from all livestock and livestock products, $3,556,000. Income from alfalfa seed was $382,000, from alfalfa hay $156,000, and from grains $130,000.

have been brought together in circular 135, “Growing Alfalfa for Seed.” This information should be of special value to the growers of certified seed. There were 20 producers of certified seed in 1956 in

Duchesne County. Marketing practices for alfalfa seed have also been studied in this county. The need for more production of certified seed of the new varieties. The demand for Utah Common alfalfa seed has almost disappeared during the past five years.
In 1955, the farm income of Emery County amounted to $2,210,000. Livestock and livestock products accounted for most of this, $2,004,000. Beef cattle were the most important livestock. Wheat and hay were the most important crops.

As a part of this program plastic films have been tested to determine their resistance to weathering and other factors which influence durability of these films as linings for farm reservoirs.

One of these trials was the lining of a reservoir in Emery. This reservoir was lined January 11 and 12, 1956, with olive green vinyl.

Before lining, the reservoir had to be refilled every week or ten days. Now, nearly a year later, the lining has been effective in controlling losses.

Tests in other parts of the state confirm the test at Emery. With current prices at about 40 cents per square yard for 1 piece plastic liners and low installation costs, such liners compare well in cost with others now used.

Studying consumptive use of water

During recent months the attention of the nation has been focused on the Upper Colorado River Basin. As the national congress battled about what this area needed, Utah was ready with facts.

In making an equitable division of water resources between states it is important to know how much water is actually needed in the various areas. Thus, at the request of the State Engineer, the Experiment Station and the Soil Conservation Service made a detailed study of water use in selected areas. Ferron Valley in Emery County is one of those areas. They found that about 27,000 acre feet of water was used in the valley.

Without the type of information obtained from this investigation, it is impossible to determine how much water is needed for the land that can be irrigated in the Colorado River Basin of Utah and how much water can be diverted out of the basin for irrigation within the Great Basin. Under the terms of the compacts dividing the waters between the states, consumptive use or streamflow depletion is the measure of the right for water. Basic and reliable figures on consumptive use are essential if such a basis of operation is feasible.

Determining fertilizer needs of alfalfa

Significant increases in yields of Ranger alfalfa were obtained in Emery County by the single application of adequate amounts of fertilizers containing phosphorus. These fertilizers also increased the amounts of cobalt, copper, manganese, and other nutrients in the hay.

GARFIELD ... Research has benefited agriculture in this county by

Studying improved livestock and feed program

The research program of the Experiment Station in Garfield County is centered around the Panguitch Farm where farming practices for areas of high elevation and short growing season are studied. Since these areas are dependent on livestock as a source of income, the research is concerned with an improved type of livestock and an increased feed program.

Investigating improved livestock practices

The emphasis in livestock production is on efficiency through improved breeding, feeding, management, and marketing. The research with cattle at Panguitch is part of a Western Regional project designed to improve cattle through breeding. Eleven states are cooperating in this project and 6,000 cattle are involved. The objective is to produce cattle that have su-
perior reproductive ability, rate and efficiency of gain, and superior conformation.

Percentage calf crop is closely related to profits. The calf crop is influenced by level of nutrition and management practices as well as by the inherent ability of the sire and dam. A cow is maintained for only one purpose, to produce a calf. If she does not do this, she fails to make a profit.

Each year a well fed cow should drop a strong early calf that will grow to weigh not less than 400 to 450 pounds when weaned at about 6% months. Hereford calves from the Panguitch farm have averaged 408 pounds at 190 days. They range from 326 to 523 pounds.

Cattle differ in their ability to gain and to use feed. At Panguitch the best bull calf gained 60 percent faster than the poorest gainer and he used feed 37 percent more efficiently. Differences in gaining ability are inherited.

Testing crop varieties and production practices

Research indicates that the production of crops in the Panguitch area can be approximately doubled by following recommended practices and planting adapted varieties.

In alfalfa trials Ranger, Vernal, and Ladak have been the best yielding varieties. Ladak will probably not survive more than 4 or 5 years because it is not resistant to wilt. Only certified seed of any of these varieties should be planted. Common seed may be anything from non-certified Ranger to one of the southern types of alfalfa. These southern alfalfas winterkill in the Panguitch area.

In tests of grass-alfalfa mixtures, mixtures yielded more than 5 times as much forage as grass alone. Intermediate wheatgrass and Mangel brome were the highest yielding grasses.

In years when additional feed is needed, and water for irrigation is available, common vetch, hairy vetch, Hubam clover, and field peas, planted with 50 pounds of oats per acre, will produce yields in excess of 3½ tons of hay per acre in one cutting. The hay is relished by cattle. Because these crops are shallow rooted, they must be irrigated to survive.

Yields of alfalfa have been increased as much as 200 percent with use of phosphate fertilizer. The recommended amount is 200 pounds of concentrated superphosphate every 3 or 4 years.

When planting alfalfa, plow the land in the fall and level it for uniform irrigation. Apply phosphate fertilizer. Manure can be used more profitably on pastures or grain crops. Plant the alfalfa in early June and irrigate as soon as possible. Seed a companion crop of oats or barley at about 50 pounds an acre. If the companion crop becomes too heavy, cut it for hay. Irrigate the alfalfa at least every two or three weeks.

Demonstrating advantages of land leveling

Results of a land leveling program show that even under conditions of drought good crops can be produced when limited water can be distributed evenly. Yields of alfalfa have averaged more than 3 tons an acre where the land had been leveled. Fifty percent less water is required than before leveling. Land should be leveled in the fall. Cost has averaged between $50 and $60 an acre. This cost is reduced by government benefit payments.

Showing value of education in community participation

A part of a sociological study on the relation of education of citizens to their participation in community activities was made in Escalante. This study showed that in both rural and urban communities, individuals with more education contributed most in all types of community activity, civic, religious, and cultural.
Experimental cattle used in the range cattle breeding studies, Panguitch

GRAND . . . Research has benefited agriculture in this county by

Investigating control of poisonous plants

Range land in this area has deteriorated through overgrazing. Poisonous plants and other unpalatable weeds have invaded the range and caused serious livestock losses. Among these are sneezeweed, horsebrush, copperweed, and halogepot.

Halogepot posed a special threat to the range livestock industry not only in Grand County, but throughout the range area. Extensive investigations by the Experiment Station approached the problem from two angles. Scientists developed sound principles of range management which made it possible to “live with halogepot” with only token losses of range animals from this cause. Briefly, they found that hungry animals are more susceptible to halogepot poisoning because they are more apt to eat the plant and less of the plant is required to cause death. Therefore, when animals must be driven through heavily infested areas, they should be fortified by feeding once a day—preferably with high calcium pellets.

Ranges with small to moderate amounts of halogepot can be grazed safely by avoiding areas of pure halogepot when trailing or bedding, by moderate use and open herding, and by supplementing animals during stormy weather. Eating small to moderate amounts of halogepot over extended periods of time does not appear to have any harmful effects on breeding ewes.

The second phase of the study concerns the eventual eradication of the plant. At a conference of scientists from the Western States on the subject it was decided that not enough was known about the halogepot plant itself. Subsequently, experiment stations in Utah, Nevada, and Idaho entered into a cooperative study. At the Utah Station physiological investigations and anatomical studies have been undertaken.

The first results of these studies are a prescribed method for killing the plant with chemicals. These should be restricted mainly to isolated spot infestations where complete kills are feasible. It is especially important that chemicals be applied at the correct time—before the plant begins its reproductive stage. The initial application should be made in early summer. Then the areas must be carefully inspected, especially after rains, and sprayed again for any seedlings. Proper timing of all treatments and complete coverage of each plant are essential.

Determining water quality

Quality of irrigation water in Grand County has been determined by Station scientists. The waters of Castle and Pack Creeks are of questionable quality. Castle Creek water contains sufficient salt to affect most crops. Water from Pack Creek is of questionable quality for fruit crops. Care should be taken in fruit orchards irrigated from this stream to prevent salt accumulation by use of extra amounts of water at each irrigation.

Studying spread and control of peach mosaic

A high percentage of the pottawattomie plums growing on ditch-banks and in hedges in the Moab area were found to be infected with peach mosaic. The mosaic was probably brought to the area in the plum. Apricots and almonds have also been found infected.

While the disease has been eliminated from other counties in the state, it has not been eliminated from Grand County because of its existence on the pottawattomie plum. At present removal of diseased trees is the only means of control.
Iron... Research has benefited agriculture in this county by developing better sheep breeding and management practices for southern ranges.

Much of the Experiment Station research in sheep breeding and management is conducted in Iron County with headquarters at the College of Southern Utah at Cedar City.

In 1943 the Station purchased a herd of 900 yearling ewes of predominately Rambouillet breeding. This herd has been used since for controlled breeding and management studies to determine the type of sheep most desirable for southern Utah range conditions. Some of the results of the work are:

1. Columbia and Targhee sired lambs are consistently heavier at birth and at weaning than lambs sired by Rambouillet rams.
2. Columbia and Targhee lambs are more open-faced and have longer fleeces than lambs sired by Rambouillet rams.
3. Carcass grades are higher for crossbreds than for Rambouillets.
4. Breed of sire has no significant effect on percent of ewes lambing, number of lambs born, or total production per ewe.

In the fall of 1955, black-faced Suffolk and Hampshire rams were also used in the breeding program. At the end of October 1956 black-faced lambs scored better than white-faced lambs. (This phase of the research must be continued before definite conclusions can be reached.) The heaviest lambs at weaning time were the Suffolk-cross lambs. These lambs averaged 83.7 pounds. Hampshire crosses weighed 80.4 pounds. Crossbred lambs were 9 to 12 pounds heavier at weaning time than white lambs. Type and condition scores were higher on the crossbred.

Studies of death losses over the period of the project have been made. The average loss over the period is 10 percent. Starvation was the most important cause of death, birth difficulties came next. These facts point out the importance of care at lambing time. Other causes of death in lambs are pneumonia, abortions, and eating dirt. Death from disease has been low.

Death losses were highest among two-year olds. These can be reduced by separate and more careful management of this group at lambing time.

Studying ways of increasing feed resources

Because of the need for greater feed resources in the area especially during the spring and fall seasons between the time the sheep are on the winter and summer ranges, research studies have been in progress to find means of increasing these resources. On dry lands with 10 inches or more rainfall and on farm lands with limited irrigation water, crested wheatgrass, tall wheatgrass, and intermediate wheatgrass have been established and maintained under grazing use.

Dryland plantings of crested wheatgrass have furnished between 35 and 75 sheep days per acre annually over the past ten years. Tall and crested wheatgrass planted in mixture on lands with limited spring irrigation water furnished between 276 and 555 sheep years during the same period.

To improve summer ranges in the area, especially in aspen areas, aspen cutting and grass seeding have been investigated. From deteriorated ranges furnishing less than one sheep month of feed per acre, range seeded to improved grasses and clear-cut of trees, produced forage within 2 years sufficient to support 8 to 10 sheep per month per acre. Broadcast seeding at or before leaf fall appears to be the most suitable time and method. The area must be protected from grazing during the first few years. Seedlings make the fastest growth where aspens are cut and left on the ground.

Orchardgrass, smooth bromegrass, intermediate wheatgrass, and tall oatgrass have shown greatest promise for seeding in aspen areas.

Finding better methods of marketing wool

Wool marketing methods are also being studied using wool from the Cedar City sheep. Physical characteristics of the grease, scoured, carded, and combed wool from these sheep will be determined to find the relation of the various physical characteristics of grease wool to the quality of the subsequent processed products.

Comparisons have been made of the legibility, durability, and scouring characteristics of sheep marking fluids to find one that is scorable yet permanent enough to be legible during the life of the fleece. Removal of non-scorable paint brands during wool manufacture is most difficult and expensive. A scorable paint would reduce processing costs an estimated 3 cents a pound of clean wool. This would result in a saving of more than $12,000 per year on the processing of Utah wool.

Studying sheep management and nutrition in relation to disease

Another sheep study in the Modena area is concerned with the nutrition of sheep and its effect on prevalence of disease and production of range sheep. A band of 840 ewes has been maintained on the winter range. While gaseous lumbadenitis, internal parasites, pneumonia, and a nervous condition thought to be caused by something in the forage were important causes of sheep losses, a much greater loss was caused by lowered production of lambs and wool be-
cause of poor nutrition and poor management practices. Supplementary feeding and shed lambing greatly improved production.

**Studying use of stilbestrol to increase weight gains in lambs**

Other lamb feeding studies have shown that stilbestrol can be added to the feed of lambs to produce increased gains and feed efficiency. These studies also showed that feeds pelleted with a ratio of 60 percent roughage and 40 percent grain were as good as those with a ratio of 50 percent roughage and 50 percent grain in the ration of lambs.

**Determining costs of applying irrigation water**

Investigations are also under way in Iron County on the economics of applying irrigation water by sprinkler and gravity systems. Costs of the various methods are being compared under different soil and topographic conditions and for different crops on different sizes and shapes of fields.

**Surveying the soils**

A soil survey has been made in the Beryl-Enterprise area and the report should be published in 1957.

**Testing crop varieties**

Corn varieties have been tested in Enoch, Paragonah and near Enterprise.

---

**JUAB ... Research has benefited agriculture in this county by**

**Investigating practices in dryland farming**

Dryland research is conducted at the Nephi Dry Land Experimental Farm in Juab County. This is the oldest dryland experimental farm in America.

Dryland farming has undergone considerable change in the past 15 years or more. Operations have become highly mechanized and better cultural practices have been adopted.

Investigations at Nephi have covered most of the problems of dryland agriculture. Tests have covered crop adaptation trials, cereal varietal testing, forage tests, grass seed production, tillage trials, fertility experiments, rotation studies, and rate and depth of seeding investigations.

**Finding best adapted crops**

Winter wheat has proved the best adapted and most profitable crop. Cache is the recommended variety because of its resistance to smut. Winter wheat yields almost twice as much as spring wheat.

**Weighing possibilities of grass production**

Grass grown for forage or seed offers promise as a substitute crop for wheat on some of the dry lands.
of Utah with more than 12 inches of rainfall. Tall and pubescent wheatgrasses produced the most forage at Nephi. Intermediate, pubescent, and crested wheatgrasses show promise for spring pasture.

Results with grass seed production are promising when soil moisture is not too low.

Evaluating cultivation practices

Varying fall plowing dates had no effect on wheat yield. There was no difference in yields obtained from fall and early spring plowing. Further delay in spring plowing reduced wheat yields drastically.

Average wheat yields have been 8 percent higher when land was plowed eight inches deep than when it was plowed five inches deep. There is little difference between yields from eight-inch and ten-inch plowing. Subsoiling 15 and 18 inches deep did not increase yields. If maximum returns are to be obtained and if costs are to be kept down, plowing should not be shallower than five inches nor deeper than eight.

Cultivation of fallow more than was necessary to control weeds did not increase yields.

Investigating fertilizer use

Wheat yields and protein content were increased by nitrogen fertilization. Forty pounds of nitrogen per acre showed more benefit than 20 pounds. The nitrate form of nitrogen was more effective than the ammonia form. No significant difference was found between spring and fall applications. Nitrogen fertilizer did not take the place of fallow. Results suggest that it would be good procedure to wait until early spring before applying nitrogen fertilizer. If at that time there is evidence of poor fall emergence, winter injury, drought, or other unfavorable conditions, the fertilizer could be saved for a more propitious year.

Manure increased the yield of winter wheat. In wet years the benefit was greater than in drier years. The benefits carry over for many years.

Jaun County has a land area of 2,183,680 acres, an irrigated area of 9,437 acres, and a farm income of $2,904,000 in 1955. Income from livestock and livestock products amounted to $2,261,000, $1,372,000 of which was from turkeys. Jaun ranks third in the state in turkey production. Income from crops amounted to $641,000, $503,000 of this was from wheat, $52,000 from hay, and $36,000 from alfalfa seed.

Determining best cropping practices

The alternate wheat fallow cropping practice has proved superior in this area when compared with continuouscroppings and with systems that permit one crop in two years and two crops in three years.

Determining seeding rates and time

Seeding at 6 pecks of wheat per acre gave the highest net yield. Seeding on October 1 gave the highest average yield, although yields were not much different for a seeding over a period of 15 days before or after this date.

KANE . . . Research has benefited agriculture in this county by

Analyzing the water resources

WATER is the limiting factor in the future development of Utah both agriculturally and industrially. Especially is this true in the southern part of the state where supplies are low. Careful inventory and analysis are basic in intelligent and long range planning for highest economic use.

The Utah Agricultural Experiment Station, the State Engineer, the Utah Water and Power Board, and the State Department of Employment Security are cooperating in a study of the water resources of Kane County. During the past two years engineers have measured the water used for irrigation, that lost by seepage from canals, and that used by non-economic vegetation such as salt cedar, salt grass, and willows. They have estimated that in Kane, Washington, and Iron Counties some 18,000 to 20,000 acre-feet of water are being used each year by vegetation having no economic value. Efforts can be directed toward salvaging water thus wasted for future agricultural purposes.

Cash farm income in Kane County in 1955 amounted to $785,000. Livestock and livestock products account for $719,000 of the county income; $408,000 of this was from beef cattle, $195,000 from sheep, and $77,000 from dairying. The most important crops were hay, alfalfa seed, and apples.

Conducting range cattle breeding studies

Range cattle breeding studies are conducted by the Experiment Station at Panguitch, just north of Kane County. Results from these studies may be used by Kane County cattlemen to improve the productivity of their cattle.

Developing methods of increasing forage production on mountain meadows

Studies have been made on methods of increasing forage production on mountain meadows in the high valleys of Kane County where many cattle pasture in the summer. The first essential to increased production is water control. When the meadows are covered with water for long periods in the spring and early summer, the principal plants found are sedges and wiregrass. These have a low nutritive value. If the flooding occurs only for short periods in the spring, timothy, redtop, and meadow fescue often become established naturally.

Studies showed that when such meadows were fertilized with 200 pounds of ammonium sulfate per acre, yield was increased as much as one ton per acre.

Meadows reseeded to higher producing mixtures of grasses and clovers such as orchardgrass, tall fescue, smooth bromegrass, red canarygrass, red clover, ladino, and alsike clover respond well to fertilizer.
Mountain meadow near Alton, Kane County. Such meadows could produce more forage if drained, reseeded, and fertilized.

Increases up to 1½ tons were measured when 300 pounds of treble superphosphate were applied per acre.

When grasses make up the major portion of the meadow, nitrogen fertilizer will give the greatest response. Phosphate fertilizers are most economical when clovers are abundant.

MILLARD . . . Research has benefited agriculture in this county by

Studying the reclamation of alkali soils

Studies in the Delta Area have shown that saline and alkali areas may be economically reclaimed by leaching with large amounts of irrigation water where drainage is adequate. Some few soils in the area require an application of gypsum or other soil amendment as well as leaching. A soil test is essential to determine whether an amendment is needed.

To bring salty soils back into productivity, organic matter must be developed in the soil. This can be done by adding manure or by growing salt-tolerant crops such as barley, sugar beets, asparagus, and alfalfa. Aside from its value as a source of plant nutrients, organic matter has a favorable effect on the physical properties of the soil, making it more porous, so that it can absorb moisture more easily.

Solving the problems of alfalfa seed growing

Farmers of Millard County look to the Experiment Station for the latest information on alfalfa seed production. For many years Station scientists have studied the problems faced by seed growers. This research may be summarized in the following recommendations:

Varieties: Grow varieties for seed that are in demand. Ranger, Buffalo, Vernal, Atlantic, and Narragansett are in the foundation program of the U. S. Department of Agriculture.

Culture: Grow seed. Hay is another crop. Grow seed on thin stands. Plants should be about 12 inches apart in rows 24 to 36 inches apart. In such thin stands, weeds must be controlled.

Insects: Control harmful insects. For alfalfa weevil spray early in the spring when alfalfa shoots

Millard County with a land area of 4,254,720 acres, irrigates 81,919 acres. The county ranks second in the state in the production of beef and hay crops and third in the production of small grains. The cash farm income in 1955 amounted to $6,968,000. Of this $4,320,000 was from livestock and $2,648,000 from crops. Beef cattle accounted for $1,992,000, poultry $1,084,000, dairying $897,000, and sheep $207,000. Alfalfa seed was the most important cash crop, amounting to $1,235,000, wheat was next, followed by hay.

FOR DECEMBER 1956  

93
Cages used in studying effects of pollination and insect damage in alfalfa seed production

are $\frac{1}{2}$ to 2 inches long with 4 ounces of dieldrin or heptachlor. For lygus bugs, dust with DDT, toxaphene, or dieldrin when alfalfa begins to bud. A second spray of toxaphene is usually needed 3 to 4 weeks after the bud stage.

Pollination: Alfalfa seed is pollinated by bees. Supply from 3 to 6 colonies of honey bees per acre for adequate pollination if wild bees are not present.

All the answers to problems in alfalfa seed production have not yet been given, however, and scientists are delving deeper into the subject. More recent studies indicate that nectar production, pod set, and seed production were doubled by thinning a stand of 8-inch rows (planted at 12 pounds per acre) to 12-inch hills in 24-inch rows. Flowering was advanced about 10 days and plant height and lodging reduced.

Another study has shown that overhead irrigation on alfalfa in bloom cuts seed yields in half.

Other studies are being made on pollination of alfalfa by honey and wild bees and on plant conditions affecting pollination. These studies are showing that (1) thinned plantings have a higher bee population and seed yield than unthinned plantings. (2) Bees moved into an alfalfa field from alfalfa-free locations collect more pollen than bees that have been in the field for some time. (3) High humidity reduces pollen collection.

Finding methods of controlling dodder in alfalfa

Dodder control in alfalfa seed fields is one of Utah's most troublesome weed problems and the most serious threat to the state's alfalfa seed industry. Research on control of this weed by the Utah Agricultural Experiment Station has shown that small widely scattered dodder patches can be most effectively and economically killed by spraying the dodder and infested alfalfa with an aromatic weed oil or dinitro-fortified oil-water emulsion. The alfalfa top growth is killed but the roots are uninjured and produce normal regrowth.

In heavily infested fields, spraying the dodder-infested alfalfa stubble after the first crop has been removed with 80 to 120 gallons of an aromatic weed oil will reduce the dodder 60 to 80 percent. Stubble treatments with a 1 to 10 dinitro-fortified oil-water emulsion at 120 gallons per acre will reduce dodder 50 to 65 percent. Such a treatment will cost from $7 to $14 an acre while the cost of the aromatic weed oil ranges between $24 and $36 an acre.

The Station is requesting additional funds from the Legislature for a more intensive study of ways to control dodder. Because dodder is a saprophyte and derives its food from the alfalfa plant, a selective chemical must be found that will kill the dodder without serious harm to the alfalfa.

Testing varieties of alfalfa

Alfalfa varieties, both for seed and for forage, are under test in Millard County at Fillmore, Delta, and Hinckley. Ranger and Lahontan yield the most forage. When growing alfalfa for seed, the varieties most in demand by the trade should be grown.

Studying needs of range cattle for supplements

Range nutrition and supplementary studies with range cattle are being conducted by the Experiment Station in the Garrison area in western Millard Country. Four hundred range cows are being fed varying amounts of phosphorus and protein to supplement range forage. Daily records are kept on feed and water consumption, weather, and cattle condition. Calf birth and weaning weights will also be taken. Results will provide recommendations to ranchers on feeding of supplements to range cattle.
From left to right, honey bee gathering pollen from alfalfa flower. Entomologist examine seed pods to measure results of pollination. Mounds of alkali bees. These wild bees are effective pollinators of alfalfa where they are plentiful.

Colonies of honey bees should be brought in to pollinate the alfalfa seed crop in most areas.

MORGAN

Total area: 390,400 acres. Irrigated land: 11,512 acres. Total farm income, 1955: $1,882,000. Income from livestock and livestock products amounted to $1,688,000; $311,000 came from dairying, $497,000 from sheep; $279,000 from beef cattle, and $264,000 from mink. Wheat was the most important cash crop, followed by canning crops, barley, and hay.

MORGAN . . . Research has benefited agriculture in this county by

Wild bee tripping alfalfa flower

Evaluating the place of cabbage production in farm income

The processing plant in Morgan which has been using locally grown cabbage in sauerkraut production was recently closed. At the request of local people the Experiment Station has studied the economics of cabbage production to help in the adjustment to other crops.

In the 29 farms studied, cabbage planted varied from 1 to 8 acres. The larger acreages were associated with lower overhead cost per acre, lower labor cost, lower power cost, lower total cost, and higher net returns.

Cabbage yields ranged from 14 to 42 tons per acre. As yields increased, man-hours of labor per ton decreased and net return per acre increased from minus $8.46 to plus $83.24.

Effective use of man-hours of labor is important to success. In this study 92 man-hours of labor per acre were associated with a net return of $73.00 per acre. When man-hours were increased to 164 per acre, net return declined to minus $80. This suggests that extra labor was not economical.

Promoting and studying cooperative organizations among farmers

A recent Experiment Station bulletin, "The Organization and Operation of the Utah State Canning Crop Growers Association," traces the history of the cooperative movement among canning crop growers in Utah. It notes the early need for cooperation among growers in areas like Morgan County. In addition, the bulletin reports the present organizational structure of canning crop cooperatives, surveys membership relations and relations with canning companies, and makes recommendations for future operation.

Present problems of cooperatives seem to lie in education and information. As any cooperative grows, it becomes more difficult to keep each member informed concerning association affairs. Like-
wise, after an association has been functioning successfully for a number of years, there is a tendency for both officers and members to lose a little of their zeal and enthusiasm. Other problems center around getting the latest possible information to the local associations before bargaining is begun.

Devising better methods for testing quality of canning peas

In studies recently made by the Experiment Station, a microscopic examination of the starch grains proved to be the easiest and least expensive method of determining quality of canning peas. This method involves the evaluation of the starch grains by studying their size, shape, and structural development.

The starch grains increase in size and become more irregular as the peas mature.

Investigating vibrio fetus infection of sheep

Vibrio fetus infection causes abortion losses in sheep. Costs to sheep growers in Utah exceed $6 million per year. Since 1954 the rams of sheep herds in Morgan County and other areas of the state have been tested for vibrio fetus infections. About 16 percent were found infected and an additional 15 percent were classed as suspects.

Positive evidence of transmission of infection from rams to ewes has not, however, been obtained. The method of infection of ewes is still being investigated. Through these important studies we hope to find some practical means for controlling this costly disease.

PIUTE . . . Research has benefited agriculture in this county by

Finding better potato varieties

Of the many potato varieties tested by the Utah Agricultural Experiment Station, none is completely disease resistant. Pontiac is the best red variety tested and it should replace Bliss Triumph in Piute County and other areas of the state. Pontiac is higher yielding than Bliss and is smoother and more disease resistant.

Pontiac potatoes need to be planted close together to prevent the development of extra large tubers with hollow hearts. The variety is only a fair keeper and should be used during early winter.

DeSoto and Sheridan varieties produce good yields of smooth red tubers and seemingly are less susceptible to virus diseases than Red Bliss Triumph.

Studying costs of potato production

Because the potato enterprise is important in providing a cash crop and a means of diversifying and intensifying farm operations on irrigated farms in Piute and other counties, Station economists have made a study of profits in potato production.

They found that the average total cost of producing potatoes was $186.16 per acre. However, the average cost in 5 southern counties, of which Piute is one, was less—$161.21.

Piute County with a land area of 481,920 acres has 15,869 acres of irrigated land. The total farm income for 1955 was $1,088,000. Of this $842,000 was from livestock and livestock products and $245,000 from crops. Beef cattle produced the highest income with a total of $311,000, followed by dairying with $296,000, and sheep with $181,000. Most important crops were potatoes, barley, and hay. Piute is third county in the state in production of potatoes. The crop was valued at $203,000.
Man labor constituted the largest single cost and accounted for 35 percent of the total cost. In the five southern counties labor hours were substantially less, 55 hours per acre, while the state average was 63. A 20-acre enterprise proved to be the most efficient.

Data collected were analyzed to see what advantage, if any, there might be in using combine potato harvesters. Comparing the two operations indicated an average saving per acre of 6 man-hours of labor, 5 tractor-hour, and 1.7 truck-hours on enterprises using the combine method. Total harvesting costs were $45.17 per acre for combines and $56.37 for other harvesting methods.

**Studying best irrigation and fertilizer practices for potatoes**

Several phases of potato production of interest to Piute growers have been studied by the Experiment Station. There are many problems relative to the production of maximum yields of quality potatoes that are still unsolved. However, sufficient information is available to increase average potato yields in Utah from 260 to 500 bushels per acre. To obtain high yields of quality potatoes, it is necessary to apply 10 to 30 inches of water to the crop in relatively light, frequent applications. Frequent light irrigations also improve the quality of potato tubers.

It is advisable to apply some commercial fertilizer to the potato crop on even relatively fertile soils. The amount of nitrogen and phosphorus fertilizer that is justified will depend on the present soil fertility conditions, but probably should not be less than 80 pounds of nitrogen and 80 pounds of phosphoric acid per acre when good irrigation practice is followed.

**Investigating other problems**

Studies on causes and control of several diseases of cattle and sheep, plant mixtures and fertilizer treatments for pastures, better forage plants adapted to low wet lands,—all these problems are of concern to Piute farmers.
Research has benefited agriculture in this county by

Improving accuracy of streamflow forecasting

Studies of past snow survey records have been made to determine their consistency and accuracy as a basis for improving soil measuring techniques. Better techniques have been developed.

The average error of forecasting flow of the Bear River has been reduced from 26.6 percent to 17.9 percent.

As a result of these studies, recommendations have been made for collection of additional information in the future which should permit further refinement of the forecasts.

Studying the value of carp as a feed protein

Carp is the most widespread and abundant of the non-game fish in Utah. It is found in considerable numbers in Bear Lake and other waters of the state. Scientists in wildlife management estimate that there are approximately 100,000 acres of warm water in Utah which would produce carp. They maintain that carp will produce more protein per acre than any other form of life.

To test the value of carp as a feed for poultry, 32 lots of 10 New Hampshire chickens were raised to 61 days of age. Experimental rations consisted of a basal ration plus a fish meal or a combination of fish meal and soybean oil meal protein concentrate.

The chicks fed commercial Utah carp meal made gains in weight equal to those fed herring fish meal and they grew faster than those fed tuna and menhaden fish meal. With the exception of the chicks fed menhaden fish meal, all chicks fed fish as the only protein concent-

When moisture is adequate nitrogen fertilizer increases the yield of dryland wheat

Inventorying the carp supply

One of the first problems in planning an industry based on carp production is to determine the yearly supply of carp. Continued successful fishing operations depend on a method of determining the age of the fish and thereby its rate of growth. After much study, it became apparent that each season of development is shown by a line on the carp's gill cover. Further studies established a ratio of gill-bone size to length of carp.

With data on the age composition of a population of carp, it is possible for a fishery manager to predict the percent of a year's catch of carp that will reach a certain age and what size they will attain. It is also possible to decide whether a population of carp is being over or under exploited and thereby place carp production on a basis as sound as other types of animal production.

In view of the present high prices of fish meals for poultry, there is a possibility that a carp meal industry, valued at several thousand dollars annually, could be established in Utah.

Improving native meadows

Experiments in typical mountain meadow areas throughout the state show that forage production can be increased in these meadows by plowing and reseeding to high producing palatable grasses and clovers, by maintaining high fertility through the use of fertilizers, and by controlling irrigation water to prevent excessive flooding.

In Rich County methods and practices were developed whereby forage production from these mountain meadows might be increased. Results showed a three-fold increase in yield when the sod was plowed and the seedbed prepared before reseeding. Reseeding in the native sod increased production, but the increase was much less than when a seedbed was prepared.

Rich County has a land area of 654,080 acres with 50,756 acres of irrigated land. The cash farm income in 1955 amounted to $2,770,000; $2,683,000 was from livestock and livestock products. Leading sources of income were from beef cattle, amounting to $1,366,000; income from sheep was $955,000; from dairying $301,000. Wheat, barley, and hay were the important cash crops.
To measure inherent production qualities of different strains of chickens, the Experiment Station is participating in the National Random Sample Testing Program.

Of the species used in a series of tests in Rich County, strawberry clover looks the most promising for wet areas. It withstood considerable submergence and was not damaged by moderate salt concentrations when kept wet; however, it did not stand long periods of seasonal drought.

Of the grasses tested, reed canarygrass was the most water tolerant; but it was difficult to establish and did only moderately well on a saline soil.

Records are kept of the egg production of each hen and the different strains are measured under a common environment.

SALT LAKE . . . Research has benefited agriculture in this county by

Salt Lake is the leading county in the state in poultry production and fourth in total farm income. Of a total farm income of $11,492,000 in 1955, $4,706,000 was from poultry. Income from dairying amounted to $1,946,000, and from sheep $1,093,000. Sugar beets were the leading cash crop, producing an income of $1,039,000, wheat came next, followed by canning crops. Total income from crops amounted to $2,434,000. The county has a land area of 448,960 acres, 49,531 of which are irrigated.

Analyzing poultry feed potentials

SALT LAKE COUNTY is the leading egg producing area of the state. Research relating to poultry production is of vital concern to poultry raisers of the area.

Tests have shown a reduction in growth rates of chicks and turkey pouls fed alfalfa as a large part of the diet in spite of the fact that alfalfa is a good source of vitamins, protein, and other nutrients. Scientists suspect that the substance in alfalfa which reduces growth is a group of chemicals known as saponins. These materials also appear to be a major cause of bloat in cattle.

When 0.1 percent alfalfa saponin was added to chick rations, growth rate was decreased 7 percent; addition of 0.3 percent decreased growth 35 percent. When 0.3 percent saponin was fed to hens, there were no adverse effects either on the hens or on chicks hatched from eggs produced by the hens. Alfalfa cut near normal cutting time appeared to contain fewer harmful factors for chicks than alfalfa cut at earlier stages.

Twelve different varieties of alfalfa were obtained from 3 dif-
Different locations and tested for chick growth depressing properties. Evidence was obtained that varieties varied in their content of detrimental substances. This gives hope that Station plant breeders may develop new varieties free from negative growth factors.

**Studying other poultry feeds**

The following practices were indicated by a feeding study with 1260 S. C. White Leghorn pullets.

• Hens having one complete feed before them at all times performed better than hens offered mash free-choice and scratch grains only in the evening.

• Hens fed a high barley ration did not perform as well as those receiving a ration containing mainly corn and wheat as the grain.

• Addition of a half pound of DL-methionine to the ration improved performance of the hens. It is believed that the methionine helped to combat certain diseases present in the flock.

• Addition of 100 grams of aureomycin per ton of feed increased egg production and feed consumption per dozen eggs. The increased number of eggs, however, would not pay the extra feed costs. A study was undertaken to determine the egg marketing organization and the operations of the various agencies competing in western egg markets in terms of sources of supply, type of eggs handled, and outlets used.

From a fourth to a third of the producers interviewed were using egg handling practices below those usually recommended to assure good quality. The high cost of individual egg candling suggests the advisability of quality control through supervision of production combined with mechanical methods of sizing and removing eggs with blood and meat spots.

A study of quality in eggs showed there was little or no relation between the grades marked on egg cartons and egg quality as judged by thickness of white, color of yolk, and lack of strong flavor. Better quality eggs would be assured the consumer if eggs moved more quickly through marketing channels. On an average eggs were in marketing channels for 10.5 days, two thirds of which elapsed from the time the eggs were candled until purchased by the consumer.

**Studying control of chronic respiratory disease**

There is a high percentage of chronic respiratory disease (CRD) not caused by death; the disease hangs on, decreasing egg production as much as 30 percent in laying hens and slowing gains in broilers.

Experiment Station scientists have obtained the best results by treating the chickens with antibiotics. If the treatment is started soon enough, aureomycin and terramycin can be added to the feeds. At a later stage, an injectable antibiotic such as streptomycin must be given.

Further study of the treatment of the disease is under way as well as attempts to curb the disease in breeding flocks. At the same time an attempt is being made to discover the relation between CRD and other virus poultry diseases.

**Studying market appeal of Utah apples**

Studies comparing consumer acceptance of Utah and Washington Delicious apples on the Salt Lake City market showed that Utah apples sold just as well as Washington apples. Utah producers can grow and harvest Delicious apples with as good a quality and external appearance as the Northwest Delicious. In addition, the Utah producers have a definite advantage in servicing the local intermountain market. If handled properly, it is possible to place a Delicious apple on the local wholesale market with better internal quality than can be obtained with Northwest Delicious.
This is mainly because of the shorter time needed to move apples from the cold storage plant to the retail store.

**Studying fluorine damage to crops and livestock**

The studies on fluorine damage centered in Utah County have been extended to Salt Lake County. Some injury to livestock and vegetation has been found in certain areas. These extensive studies indicate that industry and agriculture can flourish side by side through cooperative planning of preventive programs against air pollution.

**Studying many other problems of concern to the farmer**

Other research studies in Salt Lake County of benefit to farmers and home owners include field studies on fertilizer needs. Nitrogen and phosphorus deficiencies are the most common. Orchards in the Draper area are frequently deficient in zinc. Lime-induced chlorosis is a serious problem to fruit growers and home owners in many localities including North Salt Lake, Sugar House, and much of the west side of the valley, including Magna.

Insect and plant disease studies have benefited all. Nematode damage to alfalfa was first observed and studied in this county. Other studies have involved the tomato fruitworm, pea weevil, black heart and other diseases of celery, and virus diseases of fruit trees.

Waters used for irrigation in the county have received special attention. Waters from Utah Lake and waters from several wells contain enough salt to injure salt sensitive plants. These include many ornamentals and fruits.

**San Juan... Research has benefited agriculture in this county by**

**Surveying soil resources**

If more efficient use is to be made of the farm lands in Utah, by both the present and future generations, specific and detailed information regarding the character and quality of soils is necessary. No permanent system of agriculture can be built up, land values established, or equitable taxation schedules outlined until the status of the land is determined. Particularly is this information required by many state, federal, and private agencies.

Probably the greatest value of the soil survey, however, lies in the help it gives the individual farmer and land operator in planning a proper and adequate soil management program on his farm.

A fairly complete study of the soils of the San Juan area has been made recently. This study consisted of carefully describing and sampling approximately 25 soil profiles. Special studies of problem soils were made by comparing similar soils across the state line in Colorado. A soil map and bulletin on the soils of San Juan are being prepared for publication in cooperation with the Soil Conservation Service.

A special study is also being made of the source and distribution of the loess mantle from which many of the soils have developed. This study has consisted of sampling rock formations, sand dunes, and soil profiles along a traverse from the southern part of Monument Valley to about 15 miles north of Monticello.

**Testing commercial fertilizer**

The use of commercial fertilizer on dryland winter wheat may not be justified in many areas of Utah during years when rainfall is below normal. This conclusion was
Making range seeding tests

Range reseeding in the Elk Ridge area of the county has been studied. Broadcasting of grass seed either alone or in pellet form from airplanes was not successful unless some means was provided for covering the seeds. The trials extended from the pinion-juniper areas in the lower elevations through the oak brush associations and into the aspen-type growths. Fair seedling growth was established in limited aspen zones where leaf fall covered the seeds.

Grass testing plots on unirrigated land near Monticello have shown that several of the wheatgrasses are well adapted to the area. Crested, intermediate, and tall wheatgrasses have all survived and produced good forage yields for many years.

**SANPETE . . . Research has benefited agriculture in this county by**

**Attempting to find the causes and control of staphylococcosis**

As the turkey industry in Sanpete County has grown, staphylococcosis has become one of the most important disease problems in turkey flocks. The disease first appears on the range in birds from 9 to 14 weeks of age and can persist in the flock until marketing time.

Several methods of controlling the disease are being studied by Experiment Station scientists. A vaccine was developed but tests with 47,700 turkeys indicate it is not successful in protecting birds under field conditions. Terramycin and tytracycline were used on one flock with some evidence of control. Penicillin and streptomycin injected in combination in birds artificially inoculated, gave no protection. Sanitary management seems to be important in lessening the incidence of the disease. There is some evidence that the disease is spread through contamination.

The vaccination experiments have shown that no biological product yet known will prevent the disease. The use of antibiotics shows enough promise in controlling outbreaks that it should be tried on a limited scale.

**Studying the economics of turkey production**

The short growth period for turkeys makes possible rapid adjustments in production in response to changes in price. This results in considerable variation in net returns from year to year, and contributes to the risk and uncertainty in the business.

In an effort to find the causes of profits and losses in turkey production, economists from the Experiment Station made an analysis of one year's turkey enterprise in 85 Utah flocks. As more than one third of the turkeys raised in Utah come from Sanpete County, Sanpete flocks are included in the study.

The study showed that even in a
year of unfavorable price-cost relations, a profit could be made. The difference between profit and loss was management. Producers with high net returns had costs of 36.3 cents per pound, while those with low returns had costs of 47.6 cents. Low costs were associated with low death losses and low labor and feed costs per pound of turkey.

Feed was the greatest expense item, amounting to two thirds of the total costs. Poult cost was next, at 16 percent of all cost. Following in decreasing order were labor costs, buildings and equipment, and interest on operating capital.

In order to determine and measure the factors related to variations in net returns, the 85 flocks were grouped into four groups by net returns and various cost and efficiency factors were calculated. The average selling price for both hen and tom turkeys was found to be practically the same among the four income groups. This means that producers whose flocks made a profit did so because of management rather than selling price.

**Testing the merits of barley feeds**

To explore the difference between high cost feeds containing wheat and lower cost feeds containing barley, the Experiment Station compared the two. In a high energy growing mash, corn and wheat were the only grains. The low energy growing mash contained 36 percent barley and 10 percent mill-run. The low energy mash was also fed in pellet form.

The ingredient cost per pound of gain was one-half cent less with the low energy than with the high energy feed. Even greater savings, another 0.8 cent per pound gain, were made by pelleting the low energy mash.

A new hull-less barley is being developed and will probably be released in the near future. This barley, free of the fibrous hull, will be much higher in energy than barleys now available. The new variety seems especially adapted for poultry feeds.

**Reclaiming neglected areas**

The black organic soil of the Sanpete Valley presents problems quite different from those of other agricultural areas. The soils are poorly drained and are subject to late winter and spring flooding for varying lengths of time. In late summer these soils become quite dry with fairly deep wide cracks and, in most places, have a rather high concentration of salt.

Where undisturbed, these soils commonly are covered with heavy stands of sedges, rushes, and native species of true grasses which are high yielding. Most of the area, however, has been plowed and planted to crops, but mainly because of soil and moisture problems the land has been abandoned. It has returned to a poor mixture of saltgrass, green foxtail, sedges, rushes, and various other weedy plants. Combinations of these plants furnish practically all the wild hay in the area; they are also important for pastures. Their chief weaknesses are low yield and poor quality.

Reed canarygrass is the only cultivated forage plant known at present that can stand the flood and drought conditions found in Sanpete Valley. Results from experimental plots and other observations indicate that this grass can be established by drilling in the bottom of furrows late in the fall. It has a long life, a long growing sea-
son, recovers rapidly from grazing or cutting, and produces a large quantity of succulent palatable forage, when used before it matures.

Working with Snow College in dairy and sheep studies

The Experiment Station has a cooperative agreement with Snow College to conduct research on the Snow College Farm. The farm land is being levelled and the irrigation system reorganized for the study of methods of maximum crop production with limited late season irrigation water.

The dairy herd is being enlarged and steps taken to improve the efficiency of milk production.

The Station has conducted a breeding program to produce lines of Rambouillet sheep with smoother bodies and with open faces. Sheep and lambs with faces overgrown with wool make poorer gains on the range than those with open faces. Rams with open faces transmit this character to offspring to a marked degree. Rams from open-faced lines are now being made available to sheep growers.

Sevier County has a land area of 1,236,480 acres and an irrigated area of 54,303 acres. The county ranks fourth in the state in production of beef and potatoes and fifth in production of sheep. The total cash farm income in 1955 was $6,099,000; livestock and livestock products accounted for $4,634,000 of this. Highest income came from beef cattle, $1,712,000; dairying produced an income of $1,074,000; sheep, $267,000; poultry, $857,000. Sugar beets were the most important crop, valued at $769,000. Potatoes, barley, wheat, and hay followed in order.

SEVIER . . . . Research has benefited agriculture in this county by

Treating trichomoniasis

In the Western United States, bovine genital trichomoniasis has previously been found chiefly in dairy cattle. Beginning in the fall of 1954, examination of beef bulls in Utah and adjacent states was begun. Eight bulls of 42 examined in the initial survey were infected with Trichomonas foetus, and this finding indicated that a further examination of such bulls should be made.

During 1955-56 a more thorough survey was made in Sevier County and other areas. Out of 285 bulls examined, 15 were infected and were either sent to Utah State Agricultural College for treatment or sold for slaughter. The infected bulls were treated and returned to the owners.

At the same time, studies of various treatments were going on at the College. Acriflavine ointment (0.25 percent) was found effective in treating infected bulls, however, concentrations of acriflavine in the ointment about 0.50 percent may cause damage to sensitive tissue. Preputial douching with acriflavine, encephin R, and carbendazide have been ineffective.

An interrelation was found between the trichomonads of swine and bovines. Swine trichomonads may cause sterility problems in cows.

Developing new hybrid onions

New onion hybrids, now being developed by the Experiment Station, show promise as a cash crop in Sevier County. Some of the new hybrids are much earlier and should be well suited to this area.

The most promising hybrids are different combinations of Yellow Sweet Spanish and hybrids of Yellow Sweet Spanish with Cochine Brown. These latter hybrids are early, generally high yielding, and have good keeping quality.

The crosses of White Spanish and Cochine White also look good and should do well commercially.

Sufficient seed should be available so that trial plantings can be made in 1957.

Analyzing water quality

Irrigation waters are never pure. All contain some dissolved salts. The amount may vary from a trace to concentrations so great that the water is unfit for use. If the proportion of sodium in irrigation water is high, the soil may be gradually rendered unproductive. On the other hand, the salts may consist in part of essential plant nutrients that aid in keeping soils productive.

Scientists at the Experiment Station have studied the quality of water in Utah. These studies include an analysis of the Sevier River and its tributaries.

Salts enter the Sevier River principally in drainage water from surrounding farm lands. There is a particularly rapid increase in salt in the water between Central and Richfield. This is because between these points a nearly dry dam across the river diverts water to the Vermillion Canal. The Vermillion Canal diversion point also represents the legal division between the upper and lower river. Water quality is generally a problem in the lower area but not in the upper.

In general, the waters in the Rocky Ford Canal diverted near Sigurd and the Westview Canal diverted near Redmond are of such low quality that care must be used in selecting crops and in irrigation practices to obtain high crop yields. The problem is high total salt rather than high sodium percentages.

Testing crop varieties and fertilizer needs

Other studies conducted in the county include numerous tests on farmers' fields to determine the highest yielding and best quality varieties of wheat, barley, oats, silage corn, and alfalfa. Several field trials with fertilizers have been made. Recommendations on crop varieties and fertilizers have been made and are available through publications in the county agent's office in Richfield.
**SUMMIT** . . . Research has benefited agriculture in this county by

Analyzing the effectiveness of public libraries

Experiment Station sociologists have examined the effectiveness of the public libraries of Utah and explored means by which their efficiency can be substantially increased without undue increase in costs. The specific purposes included amassing enough facts to clarify the present library situation, finding the attitudes of the people regarding their libraries, and improving areas large enough to support adequate service institutions, ascertaining what must be done to obtain superior library service, and devising a short library pattern scale to aid librarians in measuring the effectiveness of library service.

Summit County was one of four counties in which families were interviewed to find out how much they used the public library and what their attitude toward it was. Sociologists found that an overwhelming majority of the people favored good library service. When it came to a question of spending more money for this service, people who now enjoy better service were more favorable to increased costs than those who do not. In general, persons with higher education favored more progressive library service.

Inventorying wildlife resources

The Uinta Mountains, extending east of Kamas in Summit and Daggett Counties and into the northern parts of Duchesne and Uintah Counties, contain most of the wilderness area of the state and have wide recreational value for fishing, hunting, and pack horse and hiking trips. Each year they are used more extensively by local and out-of-state nature lovers and vacationers. Fish and game resources must be perpetuated and extended to meet these demands.

In this area, ecological studies of the lake fauna have been made by Experiment Station and Fish and Wildlife scientists, along with studies of the creel take of game fish. Deer migration studies have also been made. Deer from Daggett County summer in Summit County where feed is more plentiful, then return to Daggett when the snow gets deep.

Controlling chlorosis with chelates

Tests have been made in Summit County on the effectiveness of chelates in the control of chlorosis. Chlorosis is a disease caused by the unavailability of iron in the soil and is especially prevalent in horticultural crops. A group of new chemicals known as chelates are proving successful for the treatment of chlorotic plants. In treating ornamentals in the Coalville area DTPA-Fe, APCA-Fe, or CDTA-Fe effected marked improvement.

Testing for fertilizer requirements

In Summit County, nitrogen and phosphorus fertilizer tests have been made on meadow hay, alfalfa, and dryland wheat at Marion, Wanship, Henefer, Park City, Woodland, Hoytsville, Oakley, and Peoa. In most parts of the county, especially in areas where farmers have not used much farm manure, response of alfalfa to phosphorus fertilizer has been marked. Meadow hay has responded to both nitrogen and phosphorus; growth of grasses has been stimulated by nitrogen, and legumes by phosphorus.

---

**TOOELE** . . . Research has benefited agriculture in this county by

Establishing long term grazing trials

The Benmore experimental area lies in a belt commonly considered spring and fall range. Early in this century the native vegetation here was broken up and the land was cultivated for dryland wheat production. In time it became evident that the annual precipitation was too low and too varied from year to year for the successful production of cultivated crops. The land was bought by the federal government and returned to range use. At this time 3,500 acres were set aside for experimental purposes. Twenty-four 100-acre crested wheatgrass pastures were established. These have been grazed in different ways to find the best management practices for maximum feed production and for the best longtime maintenance of the palatable grasses.

Approximately 550 cattle are used for the grazing studies. These animals are obtained from cooperators in the Vernon area. The cattle are allotted at random among the 24 experimental pastures in accordance to the stocking rate that has been previously determined.

The results show that cattle make excellent gains on crested wheatgrass pastures during the spring grazing season of approximately 60 days. The average daily gain for all treatments for the seven-year period was 2.75 pounds per head. The cattle in the pastures that were heavily grazed made
gains that averaged 0.57 pounds per head per day less than those in the moderately grazed pastures and 0.67 pounds less than those in the lightly grazed pastures. Therefore, from the standpoint of daily gains heavy grazing was inferior to the other two intensities.

Of the different methods of grazing, rotation grazing averaged the lowest daily gains, while the treatment in which the animals were removed ten days early before the grass became too dry averaged the highest daily gains. This indicates that animals make the most rapid gains during the early part of the season.

The results at Benmore have demonstrated that crested wheatgrass is highly satisfactory pasture for beef cattle during the spring season.

These studies are in cooperation with the U. S. Forest Service.

Developing range seeding methods

Other range seeding studies at Benmore have dealt with (1) sagebrush control by herbicides, burning, and mechanical means, (2) adaptability of introduced species to artificial seeding on foothill ranges, (3) method of soil preparation and seeding, and (4) method of range seeding and livestock responses.

These studies show that sagebrush prevents establishment of grass seedlings and must be thoroughly eradicated for successful seedings. Several introduced species of wheatgrasses are adapted for rehabilitation of foothill ranges, namely crested, pubescent, intermediate, and tall.

Pounds of forage produced was about the same for all 4 introduced wheatgrasses. Crested and pubescent wheatgrasses start growth relatively early in the spring but mature much more rapidly than tall and intermediate. As a result, crested and pubescent do not furnish adequate nutrients for lactating animals during the latter part of June. Intermediate and tall can be used to make up this deficiency.

Sheep grazing seeded crested wheatgrass in the spring compared to native grasses yielded about 17 more lambs per 100 ewes and 6 pounds more per lamb at weaning time. With lambs selling at 20 cents per pound, this practice would yield a total return of $8,800 per herd of 1,000 ewes.

Studying effects of irradiation on food storage

In cooperation with the Quarter-master Food and Container Institute of the Armed Forces, the Experiment Station is conducting studies on irradiation pasteurization and sterilization of fresh fruits and vegetables. The work, to determine the irradiation dose necessary to extend shelf life, is conducted at the Dugway Proving Grounds in Tooele County.

Results have shown that tomatoes and Wade and Valentine varieties of green beans develop undesirable flavor and texture changes when irradiated. However, preliminary investigations indicate a possible application of gamma irradiation to prolong the storage life and improve the quality of stored carrots.

Pre-irradiation treatment with either benzoate or propionate had no apparent effect on prolonging shelf life. Pre-treatment of vegetables with ethylene oxide prolonged the shelf life but caused a highly objectionable odor and flavor in items treated.

The emphasis of next year's work will be to determine varieties of fruits and vegetables which lend themselves to processing by irradiation.

**UITAH... Research has benefited agriculture in this county by**

**Studying problems of alfalfa seed production**

UITAH County shares honors with Millard in alfalfa seed production. These two areas have traditionally been the big producers of alfalfa seed in Utah. For a time lygus bug infestation threatened the industry, but since methods to control this pest have been perfected by the Experiment Station, seed production is again coming into its own.

To help alfalfa seed growers, members of the Experiment Station staff have brought the research findings together in a circular entitled “Growing Alfalfa For Seed.” This circular (No. 135) tells the grower about variety and site selection, cultivation, and harvesting. It also includes a section on injurious insects and one on pollination. Publications of this nature, carefully written and illustrated, give the farmer a complete guide to an operation.

**Developing new alfalfa varieties**

The development and release of new varieties of alfalfa for use by farmers involve (1) breeding and evaluation; (2) widespread testing for seed and forage production to determine regions of adaptation; (3) production of breeder and foundation seed stocks; and (4) the production of certified seed under conditions that will assure the preservation of distinctive varietal characters, and its distribution through commercial channels.

At the present time work on the second phase of this program is being conducted in Uintah County. Varietal trials (40 entries) were established there last year. Data on their ability to produce will be available after next year's growing season.
The Branch Veterinary Laboratory at Provo served poultrymen and livestock raisers in the central part of the state. In drainage studies west of Springville engineers are attempting to find the most economic methods for reclaiming much waterlogged land.

Studying the feasibility of Vernal Project

Studies of the soils, cropping practices, farm costs, and the economic benefits to be derived from the Vernal Project made by Experiment Station scientists led to the approval of the project in the development of the Upper Colorado River Basin. Studies on the water used in the Ashley Valley by crops and other vegetation have been used as a basis for allocating water under the Vernal Project.

Conducting fertilizer tests

In Uintah County fertilizer tests on alfalfa and corn have been conducted at Jensen, Tridell, Maeser, Randlett, LaPoint, and Ballard. Yields of alfalfa hay have been increased as much as 200 percent on some plots in the county when treated with phosphate fertilizers. Nitrogen fertilizer has increased yields of corn in areas where irrigation water is adequate.

Studying labor problems on sheep ranches

Because of the growing concern about the labor problem on sheep ranches a study of shepherding was made by the Experiment Station. The survey included labor conditions in several sheep-raising counties in Utah, including Uintah. Investigators found that three factors are important in labor turnover on sheep ranges. (1) A number of regular workers are leaving the sheep enterprise for work in industry. (2) Large numbers of workers move from one ranch to another. (3) Sheepherders in Utah are an aging group and retirement cuts the labor market.

Recommendations made by the researchers include a long-range public relations program to advertise more of the attractive features of sheep-herding. The researchers also pointed out that owner-herdersmen relations are important, as a herder has little other contact with the outside world. Increases in pay and living conditions have helped cut down the turnover in sheep ranch labor.

The study noted the two important sources of labor close to Utah—Spanish-Americans and Indians. Spanish-American workers are being used extensively, while Indians have not been hired to any extent. As noted, the ability to herd sheep is not dependent on race, color, or nationality; and ranchers would do well to investigate these sources.

UTAH... Research has benefited agriculture in this county by

Providing diagnostic services for livestock and poultry diseases

The branch veterinary laboratory of the Experiment Station was established at Provo to provide a diagnostic service for livestock and poultry diseases in the central part of the state. About 5,000 to 6,000 individual examinations are made on diseased animals each year. This diagnostic service is performed to assist practicing veterinarians, state and federal animal disease regulatory officials, farmers, and county agents in determining causes of disease outbreaks and developing means of control.

Most of the work at Provo is done on poultry and turkey diseases. It is here that blood samples from turkeys all over the state are tested for pullorum disease. More than 50,000 blood samples are tested each year.
As more industries locate in Utah, air pollution from gases containing compounds of arsenic, fluorine, and sulfur becomes increasingly important to agriculture. At present the Utah Station is engaged in comprehensive studies of the effect of fluorides on plants and animals.

About 1,000 dairy animals on farms in the industrial areas are examined periodically to determine possible symptoms of fluorosis. Necropsies and histopathological and chemical studies have been conducted on many animals from the fluorine-affected area. These studies have indicated that the diagnosis of symptoms of fluorosis is complicated by pathological conditions not associated with the fluorine intake of animals.

Controlled experiments have been continued on the effects of feeding different levels of fluorine to 41 dairy cows which have been studied continuously since they were calves about 4 years ago.

Under the conditions of this experiment, the levels of fluorides fed did not alter significantly the feed intake, gain in liveweight, height at withers, reproduction, or milk and butterfat production during first lactation. Dental fluorosis of varying degrees has been observed in animals fed 25 ppm of fluorine or more since calves. Exotoses (extra bone growths) have been found in certain bones of animals fed diets containing 100 ppm of fluorine and intermittent lameness has occurred in some animals of this group.

Excessive concentrations of fluorine compounds produce symptoms on certain plants which resemble the scorched caused by fire; hence the name "leaf scorched." Starting as a thin band across the tip or along the margins of the leaf, the brown scorched area develops inward.

There appear to be great variations in the ability of different plants to tolerate fluorine compounds. Leaves of certain varieties of gladioli, Chinese apricots, Italian prunes, and Concord grapes appear to be sensitive to fluorine compounds. Under certain conditions they will show scorching from fluorine compounds while other plants growing near them will not exhibit any signs of injury even though they may have a comparable fluorine content in the leaves.

The development of reliable information relating to the concentrations of atmospheric fluorides and the time required to injure plants, and the levels and time required for contaminated forage to affect animals is important. The

Utah County with 1,278,720 acres of land, 86,549 of which are irrigated, is the leading agricultural county in the state measured by cash farm income. The total income was $15,886,000 in 1955. The county ranks first in fruit, vegetable, and silage corn production. It is second in the production of sheep, turkeys, chickens, and milk cows, third in the production of beef, and fourth in the production of small grains.

Value of livestock and livestock products amounted to $10,521,000. Poultry income was $4,257,000, dairying $3,055,000, beef $1,617,000, and sheep $1,438,000. Fruit crops were valued at $2,092,000, canning crops at $1,014,000. Sugar beets, wheat, hay, and barley were other cash income crops.

The farmers of Utah County having fluorine troubles purchased 20 acres of land near Pleasant Grove as an experimental farm. The land has been levelled and drained. Barns have been built and an experiment is under way measuring the effects of fluorine in feed on the health and performance of dairy cows. The farm will be used to study feed production and livestock health and management in this area where fluoride damage has been important.

Drainage and alkali land reclamation studies have been under way west of Springville. The studies point to the need of a cooperative drainage program to convey excess ground water out of arable lands. Salts can be removed and improved vegetation established where ground water is controlled.

When the first attempts to stabilize the fluid milk market were made in Utah, it was discovered that Wasatch County was among the leaders in percentage of grade A milk produced. Although Wasatch's dairy industry is not large enough to compete with the big dairy counties in Utah, it has maintained this precedence in quality production.

An increase in the percent of grade A milk sold is one of the ways in which the dairy industry is trying to pull itself out of the surplus milk problem. Grade A is that milk sold in fluid form. Other milk is used in the manufacture of dairy products. As the grade A sales increase, less Utah milk will be competing with products made from vegetable oil substitutes.

Because of their high percentage of grade A producers, Wasatch County dairymen profit by any increase in fluid milk sales. The Experiment Station has made several studies of milk marketing. One of them is on vendor machines. Economists found that vendors can increase total milk sales nearly one third because they operate in a new consumer field.

WASATCH... Research has benefited agriculture in this county by

FARM AND HOME SCIENCE
They also found that the location and appearance of vending machines are most important, that milk supplies must not be allowed to run out, that 25 machines are necessary for efficient vendor route operation. Milk sales through vendors have not, as a rule, detracted from sales at nearby lunch counters or restaurants.

A study of school lunch milk sales showed increase in sales when milk was available to students 3 or 4 times a day instead of only at lunch.

In this study, 97 schools were visited to determine if school children were getting the kind of milk they wanted. Dairy leaders believe that the school milk market is one of the most important supplied by the industry. In answer to a questionnaire, 44 percent of the students replied that the milk was served too warm, 5 percent said it was off flavor, and 51 percent were well satisfied.

There were two major causes for the milk being too warm at serving time: It was stored without refrigeration between delivery and serving, or it was held on the serving counter or eating tables at room temperature for too long a period before consumption.

Both milk producers and school officials in some sections were concerned that students bought soft drinks more than milk. This study showed that when milk is priced the same or less than soft drinks and is sold in a disposable carton, it can compete successfully with soft drinks.

A recent survey of 1,200 homes showed that housewives generally think youth and adults need milk. Nearly two thirds of the families reported they consumed from 1 to 3 glasses daily and 12 percent drank 4 or more glasses daily.

Eighty-two percent of the housewives reported they did not use non-fat dry milk solids at all. The reason given was the undesirable taste and that mixing was bothersome. Consumption apparently was not influenced by advertising of fluid milk. Advertising did encourage the use of cottage cheese and other milk products. TV advertising and store specials ranked highest in motivating consumers to purchase.

**Studying causes of lowered milk production**

Many Experiment Station projects are initiated because someone in a county has brought a specific problem to the Station. Such was the case when a group of Wasatch County dairymen saw milk production in their herds dropping off.

Experiment Station staff made a preliminary survey of Dairy Herd Improvement records, plotting averages and trends over the county and on some individual herds. They found a drop in production centered around the time from 1950 to 1953. Studies are now being continued with 6 herds selected by Wasatch County dairymen. Records and management practices for these herds will be studied in detail in an effort to ascertain the cause of the production drop.

**Surveying soils and testing to determine fertilizer needs**

The soils of the county are being surveyed as a base for improved farming recommendations. Field tests on fertilizers have been conducted in the county. Numerous samples of forage crops have been analyzed for potassium and found to contain ample for maximum yields without the use of potassium-containing fertilizers.

**WASHINGTON . . . Research has benefited agriculture in this county by**

**Assessing the water resources**

Water shortages are experienced more frequently and are of greater intensity in the Virgin River Basin than in any other arable land areas in the state. The climate is generally favorable. The average frost-free growing season is nearly 200 days in the Virgin River Valley. This is the longest of any found in the state. If more irrigation water were available, the farmers of Washington County could benefit more from their favorable climate.

With this need in mind the Experiment Station is now studying the amount of water used in various seasons for different crops, amount of effective precipitation,
normal water loss, water losses from water-loving plants growing along the river, and water resources that can be made available for future use.

Salvaging large quantities of water used by non-economic plants may be the greatest source of "new" water in the area.

The data from this study provide a basis for designing and properly operating irrigation and drainage systems to make full economical use of the available water supplies and to administer water rights on the streams of the state and divide water between states.

Surveying farm income possibilities

The major sources of agricultural income in Washington County rank in the order of beef cattle, field crops, dairying, turkeys, laying hens, and fruits.

A study of possible changes in agriculture indicates that farm income can be increased in several ways. Income from fruit crops could be increased by: producing early apples for the Los Angeles market; planting selected peach varieties to give more early peaches and a longer marketing season; increasing strawberry production for the surrounding and northern Utah markets; increasing pecan production; producing fruit juices, purees, and nectars (discussed under Weber County) particularly for tourist trade.

Housing costs for laying hens are lower in Washington County than in other parts of Utah. Eggs could be marketed in Los Angeles, which is easy trucking distance from this area.

There could be some increase in production of vegetables for fresh market. Suggested crops include sweet corn, broccoli, cauliflower, early cabbage, and spinach.

Increased dairy production is dependent on larger and better feed supplies. Pasture, hay, and grain production can be increased on lands now farmed through improved production practices.

Research and testing programs now under way include alfalfa variety trials, corn variety trials, fertilizer tests in orchards, and treating lime-induced chlorosis with chelate chemicals. Early apple varieties have been grafted on mature trees and nine raspberry and eleven strawberry varieties have been planted for trial and observation.

Breeding hybrid turkey strains

Washington County has become an important turkey egg producing center. Three or four producers are getting 35 to 40 cents per egg with a few selling for as high as $2.75 per egg. Continued leadership will require a definite poultry breeding program.

Cross breeding of selected strains of Broad Breasted Bronze turkeys has shown that crossbred or hybrid strains are superior to pure strain birds produced at present. Birds of cross-strain breeding show an early growth rate far superior to the pure strains. Not only do the cross strains weigh more at maturity but the gain is more economical. Cross strain birds, while 9 to 16 percent heavier, show a feed conversion which is 2 to 3 percent more efficient than the pure strains.

Eggs produced after cross-strain breeding hatched 15 percent more poults and had 10 percent fewer.
dead embryos and 5 percent fewer "helps" than those from pure strains. Livability among cross strains is slightly better.

Studying artificial breeding of turkeys

In experimental studies, more than a thousand poults were hatched over a period of 11 weeks. These were hatched from artificially and naturally inseminated eggs. Hatchability of fertile eggs was 10 percent greater for those naturally fertilized. Artificially fertilized eggs showed 7 percent more dead embryos and 3 percent more "helps" than eggs naturally fertilized. Future studies are needed to reduce these hazards before artificial breeding of turkeys can be used commercially.

Adding oxygen to incubators

In other hatchability tests researchers found that the addition of oxygen to approximate the available supply at sea level gave a definite increase in hatchability.

In a supplemental study, oxygen was applied to different groups of eggs at different times during the incubation period. Results showed that on the average supplemental oxygen increased the hatchability approximately one-half percent for each day it was added. Extra oxygen does not appear to be of greater value during the peak embryonic mortality period than at other times.

As the incubation period advances, the embryos become large and a greater amount of oxygen is required. From an economy of operation standpoint, oxygen gives its greatest returns during the first part of the incubation period.

Testing breeding flocks for pullorum disease

In an effort to protect the turkey industry the Utah State Legislature passed a law requiring all breeding flocks to be tested for pullorum disease. The turkey testing, which is a laboratory procedure, is done at the Provo Laboratory of the Experiment Station. About 54,800 samples were tested in 1955.

Through the application of this testing program to the turkey breeding flocks in the state, the incidence of pullorum and paratyphoid diseases has been reduced to a minimum. It is only through constant supervision with this testing program that the turkey breeding industry is able to produce disease-free poults.

WAYNE . . . Research has benefited agriculture

in this county by

Searching for the causes of brisket disease

Whenever science makes an important discovery, the final result often overshadows the years of painstaking work and disappointment that have led to it.

Consumptive use of water studies are being conducted in the Virgin River area in three counties, Kane, Washington, and Iron. Scientists estimate that non-economic plants along the river banks are using twice the water used by the average irrigated crop. For each acre of this type of vegetation that is eliminated, water is available for two acres of irrigated crops. Pictured at top left shows area of cattails along river bank. The next two pictures show tanks used in the studies to measure the water used by river vegetation. The bottom picture is a panoramic view of the river from the Washington Fields, showing the vegetation along the bank.
brisket disease, accept negative results in one area, and start anew in another.

A condition characterized by a swollen brisket has been affecting cattle in southeastern Utah for more than 25 years. It was brought to the attention of the Experiment Station by the county agent and cattlemen of Wayne County.

Initial studies centered around mineral salt supplements in an effort to determine if the disease was caused by a dietary deficiency. At the same time other animals on the range were fed bone meal, salt, and trace minerals. Neither mineralized salts nor trace minerals seemed to have any relation to the incidence of the disease.

Necropsy studies made during the past year revealed definite pathological lesions that aid in explaining the disease. More necropsy studies are planned as well as the force feeding of certain poisonous plants as the search goes on.

At the same time, rock, soil, plant, and water samples from U.M. and Seven-Mile ranges and Gooseberry Canyon have been collected. These will be analyzed chemically to determine if toxic elements are present in the soil that may be a factor in the disease. When the analyses are complete, results will be reported.

In the meantime, the Experiment Station is recommending careful range management in an attempt to cut down overgrazing and overstocking, controlled breeding, and removing the animals from summer range 3 to 4 weeks earlier in the fall.

Analyzing electric and telephone cooperatives

There are six electric and telephone cooperatives that serve farms in isolated areas in the state where private companies do not find it profitable to extend their lines. One of these, the Garkane Power Association, serves parts of Wayne County.

Station economists have made an economic analysis of these co-operatives. In 1958 these cooperatives had 5,840 members and ranged in size from 82 to 1,985 members. Sales of services averaged $117,280 per association and operating expenses $114,187 an association. The net margin averaged $3,095. Of the total capital of all the associations of $4,212,- 532, 95 percent was borrowed from the federal government.

Of the total farms in Utah with electric service, 3,830, or 17 percent, were served by cooperatives, and of the farms with telephones, 1,400, or 8 percent, received service from cooperative associations.

Studying nutrient deficiency diseases of fruit trees

Manganese deficiency and lime-induced chlorosis are common in fruit orchards in Fruita. Manganese deficiencies can be controlled by applying about 2 pounds of manganese sulfate to the soil around affected trees. The use of chelates in controlling lime-induced chlorosis is reported elsewhere.

**WEBER . . . Research has benefited agriculture in this county by**

Conducting investigations on fruit production

The Howell Station for Horticultural Research was established by the Experiment Station in Weber County in 1944 to test fruit varieties for production in Utah and to study orchard management, production, and marketing practices. Since that time 40 acres of orchards have been planted to 8 different kinds of fruit.

Selecting peach varieties

The success of the Utah fruit industry is dependent on growing the best adapted, highest yielding varieties with quality acceptable to the consumer. In an effort to select peach varieties suited for Utah from the many released each year, the Howell Station introduces new varieties in its orchards and elim-
inates those of poor quality. In a preliminary study, 108 varieties were tested and 19 showed promise for this area.

Evaluating methods of pruning peach trees

As there is considerable controversy in Utah about how to prune peach trees, an experiment in pruning was begun at the Howell Station. Four types of pruning were practiced—corrective, long or thinning out, conventional, and severe. Lighter pruning produced heavier yields of fruit, and the recommendation was to prune less, thin more. Fruit from trees pruned more lightly tended to ripen earlier. Corrective pruning (the lightest) tended to produce less fruit over 2½ inches, however.

Over the seven-year study, the thinning out method produced the highest yield of saleable fruit, 337 bushels per 100 trees. An 18 percent increase in yield was shown from the conventional to the thinning out method.

Trees pruned lightly survived severe winters more successfully than the others. Fruit from corrective or thinned out trees had the highest quality and the best color.

Investigating soil management practices in orchards

A five-year study showed that clean cultivation reduces soil organic matter in orchards. A cover crop such as winter vetch, clovers, alfalfa, or small grains is recommended where moisture is available.

Studies showed that fertilizers must be adjusted to individual soil needs. Nitrogen and phosphorus should be applied to obtain proper tree growth and maximum yields of desirable commercial fruit.

Adoption of improved soil management practices sometimes increases peach yields as much as 150 to 200 bushels an acre.

Testing miticides

Brown or clover mite has injured all kinds of fruit trees in all major fruit growing areas of that. Because of its widespread importance, field experiments to test miticides for its control were conducted. After a study of the life cycle of the brown mite, a delayed dormant spray in the spring when the eggs are hatching was recommended. Lime sulfur and oil, Ovotran, and Genite 923 were found good. TEPP and malathion were the most satisfactory knock-down sprays. Systox gave spectacular results against the brown mite, but has not yet been approved for use on stone fruits.

Studying marketing of peaches

Producing a quality fruit is one problem, getting it to the consumer at its best is another. Studies made by agricultural economists at USAC show that Utah peaches are picked too green. They established six stages of maturity and showed that a peach in transit from Utah to most markets will advance one stage. Since consumers will pay more for peaches in the "ripe" stage, it will pay growers to pick more often and ship fruit of "firm ripe" quality.

Finding new outlets for Utah fruits

In an effort to find new markets...
for Utah grown fruits, the Experiment Station has studied various fruit beverages. Purees and juices were prepared from sweet and sour cherries, apples, Concord grapes, Damson plums, Italian prunes, peaches, and pears.

A tasting panel determined the most satisfactory levels of acid and sugar, since these factors markedly influence taste acceptability. Results showed that a definite ratio of sugar to acid in fruit drinks should be maintained, and that amounts liked best in one beverage may not be best liked in another.

Grape-apple, red raspberry-apple, and grape drinks were rated as best liked. Prune, prune-apple, and cherry (Montmorency) were least liked.

Studying problems supplementary to Weber Basin Project

About 30,000 acres of land under the Weber Basin Project are in need of reclamation and drainage. The Experiment Station is studying drainage in the area served by the Hooper pilot drain in west Weber County. New equipment has been installed to measure the ground water. A survey of the soil strata has been completed and permeability measurements of soils in the vicinity of the drain have been made. Field data on leaching have also been collected. These studies should not only benefit west Weber, but many other areas of the West where reclamation work is under way.

Studying diseases of fruit trees

Station plant pathologists are studying a number of disease problems in fruit trees in the orchards at the Howell Station: the cause, symptoms and control of green rot of apricot, varietal response to pear fire blight, comparison of own rooted and grafted fruit trees for disease resistance and other qualities, life history studies on vectors of western x virus.

Investigating land use changes

Between 1938 and 1952, 6,186 acres of land in Weber County were shifted from agricultural to non-agricultural uses. More than 60 percent of this land had been irrigated. Most of the land was shifted to military and residential uses.

Studying costs of fattening cattle

Cattle fattening enterprises of 16 cattle feeders in Weber County were included in a study of costs of such enterprises. This study gives answers to the following questions: Will the cattle feeder increase his income? What resources does he need? What are the costs for cattle, feed, labor, overhead, materials, and power? How can profits be increased?

NEW PUBLICATIONS

Single copies of any of the publications listed may be obtained free by writing to the Division of Agricultural Sciences, Utah State Agricultural College, Logan.


This bulletin compares the nutritive value and palatability of four introduced wheatgrasses, crested, tall, pubescent, and intermediate, with four native grasses, western and beardless wheatgrass, squirreltail grass, and Indian ricegrass, and with Russian-thistle and smother weed.


This bulletin gives the space required to store everyday foods used by western farm families.


Travel distance in meal preparation was measured in seven experimental and two other kitchens. The bulletin discussed arrangement of work centers in the kitchen to save time and effort in meal preparation.


This publication reports studies of the toxicity of DDT, chlordane, benzenehexachloride, dieldrin, aldrin, endrin, and methoxychlor to soil microorganisms which cause decomposition of organic matter.


This bulletin reports the construction requirements for farm reservoirs with plastic film. It also reports tests to determine biological deterioration, weathering, root penetration, rupture under hydrostatic heads, mechanical damage, cushioning effect of water, stable slopes for cover material, and seepage loss.
State funds needed during the next two years, 1957-1959 $1,140,200

$1,016,700 of the request is needed to continue the present research programs.

This consists of 165 organized research projects, including research on the major agricultural problems of the state:

- Control of insects and diseases affecting plants and animals.
- Selecting and breeding new crops and superior lines of livestock and poultry.
- Inventory, conservation, and best use of water and soil resources.
- The most efficient and economic production practices for crops and livestock.
- Improved marketing and new uses for agricultural products.
- Air pollution—effects on crops and livestock and control measures.
- Home management and human nutrition.
- Economic and social problems of farm and home.

$123,500 of the request is for new research

Three areas of expanded research are urgently needed:

1. Studies on Colorado River and other water development projects
   Classifying land, inventory of water resources, determining water needs, appraising economic benefits of project development and otherwise developing basic information needed for the most effective use of soil and water resources. Requested $80,000

2. Poultry and livestock disease studies
   Staphylococcosis disease of turkeys and pulmonary emphysema of beef cattle will be studied. These diseases caused losses in 1956 to Utah farmers in excess of $1,000,000. Requested $25,000

3. Control of weeds and insects
   Dodder, a parasitic weed, is threatening our $5 million alfalfa seed industry. The spotted alfalfa aphid is causing disastrous losses to Utah's major feed crop—alfalfa. Requested $18,500

Budget Request for Buildings and Other Research Facilities

Total request for 1957-59 biennium $288,098

These funds will be used at four locations:

1. At livestock, dairy, and poultry experimental farms, North Logan $155,803
   To provide facilities for research on livestock, dairy, and poultry. To repair and make livable dairy farm residence. To replace livestock buildings demolished and removed from College campus.

2. At Howell Field Station for Horticultural Research, North Ogden $55,595
   To provide facilities for handling the fruit crop on the experimental farm and for research on fruit harvesting, grading, packing, storage, and marketing.

3. At Range Livestock Field Station, in cooperation with College of Southern Utah, Iron County $56,200
   To develop irrigation and culinary water and construct a farm residence on the Valley Farm, and for flood control and water development facilities on the summer range.

4. Sanpete Field Station, in cooperation with Snow College, Ephraim $22,500
   To purchase land needed to conduct research and demonstration on water use, crop rotations, soil fertility, pasture management, crop production, and dairying.
The Research Program

The research program of the Experiment Station is organized on a project basis. While it takes many years to complete some types of research, other projects are of shorter duration. As the work is completed, new projects are undertaken. Many factors are considered when undertaking new research—the need for a solution to the problem; the importance of the segment of the industry it will benefit; its cost in relation to the funds available; the personnel, and facilities necessary to conduct the study.

To become more familiar with the problems of the farmers, a number of advisory committees have been appointed to discuss with station administrators and scientists the research needs of the various agricultural enterprises. At present there are six such committees for canning crops, dairy, general agriculture, horticulture, livestock, and poultry. These committees meet once or twice a year to review the progress of research and discuss plans.

To supplement and broaden the scope of the research program, the Experiment Station cooperates with the U.S. Department of Agriculture. Thirty federal employees have headquarters at the College at the present time; they work with Experiment Station personnel in the solution of state problems. Certain phases of the research program are financed by grants-in-aid through contracts with the Department of the Interior, the Quartermaster Division of the Army, the Atomic Energy Commission, the National Institutes of Health, other state and federal agencies, public organizations, and private concerns that are interested in the solution of perplexing agricultural problems. These agencies provide personnel, funds, and materials to further the program.

CONTRIBUTIONS TO RESEARCH
August 15, to December 31, 1956

<table>
<thead>
<tr>
<th>Company</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kennecott Copper Company</td>
<td>$50,000</td>
</tr>
<tr>
<td>Quartermaster Research and</td>
<td>$17,645.05</td>
</tr>
<tr>
<td>Development Center</td>
<td></td>
</tr>
<tr>
<td>Sugar Research Foundation</td>
<td>$9,410</td>
</tr>
<tr>
<td>Amalgamated Sugar Company</td>
<td>$4,605</td>
</tr>
<tr>
<td>Portland Cement Company</td>
<td>$4,500</td>
</tr>
<tr>
<td>American Cyanamid Company</td>
<td>$3,000</td>
</tr>
<tr>
<td>Schaffhauser Corporation</td>
<td>$3,000</td>
</tr>
<tr>
<td>United States Steel Corp.</td>
<td>$2,000</td>
</tr>
<tr>
<td>Columbia-Geneva Division</td>
<td></td>
</tr>
<tr>
<td>Stauffer Chemical Company</td>
<td>$500</td>
</tr>
</tbody>
</table>

Penalty for private use to avoid payment of postage $300
Utah State Agricultural College
Division of Agricultural Sciences
Agricultural Experiment Station
Logan, Utah

L. W. Thomas
Director
Form U. Q. Permit 1142