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1947 *Research Goes to Market*

# COLORADO... AGRICULTURAL EXPERIMENT... STATION.....

COLORADO A&M COLLEGE  
FORT COLLINS

1946 • 1947



# 60<sup>th</sup> ANNUAL REPORT

## **Letter of Transmittal**

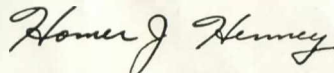
### **Sixtieth Annual Report**

#### **Colorado Agricultural Experiment Station**

Hon. Lee Knous  
Governor of Colorado  
Denver, Colorado

Sir:

In compliance with the act of Congress, approved March 2, 1887, entitled, "An act to establish Agricultural Experiment Stations, in connection with the colleges established in the several states under the provisions of an act approved July 2, 1862, and under the acts supplementary thereto," I herewith present the Sixtieth Annual Report of the Colorado Agricultural Experiment Station for the fiscal year of July 1, 1946 to June 30, 1947, inclusive.

  
Director

*Fort Collins, Colorado*  
*July 1, 1947*

# DIRECTOR'S ANNUAL REPORT

Sixtieth Fiscal Year 1946-1947

## Colorado Agricultural Experiment Station

*To the President and State Board of Agriculture:*

### What's New In Farm Science

The Colorado Agricultural Experiment Station is completing a year in which there has been more change in personnel, more confusion with respect to continuity of research projects, perhaps less return per dollar expended than in any year during the war and, the director trusts, than in any year ahead.

The program of the Experiment Station must be geared to the triple function of aiding agriculture in its depleted resources, and in meeting the economic problem of feeding Colorado residents. At the same time care must be taken to avoid the dangers in burdensome surpluses and the resultant keen competition.

Rebuilding soil fertility is the immediate problem, now nearing the danger point in Colorado. The Station must meet this problem by expanding research on soil fertility, application of commercial fertilizers, alkali elimination, crop rotation, water utilization, and diversification to provide balance between crops and livestock.

Sharply increased need for research in the Platte and Colorado River Basins is due to the development of several trans-mountain water diversion projects in the State. Expanding the Institute of Irrigation Engineering and more closely integrating the Agronomy and Civil Engineering Sections, as well as parts of other sections, will facilitate needed research in this field.

Near completed work on sugar beet machinery indicates the Station's preparedness to continue its efforts toward further mechanization and simplification of farming operations. Industrialization of agriculture is in full swing. New projects on methods of handling hay to yield the highest nutritive value with the least effort will be stressed, and mechanical potato harvesting equipment is to be investigated.

The economic problems of agriculture are being met by continued research to aid in greater production of higher quality handling, and processing practices. The goal is to eliminate the plant and animal products through improved breeding, culture, production of culls or non-marketable products. Studies on improved marketing of peaches and potatoes are planned in co-







Studies on improved marketing conditions include types of containers. Peaches are packed in the popular lug at Palisade, Colorado. Photograph, courtesy of Midwest Photo Service, Grand Junction.

operation with the U. S. Department of Agriculture, and developments in consumer pre-packaging are being followed. Research in inbred lines of beef and dairy cattle is toward the goal of high-quality production.

To meet the problems of industrialized agriculture, the Experiment Station must be adequately staffed and financed and must have a sufficiently broad and flexible program to anticipate or at least keep abreast of the needs. The insecticide and fungicide experiments of the Station have accomplished much in increased yields of crops and livestock gains the past year.

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### Station Program

The Experiment Station program for the past year has changed materially to stress production problems of continued heavy demand. The Station program must continue to enlarge as Colorado's agricultural problems continue to increase; as

Colorado's importance nationally in the production of potatoes, peaches, wool, celery, carrots, and other crops increases; and as the population grows in the cities and on the farms.

## Soils

The laboratory studies of permeability, dispersion and other properties of saline soils which affect their suitability for irrigation and reclamation were continued. These were in conjunction with field investigations to evaluate and develop new techniques and procedures for classifying saline soils. In addition to these studies, cooperation with the Soil Conservation Service on land classification standards was continued.

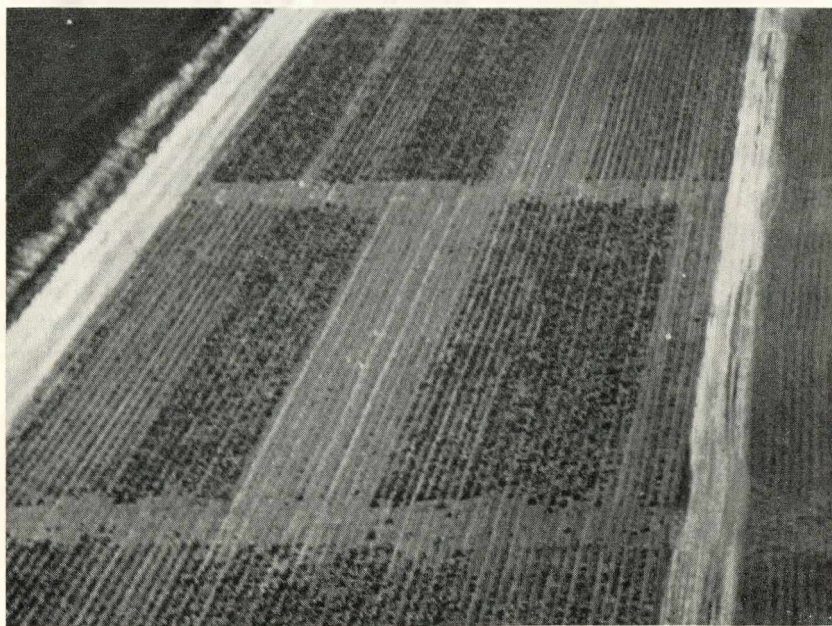
The eleventh year of a comparison of two crop rotations, one with alfalfa and the other with no legume, was completed in 1946. On portions of the land where no fertilizers were used, a gradual decline of crop yields occurred during the 11-year period. A much greater decline occurred, however, in the rotations without alfalfa. The following condensed table shows the comparative yields for 1946.

	8-year rotation with alfalfa		5-year rotation without alfalfa	
	With phosphate	Without phosphate	With phosphate	Without phosphate
Corn (bu.) .....	74.9	74.1	60.1	57.9
Sugar beets (tons) .....	13.9	10.3	10.5	8.6
Wheat (bu.) .....	45.2	42.3	33.4	32.4
Barley (bu.) .....	47.0	40.3	48.6	37.2

The crop yields and soil and plant analyses indicate that available phosphate declined in both rotations and that available nitrogen suffered a marked decline in the rotation without alfalfa. The alfalfa apparently maintained the average available nitrogen at about the same level during the experiment in the rotation with alfalfa. Analyses of plant samples from 150 sugar beet fields were made during 1946 to study in part the effect of previous crops on the available plant nutrients. The results of the study indicated that a pronounced depression of the available nitrogen usually followed a corn crop. Phosphate deficiency was generally more pronounced following alfalfa.

The second phase of the project on the study of methods of restoring the productive capacity of land after the surface soil has been removed by land leveling or erosion, showed interesting results and good recovery as indicated by the corn yield on the plots receiving manure. Commercial fertilizers did not give the response obtained from manure.

Soil tests were run on potato plots to determine the pH, salts, mechanical analysis, nitrate, nitrogen, phosphate, and potash. Treatments included rates and combinations of nitrogen, phosphorus, potash and copper, iron, and manganese. Records were taken on effects of the treatments on yield, cooking quality, color, grade, and storage quality. The application of a complete fertilizer (1-4-1) or 30 pounds of nitrogen, 120 pounds of phosphate, and 30 pounds of potash per acre increased the yield of potatoes planted after sweet clover by 40 percent over the unfertilized plots. This is the result of one year's test. In greenhouse tests with poor and good San Luis Valley soils, the addition of calcium sulfate at the rate of 3 tons per acre improved both soils and their leaching. Copper, iron, and manganese applications failed to produce significant effect on yield and color of potatoes this past year. Applying 300 pounds per acre of 10-18-5 fertilizer produced a higher yield of U. S. No. 1 potatoes than unfertilized potatoes in the San Luis Valley at odds of 99:1, which is highly significant to the important potato-growing areas in the State.



Fertilizer trials on land leveling project. Dark patches showing greater growth were treated with either commercial fertilizer or manure. Light patches were untreated.



Application of minor elements to the soil around and into chlorotic peach trees showed that soil application of ferrous sulfate restored chlorotic trees to normal color in 80 percent of those treated in the Palisade and Delta districts. It is more common on soils of high lime content where iron is apparently fixed or available. Results show the research approach should be on a broad orchard-soil-management basis rather than by the use of temporary treatments.

Preliminary results of study indicate death losses of plants can be reduced by thorough aeration of the steamed soil before planting and by frequent light watering of the plants.

### **Irrigation**

It is quite definitely known that a concrete lining is the most effective in reducing seepage, but in most cases it is also the most expensive. There are other types of lining such as bentonite, soil cement, and some newly developed synthetic resins, which have been tried but their use is still in the experimental stage. Brick and tile linings have proved effective in areas which are unsuitable for concrete, either because they are too expensive or because they are disintegrated by the chemicals in the soil or water. Lining of canals is an economic problem, and to be feasible, the cost of the lining must be less than the benefits that accrue.

Pumping from wells provides an effective method of supplying additional water during periods of drouth as well as an irrigation supply in areas not served by streams or reservoirs. The data contained in the reports of these studies have been used extensively by Soil Conservation Service engineers working in irrigated areas. The capacity of an irrigation well depends primarily on the depth and diameter of the well, the draw-down, the type of screen, and the thickness, character and extent of the water bearing formation.

### **Crops**

The Hardistan variety of alfalfa, after breeding and selecting for several years in small plots, has proved the most promising strain for winter hardiness in Colorado. An increase of the strain for seed development is being started this year.

Hardistan has yielded well at Fort Collins and some other locations in the State. It is wilt resistant enough to live 10 years in wilt-infested soil. Although it has been available as a variety for a number of years, it is not grown by seed producers because its yield of seed is too small. Selection is in progress to increase

resistance to mildew and to maintain the present degree of resistance to bacterial wilt. In the three generations of selection made, the advanced materials appear to be improved in seed setting and freedom from mildew. Field trials are in progress at Fort Collins, Rocky Ford, and Fort Lewis for final evaluation.

An extensive barley testing program is maintained in which all new and promising varieties are grown in replicated comparative tests to determine their adaptability to Colorado conditions. When a high-yielding variety adapted to these conditions is found it is further tested in the counties in cooperation with the Extension Service. If results are promising, it is increased through the seed registration service and released and recommended to the farmer.

Considerable work is being done at the Station to produce varieties of barley resistant to the more destructive diseases prevalent in Colorado. Some of our best yielding varieties are susceptible to infection by loose smut. Progress is being made in transferring loose smut resistance to Lico, one of our best-yielding irrigated barleys.

A test on the best date to plant barley is being carried out, but conclusive data are not yet available. However, the present results indicate that plantings in late March and early April tend to give the highest yields.

Another project of importance to the farmer is the fundamental studies of inheritance in barley. While the results from this study may not be used directly by the farmer they are of immediate value to the plant breeder. This information can be used in determining how to combine the desirable characteristics necessary to produce a new variety.

Five tests were completed on hybrid corn and recommendations of the better hybrids were published in February. It is estimated that 90 percent of the irrigated-corn acreage is planted to hybrid corn and over 30 percent of the dry-land corn is hybrid.

The project on corn improvement was continued and inbred stocks of Colorado single and double crosses were grown. Some new combinations, which include Station inbreds, have been grown in the hybrid tests and show up well for the northern area of the State. Some later inbreds are being tested at Rocky Ford.

The Poultry Section found dehydrated beet-leaf meal to be fully as satisfactory as dehydrated alfalfa meal at comparable levels (5 and 10 percent) in a chick starter mash, when sufficient calcium was present. When the ration contained barely



the minimum required level of calcium, the beet-leaf meal caused a lowering in bone ash. This was probably because of the high oxalate content of this product. Preliminary results indicate that dehydrated beet-leaf meal can be used satisfactorily to replace dehydrated alfalfa meal in a laying ration.

Because controls more effective than poison bait for grasshoppers in intensive agricultural areas are needed, some recently developed insecticides were tested as sprays and dusts. While the results are only preliminary, they indicate promising controls from benzene hexachloride, chlordane, toxaphene, and di(methoxyphenene) trichloroethene in dust and spray.

## **Fruits**

Testing material for codling-moth control on apples proved DDT to be most effective, and far superior to arsenate of lead, which has been considered the standard. One-half pound of DDT to 100 gallons of water, used in five cover sprays, was not inferior to  $\frac{3}{4}$  pound. The calyx application does not appear to be necessary in a spraying schedule in which DDT is used. Five cover sprays with three applied against the first brood of worms and two against the second brood were not superior to two cover sprays against each brood of worms. Omitting the second cover spray for the second brood, or what is usually considered the fifth cover spray, greatly reduced efficiency. When cryolite was used for the second brood sprays in place of the DDT, results were significantly less efficient. Sulfur used with DDT for mite control did not reduce the efficiency of the DDT for codling-moth control.

There is some indication that peach mosaic vectors also can be controlled by DDT.

Commercial fertilizer tests on peaches show that yields can be increased by the application of nitrogen fertilizers, but the fruit is delayed in maturing and is somewhat softer than when unfertilized. Phosphate applications increased maturity of peaches. Results indicate that the cover crop and cultural practices used are basic to maintaining fertility. Commercial fertilizers should be used only in a supplemental way.

## **Vegetables**

Research is being conducted to determine low cost and quick methods of identifying virus diseases in tubers of potato seed. Cut potato tubers were placed under the ultra-violet light and the fluorescence pattern correlated with specific virus diseases.

A method of separating the blue-white fluorescence material from potato juice by means of N-butanol was developed. The extracted fluorescence material came from the juice of tubers infected with leafroll, spindle tuber, and rugose virus. Intensity of fluorescence varied. By subjecting cut tubers to ultra-violet light, virus-infected and healthy tubers can be separated by their fluorescence pattern 75 percent of the time.

A scab-resistant potato, No. 6317, also resistant to several other viruses, is ready for increasing, naming and releasing to foundation growers. The Station cooperated with the U. S. Department of Agriculture on this project at the Colorado Potato Station at Greeley. A cheaper and quicker method of determining virus disease not only in potatoes but probably several other crops or plants has been worked out.

Control tests for potato insects were carried out at the College farm and in cooperation with W. C. Edmundson at the Colorado Potato Station. At Fort Collins 16 treatments, each replicated six times, were tested. Records were taken on the control of psyllids and the tuber flea beetle. Sweeping records indicate a number of other insects are affected. The more effective treatments for psyllids gave a yield about double that from the check, the check producing 203 bushels of marketable tubers and the best treatment, 432 bushels per acre. The highest yield, which is an indication of better psyllid control, was produced with 2 pounds of 50 percent DDT to 100 gallons of water. Five applications were made in all cases. The differences between the highest yield and those secured from other treatments were not highly significant.

In the Greeley tests, the efficiency of DDT for flea-beetle control was not reduced when used as a spray with bordeaux mixture or with dithane, or when used as a dust with 8 percent cuprocide or 20 percent zerlate.

Two pounds benzene hexachloride (5 percent gamma isomer), in 100 gallons of water gave highly significant control of the tuber flea beetle.

Strains of potatoes that had been selected in the greenhouse as showing resistance to the psyllid were grown in the field. Some strains have shown resistance as indicated by top symptoms, but the yields of these strains have not been satisfactory. Considerable work has been done on the nature of psyllid yellows. A study of the salivary glands and toxemia produced in the plant by the secretion from these glands has been a major part of the work toward a doctor's thesis.

The specific gravity distribution method of evaluating potato quality was developed in the chemistry laboratories and is proving to be a valuable tool. A method for determining the water-holding capacity of potatoes also has been developed.

The development of  $F_1$  hybrid onions by making use of the mode of inheritance of male sterility has shown satisfactory progress. The  $F_1$  hybrids yield more, are more uniform, and store better than standard varieties.

## **Ranges**

During the year, 540 determinations were made on forage samples collected by cooperating organizations. Significant observations arising from these analyses follow: Samples of winter fat and sage obtained from the Western Slope during the winter months more nearly retained the protein value of the summer months than any of the grasses. Grasses from the Fort Collins foothill region are fairly high in protein during the summer months. There winter protein value has not been evaluated. Throughout this study of the quality of native forage, the calcium-phosphorus ration has been found higher than desirable.



Hereford cows graze on an experimental range of Intermediate wheat-grass west of Fort Collins.

## **Beef Cattle**

Laboratory and field investigations pointed to the discovery that adding small amounts of copper to rations of heavily fed beef cattle prevents symptoms of a rickets-like nature and im-

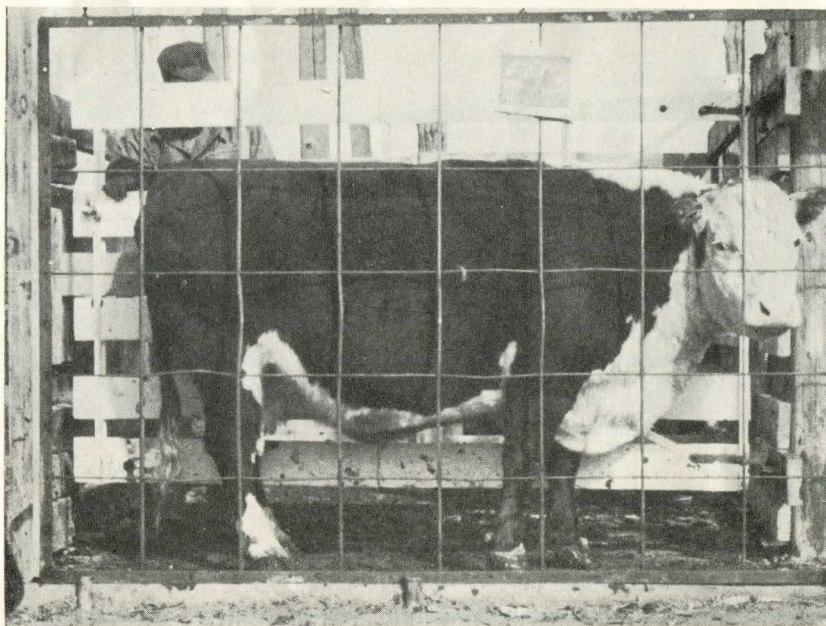


pairment of breeding ability. The practical significance and value of the discovery is inestimable.

Analysis of over 500 samples of forage has revealed a deficiency of carotene in winter roughage grown in the dryland areas. This may have an important bearing on the economy of beef production on the Great Plains. Winter forage of low carotene value appears to be more frequently due to improper harvesting than any other known factor. This has significance in pointing up the practical importance of nutrient conservation and better harvesting and storage methods.

Studies at Akron with heifer calves wintered on common dryland rations have shown that alfalfa is more effective in raising blood vitamin A levels than high-potency fish oils. Blood carotene and vitamin A levels of calves wintered on range may drop to a dangerously low point before spring, the depletion occurring at a more rapid rate than is commonly assumed.

Alfalfa preserved as silage with the addition of phosphoric acid has a higher feeding value for steers than alfalfa silage preserved without acid, and is approximately equal to corn silage. Nutrient conservation is enhanced by this method of preservation.



A foundation cow for one of the inbred lines is shown behind a grid used in taking measurements.

Comparison of the progeny of comprest vs. conventional types of Hereford sires is now underway at Fort Lewis. The first calves by the sires of the diverse types are on the ground. A corollary study of compact-type Shorthorn cattle in a cooperator's herd is also revealing information on the variation in types.

In a second phase of the beef-cattle breeding work, six inbred lines of registered Hereford cattle are being established. Body scores, weights, and photo-measurements have been obtained on all experimental animals.

Using Hereford calves, approximately 7 months of age, an experiment was conducted to determine if vitamin A deficiency or loss of liver reserves of vitamin A is a factor in the cause of abscesses. One hundred and fourteen calves were divided into six equal lots. Lot 1 was slaughtered at the beginning of the experiment. Lots 2 to 6 were placed in fattening pens on a basal ration composed of barley, beet pulp, cotton cake and oat straw. Increasing increments of vitamin A in the form of fish liver oil were given the lots, and feeding was continued for 10 months. Advanced symptoms of vitamin A deficiency developed in lot 2. A summary of this experiment is shown in the following table.

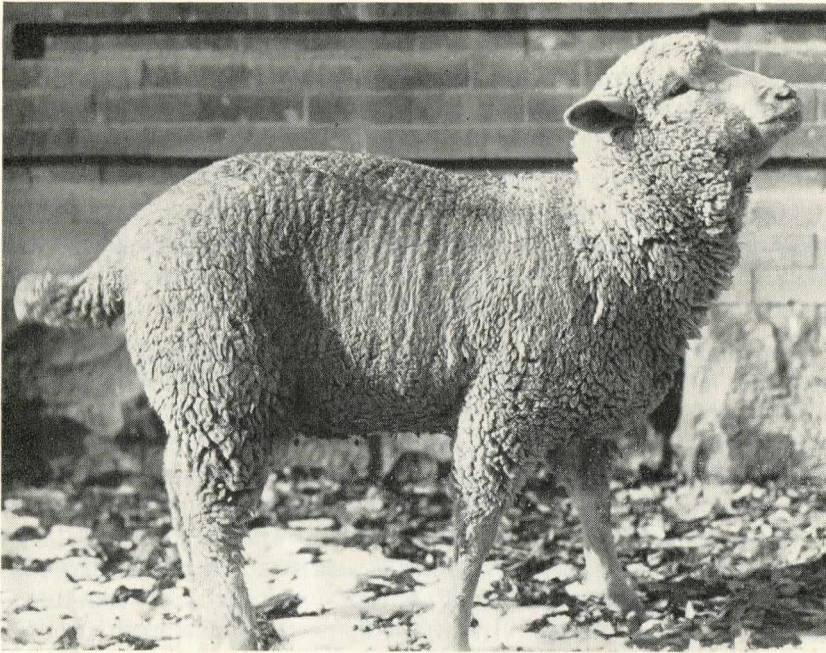
Lots	Cattle	I. U. vit. A per lb. body wt. per day (supplement)	I. U. vit. A per gm. fresh liver at slaughter	Liver abscesses percentage
1	19	Initial slaughter	202	5
2	19	0	1	26
3	19	25	6	58
4	19	100	74	21
5	19	200	159	31
6	19	500	549	10

As shown in the table, hepatic (liver) stores of vitamin A diminished in lots 2, 3, and 4. In lots 5 and 6, the original levels were maintained or increased. Despite these differences in vitamin A content of liver, abscesses developed in all lots. These data indicate that vitamin A is an unimportant factor in the cause of liver abscesses.

It has been proved that carotene deficiency in all matured crops in the dryland area apparently is the cause of most of the non-reproductive problems in cow herds.

## Sheep

The value of sulfur as a means of controlling death loss in feedlot lambs has received added proof. A daily level of  $\frac{1}{3}$  to  $\frac{2}{3}$  ounce per lamb appears to be effective in controlling death loss



Enterotoxemia reacts similarly to apoplexy and lambs may die from "overeating" within a matter of hours.

without seriously reducing the consumption of grain and consequently the rate of gain. Combinations of protein and sulfur at levels ordinarily fed to lambs were not toxic, thus indicating that sulfur can be safely mixed and fed with protein concentrates. The experiments conducted this year were designed to determine the optimum dosage of sulfur to use with our method of self-feeding grain which has been shown to be conducive to a high mortality in unprotected lambs. Results indicate the value of sulfur, but further work needs to be done to simplify the methods of application so that its use may be easily adapted to normal feedlot practices.

Heavy mortality in both sheep and cattle resulted from feeding pellets composed of 44 percent cottonseed meal, 44 percent linseed meal, and 12 percent sulfur flour. Chemical analysis of these pellets revealed only traces of common poisons. By extracting with carbon disulfide, the pellets were divided into sulfur and protein concentrate fractions. Either fraction when fed alone was harmless. When recombined, the mixture was toxic. It was determined that 10 grams of this mixture per kilogram of body weight approximates the minimum lethal dose for



sheep. The minimum lethal dose for cattle has not been determined.

Research on the fringed tapeworm determined that fertilized segments of *Thysanosoma actinioides* are passed in the feces of the host, as is the case with most cestodes. Observations concerning such proglottides were recorded, organized and published as a paper entitled, "The Identification of *Thysanosoma actinioides* Infections in Sheep by Examination of Fecal Pellets," published in the Transactions of the American Microscopic Society, Volume 65. On the basis of these findings we are now able to isolate infected sheep for anthelmintic and other experiments.

Observations on 18 ewes, slaughtered for consumption on the King Ranch, showed that the parasite is common in animals 5 and 6 years old and that possibly 30 percent of the ewes on the ranch are infected with this tapeworm. As many as 38 worms were collected from a single animal. The parasite is ordinarily considered to be one affecting young animals.

## **Dairy Cattle**

A new pregnancy test for dairy cattle has been discovered and is being evaluated. Research on dairy pastures for Colorado conditions was started in a small way in 1946-1947.

## **Poultry**

As in previous years, the Wyoming type poultry house was consistently more uniform in temperature. Again, egg production of White Leghorn pullets has been consistently lower in the Colorado house. Birds in the Wyoming house recovered egg production more rapidly following an outbreak of laryngotracheitis and fowl pox than those in the Cornell and Colorado houses. The wet litter occurring in the winter in the latter two was greatly improved by keeping more front windows open at night and by opening the rear rafter ventilators about  $\frac{3}{4}$  of an inch.

An old laying house was remodeled in three divisions to compare insulated pens having restricted ventilation with the original uninsulated pen in which all front windows remained open all the time. New Hampshire pullets were used. Despite exposure to outside temperatures, the birds in the open uninsulated pen have laid slightly better than those in the insulated pens and have a very low mortality rate. The two insulated pens became very damp. This condition was improved by greatly increasing the ventilation.

Results to date confirm the opinion that adequate ventilation in an insulated house is essential and that a cold dry house is much better than a warm wet one for laying chickens.

The practical value of this investigation is in confirming advice to poultrymen to keep the windows open at least enough to prevent the house from frosting in cold weather and to maintain dry litter.

It has been concluded that protamone is of no value in controlling leukosis or in improving growth or early egg production of pullets.

### **Fur-Bearing Animals**

A disease causing abortion in fur-bearing animals has been studied. This disease is apparently contagious. From the uterus of infected animals a *Salmonella* has been isolated and a bacterin is now in the process of being prepared. It is hoped that this bacterin will be an aid in the control of this disease.

### **Mechanization and Storing**

Thirty-five tons of sugar are lost daily in Colorado in the large beet piles at the dumps. Studies on ventilation in, or the covering of, piles has indicated some of this loss can be prevented. Mathematical calculations were made on the heat transfer problems in the beet pile and with this basic information improved beet storage systems will be studied. There is evidence from the experimental work already done that this high storage loss may be reduced 50 percent by artificial ventilation and cooling.



Night air blown through this experimental beet pile succeeded in lowering the temperature of the pile.

Ventilation in the insulated house for livestock is still better than cold still dry air or wet still warm air in houses not ventilated.

Some artificial hay curing has also been done in cooperation with a farmer.

A portable form for casting 6-inch concrete Parshall flumes was constructed in the hydraulic laboratory for the Rocky Ford Highline Canal at their expense, but under supervision of the Civil Engineering Section. Plans for the form followed essentially those of previously constructed forms with slight improvements. However, 12-gauge sheet iron was used on the water side instead of plywood or transite employed previously, as the latter were unobtainable. Initial use of the form demonstrated its practicability.

The ultimate goal in the spring mechanization program was to be able to plant beet seed to a final stand. Before this can be done two problems must be solved, (1) germinating conditions must be improved so that 90 percent of the seed plants will grow, and (2) weed-control methods must be improved so that hand labor can be eliminated. Last spring experimental plantings were made in various parts of the State where 22 different experimental devices were tried to improve germination and weed control. The most promising of these, along with other new ideas, are being checked again in 1947. Planting rates as low as  $1\frac{1}{2}$  pounds per acre are being checked with a fair chance of success as compared to the generally recommended practice of planting 5 pounds of seed per acre.

Chemical weed-control methods have been given preliminary trials and will be continued with the addition of flame weeder experiments.

In connection with better land use and increased efficiency in the use of water on the Colorado Potato Experiment Station an area of about 12 acres was leveled in April 1947. The work was planned for the fall of 1946 but inclement weather made it necessary to delay operations and the results of moving soil with too high a moisture content will be of considerable interest.

### **Feeding the Family**

Frozen peas were used as a uniform source of material for tests on the effects of altitude, time of cooking, and pan pressure, on the ascorbic acid retention and palatability of vegetables cooked in a pressure saucepan.



Cooking under the same conditions at simulated altitudes of sea level, 5,000, and 10,000 feet, did not affect the retention of ascorbic acid. Length of time of cooking (up to pressure or minute after pressure was reached) or pan pressure (5 or 15 pounds) at which the peas were cooked did not affect the ascorbic acid content of peas under the conditions of this experiment.

Many different shortenings, butter, margarines, lards, and hydrogenated vegetable fats, some with and some without emulsifiers, are now on the market for home and bakery use. Such shortenings are suitable for use in baked products, but different procedures must be used to obtain the best results with each type. Altitude is an influencing factor in the determination of the best method of handling each fat and in the determination of the best formula to use with each one in the baking of cakes. At present two types of shortenings, hydrogenated vegetable fats, with and without an emulsifier, are being investigated at altitudes of sea level, 2,500, 5,000, 7,500, and 10,000 feet.

Although results are incomplete, the best methods of creaming and mixing vary with different fats. In addition, the amount of liquid varies with the type of fat and with the altitude.

### **Making The Farm and Ranch Pay**

Snow survey and irrigation forecast reports were regularly issued for the Colorado, Rio Grande, Missouri, and Arkansas drainage basins. These reports cover the conditions existing as of the first of February, March, April and May. Forecasts were made of stream flow for the period April through August on April 1. An amended forecast was made on May 1. In the 35 forecasts of stream flow in April 1946, the maximum error was 24 percent. The error for the flow of the Cache la Poudre was 12 percent high. Estimates on the filling of the principal reservoirs on the North Platte was 6 percent low.

Motion studies of some farm operations around the State have resulted in recommendations which, if carried out, will effect much saving in time and labor. Specifically, in the case of two dairy barns operated by one company, the labor in barn A per cow was just double the labor in barn B.

The shipping of fourteen test cars of peaches out of Palisade indicates the value of pre-cooling and superiority of the fan-type car over standard-type refrigerator car.

During 1946-47 special attention has been given to securing labor requirements and costs for various methods of harvesting alfalfa hay. Analysis of these records indicates that the sweep-stacker, which combines bucking and placing the hay in the

stack, is the quickest and cheapest method for stacking. Where 300 or more tons of hay are harvested annually and fed on the farm, the pick-up chopper is the most economical, since the hay is delivered to the stack ready for final feeding.

Colorado peaches occupy an enviable position in some markets while meeting stiff competition in others. Colorado peaches win approval because of their flavor, color, and freedom from insect or disease damage. Because of these conditions, Colorado growers have succeeded where others, using similar methods, have not. Studies in recent years suggest several possible ways to improve the general appearance of the Colorado peach pack: (1) use more central shed packing to secure greater uniformity, (2) use ring packing equipment more carefully, (3) remove over-ripe peaches, especially from the bushel pack, (4) label or identify baskets as coming from Colorado, (5) avoid overloading of cars, (6) improve methods of pre-cooling to lengthen time that peaches will keep enroute.

This study was made by the Economics and Sociology Section of the Colorado Agricultural Experiment Station in cooperation with the Farm Credit Administration and the Western Slope peach industry.

## **Substations**

The long-time Experiment Station policy calls for at least 20 percent of total Station funds to be spent at 8 substations or field-plot areas scattered over the State. For 1947-48 only \$400,000 was available for Station work from all sources; \$46,999 of this, or about 12 percent, is being budgeted for substation work. If the total amount for the fiscal year 1948-49 could be increased to \$500,000, at least \$100,000, or double the current year's amount of \$46,000, should be spent at these 8 substation areas.

The great variety of problems faced by farmers and ranchmen in Colorado is due to the different conditions and types of soil, climate, altitude, and water in various sections of the State. These affect agricultural activity in so many ways that no single set of research findings is applicable to the entire State.

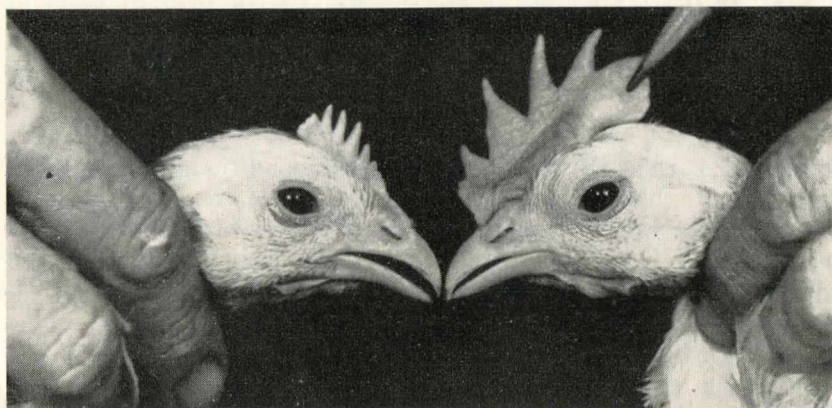
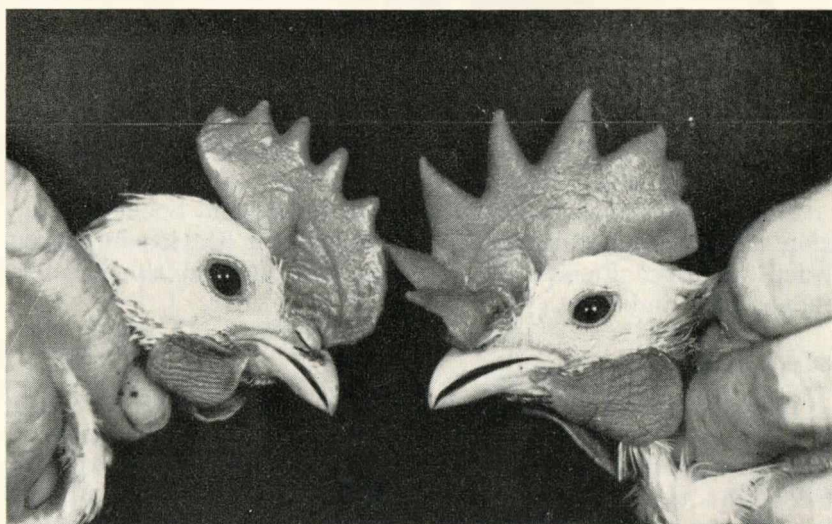
To enable the research staff to work with problems in the major agricultural regions of Colorado, substations are maintained in these areas. Research findings at these substations are included in the general report of research results.

Substations greatly enlarge the scope of agricultural research in Colorado. The projects on the substations are under the direction and leadership of the members of the staff of the

main Station at Fort Collins, who by using the substations, test their findings under the various conditions existing throughout the State.

### **Agricultural Research**

Twenty-one additional chick and rat experiments, involving about 3000 chicks and several hundred rats, have been completed to ascertain the androgenic potency of concentration of male hormones in cow manure throughout the pregnant period and the estrous cycle and of various fractions of cow manure extracts.



**ASSAY METHOD FOR ANDROGENIC SUBSTANCES:** Above cockerels have greatly increased combs following the feeding of manure from pregnant cows. Below are normal untreated chicks.



Maximum potency during gestation occurred during the seventh and ninth months and the last week of pregnancy. It dropped sharply to zero following calving. Androgen excretion in manure showed a peak in the normal estrous cycle coincident with the usual time of ovulation and of corpus luteum maturation. One kilogram of dried feces contained androgenic potency equivalent to 300 milligrams of methyl testosterone or 180 milligrams of androstenedione.

Further progress has thus been made toward the isolation of hormonal substances from the manure of pregnant cows which may be economically rendered pure enough to be useful in treating certain types of reproductive disorders in cattle. One ton of fresh potent cow manure of a certain type may contain the androgenic activity of about \$1,500 worth of pure hormone at present prices.

Of the 150 organic chemicals having growth-regulating constituents synthesized by the Chemistry Section during the previous year, seven were selected by laboratory and greenhouse tests for field trials during the past season. Field tests with Pawnee potatoes were carried out at the Colorado Potato Station at Greeley, Colorado. One growth stimulant gave a 27 percent increase in yield over controls.

Ultra-violet light treatment of commercial weed killers lowered the effectiveness of some and greatly enhanced the effectiveness of others.

Study of the browning reaction in potatoes by means of pH fluorescence curves has been developed in the Chemistry laboratories. It has been shown that both amino acids and reducing sugars are necessary as reactants in the non-enzymatic browning of potatoes. The similarity of the browning reaction in dehydrated and in fried potatoes was demonstrated. It was shown that hydroxymethyl furfural is a primary reaction product responsible for the type of pH-fluorescence curve obtained in the early stage of browning. The browning which occurs when glucose and amino acids are cooked together, destroys part of the nutrients as shown by poorer growth of the microorganism in feeding trials. This discovery may have far-reaching significance in relation to heat damage to nutrients during food processing. A hot-water-extraction method has proved successful in removing the non-enzymatic browning reactants from potato pieces. This is applicable to both the dehydration and frying of potatoes.

Frozen fruit purees may be effectively protected against

enzymatic browning and oxidation for a considerable period after defrosting.

A new method of preparing fresh frozen apple sauce has been developed. The sauce has a fresh apple flavor and is stabilized against enzymatic browning and the development of oxidized flavors.

Cancer growth and tumors in aging bitches has been arrested by testicular extracts. This project is an outgrowth of industrial studies using agricultural wastes. It is being considered by the Cancer Institute for support.

### **Seed Laboratory**

With the ending of the war, demands on the Seed Laboratory dropped considerably but the number of samples received was still almost three times the number received in 1941, the year of reorganization. Seed inspection was conducted more thoroughly than in many previous years, with three inspectors blanketing the State. Laboratory analyses of the inspection samples are gradually being completed. Securing competent help is still the major problem.

Weed control studies are being continued in the field and along physiological lines in the laboratory. There is no question that 2,4-D is the greatest development in weed control to date, although it is not the complete answer. Certain weeds are resistant and do not respond to ordinary treatment with 2,4-D. However, some headway is being made in the development of special methods for treating weeds of this type.

The development of selective herbicides that function in the opposite manner from 2,4-D herbicides, that is, destroy grass plants without severe injury to the broad-leaved plants, and the development of methods of controlling water weeds are of much concern and are being watched with a view to active participation in the future.

The activities in weed-control investigations involve cooperation with the Divisions of Agronomy, Forestry, Poultry, and the Sub-Stations in the College and with the Forest Service, Bureau of Plant Industry, and Beet Sugar Development Foundation.

### **Editorial Service**

Scientific journals published 31 manuscripts bearing scientific series numbers, and 44 manuscripts were published in popular journals or mimeographed forms under the Station miscel-

laneous series numbers. There were 25 other contributions published during the year in miscellaneous types of publications. There were 117 news stories written, and in all cases these were used by the office of information at the college for radio releases.

### Monthly Publications

Twelve issues of the Colorado A & M News made up volume I and were published monthly during the fiscal year 1946-1947.

### Technical Bulletins:

- No. 34 "Ground Water Supply of Prospect Valley, Colorado" by W. E. Code.
- No. 35 "Fertilizer Studies with the Red McClure and Bliss Triumph Varieties of Potatoes in the San Luis Valley" by John G. McLean, Walter C. Sparks and A. M. Binkley.
- No. 36 "A New Technique of Field Crop Labor Analysis" by R. T. Burdick.

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Fifty-Ninth Annual Report, Colorado Agricultural Experiment Station, 1945-56.

### Staff Contributions—1945-1947

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## Personnel

Joining the staff during the fiscal year were:

Donald R. Wood	Assistant Agronomist
R. E. Carlyle	Assistant Agronomist
E. K. McKellar	Assistant Animal Husbandman
Walter D. Thomas	Assistant Plant Pathologist
H. H. Schweizer	Assistant Civil Engineer
Josephine Brooks	Associate Home Economist
Carl J. C. Jorgensen	Associate Horticulturist
Walter R. Horlacher	Director of Substations
Ray S. Jackson	Assistant Veterinary Pathologist
W. H. Leonard	Agronomist, returned from military Service.

Resignations from the staff during the year were:

Allen A. Heidebrecht	Assistant Animal Husbandman
Robert Eslick	Assistant Agronomist
Alvin Kezer	Agronomist
W. E. Kreutzer	Associate Botanist
Ellen Zink	Seed Analyst
D. F. Gunder	Irrigation Engineer
Floyd Brown	Associate Agricultural Engineer
Fred Beatty	Associate Civil Engineer
Marvin J. Russell	Station Editor

**COLORADO A & M COLLEGE**  
**COLORADO AGRICULTURAL EXPERIMENT STATION**  
 FORT COLLINS, COLORADO

**STATE BOARD OF AGRICULTURE**

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Rex C. Eaton	Eaton	T. C. McPherson	San Acacio
Ex-officio—Gov. W. Lee Knous and Pres. Roy M. Green			

\*Appointed December, 1946 to serve unexpired term of Robert F. Rockwell, resigned.

**EXPERIMENT STATION OFFICERS**

ROY M. GREEN, M.S., D.Sc.	Pres.	JOSEPH M. WHALLEY, M.S.	Treas.
HOMER J. HENNEY, M.S.	Director	REN W. BROWN, B.S.	
NORMA BROWN	Clerk		Director of Information
		MARCIA GREGG	Assistant Editor

**EXPERIMENT STATION STAFF**  
**AGRICULTURAL DIVISION**

**Agronomy**

D. W. Robertson, Ph.D.	Chief Agronomist
Warren H. Leonard, Ph.D.	Agronomist
Robert Gardner, M.S.	Agronomist (Soils)
Dale S. Romine, M.S.	Associate Agronomist (Soils)
Ralph Weihing, Ph.D.	Associate Agronomist
Robert Whitney, M.S.	Associate Agronomist (Soils)
R. E. Carlyle, Ph.D.	Associate Agronomist
Glen Gausman, M.S.	Assistant Agronomist
Donald R. Wood, B.S.	Assistant Agronomist
Thilo E. Haus, M.S.	Assistant Agronomist

**Cooperators:**

G. W. Deming, B.S.	Assistant Agronomist, USDA
Bruno Klinger, M.S.	Associate Soil Conservationist, USDA
H. L. Parkinson, B.S.	Soil Scientist, USDA
Roger R. Headley, B.S.	Soil Scientist, USDA
J. F. Brandon, B.S.	Associate Agronomist, USDA, Akron

**Animal Investigations**

S. S. Wheeler, Ph.D.	Chief Animal Husbandman
W. E. Connell, M.S.	Animal Husbandman
L. E. Washburn, Ph.D.	Animal Husbandman
H. H. Stonaker, Ph.D.	Associate Animal Husbandman
A. Lamar Esplin, M.S.	Associate Animal Husbandman
Melvin Hazaleus, M.S.	Assistant Animal Husbandman
Eugene Bertone, B.S.	Assistant Animal Husbandman
Elmer K. McKellar, B.S.	Assistant Animal Husbandman

**Animal Pathology and Veterinary Medicine**

Floyd Cross, D.V.M.	Chief Veterinary Pathologist
L. E. Newsom, B.S., D.V.S., D.Sc.	Veterinary Pathologist
A. W. Deem, D.V.M., M.S.	Associate Veterinary Bacteriologist
Wendell H. Krull, D.V.M., Ph.D.	Parasitologist
Rue Jensen, D.V.M., M.S.	Associate Veterinary Pathologist
Ray S. Jackson, D.V.M., B.A.	Assistant Veterinary Pathologist
J. W. Tobiska, M.S.	Chemist

**Botany and Plant Pathology**

L. W. Durrell, Ph.D.	Chief Botanist and Plant Pathologist
Bruce J. Thornton, M.S.	Associate Botanist
A. O. Simonds, Ph.D.	Associate Botanist
Jess L. Fufts, Ph.D.	Associate Botanist
H. D. Harrington, Ph.D.	Associate Botanist
George H. Lane, M.S.	Assistant Plant Pathologist
Walter D. Thomas, Jr., Ph.D.	Assistant Plant Pathologist
R. E. Atkinson, M.S.	Assistant Botanist
<b>Cooperators:</b>	
J. O. Gaskill, M.S.	Junior Plant Pathologist USDA
L. A. Schaal, Ph.D.	Associate Plant Pathologist USDA
E. A. Lungren, M.S.	Associate Plant Pathologist USDA

**Chemistry**

W. E. Pyke, Ph.D.	Chief Chemist
Lowell Charkey, M.S., Ph.D.	Associate Chemist
A. R. Ronzio, Ph.D.	Associate Chemist
A. R. Patton, Ph.D.	Associate Chemist

Paul R. Frey, Ph.D.	Associate Chemist
E. B. Crone, Ph.D.	Assistant Chemist
Gestur Johnson, M.S.	Assistant Chemist
Howard A. Durham, M.A.	Assistant Chemist
W. W. Allison, M.S.	Assistant Chemist
E. G. Hill, B.S.	Research Assistant

#### Entomology

George M. List, Ph.D.	Chief Entomologist
John L. Hoerner, M.S.	Associate Entomologist
Leslie B. Daniels, M.S.	Associate Entomologist
J. H. Newton, B.S.	Associate Entomologist
M. T. James, Ph.D.	Assistant Entomologist

#### Forestry and Game Management

J. Lee Deen, Ph.D.	Chief Forester
R. J. Preston, Ph.D.	Forester
J. V. K. Wagar, B.S., M.S.	Game Conservationist
E. W. Nelson, M.A.	Range Conservationist
Clinton H. Wasser, M.S.	Associate Range Conservationist
D. F. Hervey, B.S.	Assistant Range Conservationist

#### Home Economics

Elizabeth Dyar, Ph.D.	Chief Home Economist
Flora L. Slocum, Ph.D.	Home Economist
Josephine Brooks, M.S., Ph.D.	Associate Home Economist
Miriam E. Hummel, M.S.	Assistant Home Economist

#### Horticulture

A. M. Binkley, M.S.	Chief Horticulturist
George A. Beach, M.S.	Horticulturist
Robert Kunkel, Ph.D.	Horticulturist
Carl J. C. Jorgensen, M.S.	Associate Horticulturist
Walter C. Sparks, M.S.	Associate Horticulturist

#### Poultry

H. S. Wilgus, Jr., Ph.D.	Chief Poultry Husbandman
Robert Adolph, B.S.	Assistant in Poultry Research
Frank X. Gassner, D.V.M., M.S.	Associate Pathologist

#### Rural Economics and Sociology

R. T. Burdick, Ph.D.	Chief Rural Economist
J. L. Paschal, Ph.D.	Associate Rural Economist
G. T. Hudson, Ph.D.	Assistant Rural Sociologist
Catherine Clark, B.S., A.B.	Assistant in Rural Sociology Research

#### Seed Laboratory

Bruce J. Thornton, M.S.	Associate Botanist, in Charge
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### ENGINEERING DIVISION

N. A. Christensen, Ph.D.	Dean
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#### Civil Engineering

Robert L. Lewis, M.C.E.	Chief Civil Engineer
W. E. Code, B.S.	Associate Irrigation Engineer
R. H. Dodds, M.S.	Associate Irrigation Engineer
Maxwell Parshall, B.S.	Meteorologist
H. Schweizer, B.S.	Assistant Civil Engineer
Cooperators:	
R. L. Parshall, B.S.	Senior Irrigation Engineer, USDA
Carl Rohwer, B.S., C.E.	Senior Irrigation Engineer, USDA
H. J. Stockwell, B.S.	Irrigation Engineer

#### Mechanical Engineering

J. T. Strate, M.S.	Chief Agricultural Engineer
H. H. Kob, B.S.	Associate Agricultural Engineer
Raymond D. Barmington, B.S., M.E.	Assistant Mechanical Engineer
H. B. Mummert, B.S.	Associate Engineer
Nellie L. Landblom, A.B.	Research Statistician
Cooperators:	
A. D. Edgar, B.S.	Agricultural Engineer, USDA
S. W. McBirney, B.S.	Senior Agricultural Engineer, USDA
George Stafford	Engineering Aide, USDA
P. F. Gifford, B.E.	Farm Job Analyst, USDA

#### SUBSTATIONS

W. R. Horlacher, Ph.D.	Director
Herman Fauber, M.S.	Superintendent, Arkansas Valley
Ferris M. Green, B.S.	Superintendent, Western Slope
Dwight Koonce, M.S.	Associate Agronomist, Fort Lewis
W. F. McGee, B.S.	Superintendent, San Luis Valley
Cooperator:	
W. C. Edmundson, M.S.	Horticulturist, USDA, Colorado Potato Station

# FINANCIAL REPORT, COLORADO AGRICULTURAL EXPERIMENT STATION

For the year ending June 30, 1947

	DR. (Receipts)							TOTAL FUNDS
	Hatch Fund	Adams Fund	Purnell Fund	Bankhead Jones Fund	State Mill Levy Fund	Special Funds	Research Foundation	
Balance, July 1, 1946	\$	\$	\$	\$	\$	\$	\$	\$
From the treasurer of the United States per appropriations for the fiscal year ending June 30, 1947, under the Acts of Congress approved March 2, 1887. (Hatch fund), March 16, 1906, (Adams fund), February 24, 1925, (Purnell fund), and June 29, 1935, (Bankhead-Jones fund)	15,000.00	15,000.00	60,000.00	24,243.47	112,406.07 <sup>2</sup>	143,155.60 <sup>3</sup>	40,939.48	114,243.47
Other sources than the United States								
Total Receipts	15,000.00	15,000.00	60,000.00	24,243.47	141,439.19	185,977.06	79,687.99	521,347.71
CR. (Expenditures)								
Personal services	13,103.70	10,899.83	43,973.50	18,314.43	89,676.59	68,399.16	14,939.01	259,308.22
Travel	1,034.24	667.87	2,202.17	553.24	2,540.16	4,234.14	2,597.63	13,829.45
Transportation of things		26.42	21.70	9.96	464.09	708.42	24.08	1,254.67
Communication Service		21.05	34.39	29.02	1,954.62	353.68	36.95	2,462.43
Rents and Utility Service	32.72		764.74	434.21	2,957.38	4,332.99	3,173.99	12,027.89
Printing and Binding		364.58	324.38	442.00	1,301.52	217.73	59.72	2,353.85
Other Contractual Services	8.50	757.02	1,593.39	465.01	4,004.40	4,222.50	631.53	11,761.49
Supplies and Materials	528.93	1,064.49	2,546.47	770.02	12,159.59	57,227.94	6,642.94	80,940.38
Equipment		1,039.53	7,321.66	2,857.37	8,179.50	11,168.60	3,247.49	33,814.15
Lands and Structures					2,506.02	3,570.72	105.27	6,182.01
Contributions to Retirement	204.27	159.21	1,217.60	368.21	1,382.56	1,150.46	158.51	4,640.82
Total Expenditures	15,000.00	15,000.00	60,000.00	24,243.47	127,126.43	155,586.34	31,617.12	428,573.36
Balance on hand June 30, 1947	0	0	0	0	14,312.76	30,390.72	48,070.87	92,774.35
Grand Total	15,000.00	15,000.00	60,000.00	24,243.47	141,439.19	185,977.06	79,687.99	521,347.71

<sup>1</sup> Includes \$20,220.50 Station Special, \$2,285.11 IDR, \$315.85 Plant Disease

<sup>2</sup> Includes \$20,000.00 HB No. 74

<sup>3</sup> Includes receipts \$98,905.60 Station Special, \$19,000.00 IDR, \$10,000.00 Bindweed, \$6,000.00 Pure Seed, \$9,250.00 Plant Disease

<sup>4</sup> Includes disbursements \$108,763.00 Station Special, \$21,285.11 IDR, \$9,972.38 Bindweed, \$6,000.00 Pure Seed, \$9,565.85 Plant Disease

<sup>5</sup> Includes disbursements \$20,000.00 House Bill No. 74 for personal services.



