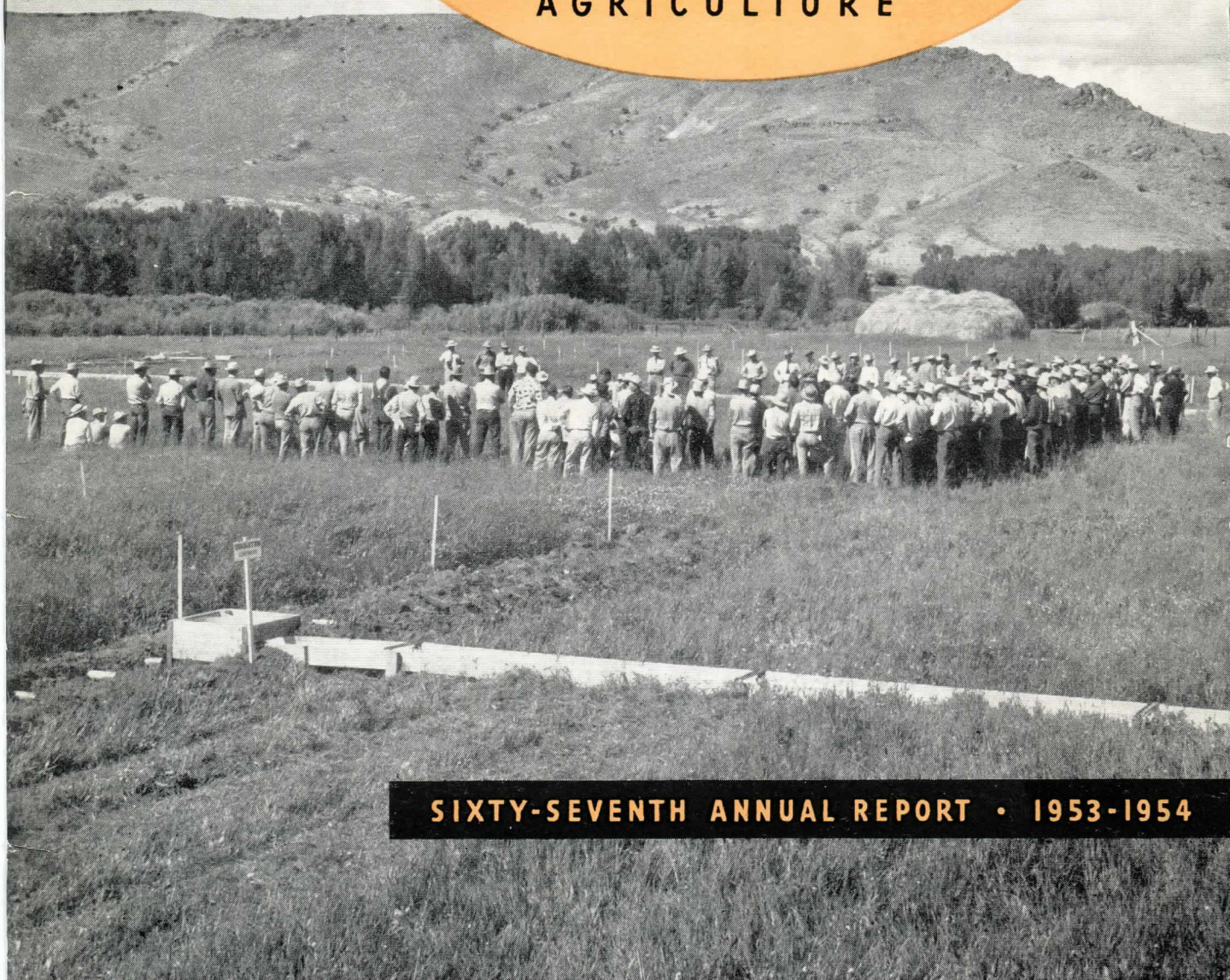


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Research

SERVES COLORADO
AGRICULTURE



SIXTY-SEVENTH ANNUAL REPORT • 1953-1954

COLORADO AGRICULTURAL and MECHANICAL COLLEGE
AGRICULTURAL EXPERIMENT STATION
FORT COLLINS

**Letter of Transmittal
Sixty-Seventh Annual Report
Colorado Agricultural Experiment Station**

Honorable Daniel I. J. Thornton
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 several states under the provisions of an act approved July 2, 1862, and under the acts supplementary thereto," I herewith present the Sixty-seventh Annual Report of the Colorado Agricultural Experiment Station for the fiscal year of July 1, 1953 to June 30, 1954.

Fort Collins, Colorado
July 1, 1954



S. S. Wheeler
Director

**Agricultural Building
Colorado A and M College**



Sixty-Seventh Annual Report
Colorado Agricultural Experiment Station

Research Serves Colorado Agriculture



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Crops and Soils

One-Fourth of Irrigated Land Has Salt Problem

More than one-fourth of Colorado's irrigated farmland is affected to some degree by salts and alkali.

Station researchers found in a state-wide survey that around 810,400 acres, or 28 percent of the total irrigated land, contain from slight to large amounts of salt.

In connection with their study of means of development, improvement and application of methods of classifying arid and semi-arid lands, the scientists are attempt-

ing to find a better basis for classifying large areas of sandy and gravelly soil now being used as mountain meadows. As part of the investigation, the researchers are testing the effect of water table height on plant growth on these soils.

Greenhouse studies indicate that controlled water tables in gravelly mountain meadows may increase production and reduce fertilizer costs by preventing excessive leaching.

Researchers Combat Harmful Salts

A four-phase program may be necessary to combat the detrimental effects of salts and alkali in the San Luis Valley in Colorado. Station studies indicate this program should include soil amendments, leaching, subirrigation and surface irrigation, especially for shallow rooted crops such as small grain.

Researchers are studying these measures on slated land in the Mosca-Hooper area in the San Luis Valley. Sweet clover grown during the past year yielded highest when (1) the water table was kept high; (2) salts were leached or washed down through the soil at a high rate; (3) soil amendments were used.

A good crop of wheat can be grown in alkali areas of the San Luis Valley with proper management methods.



Heavy Fertilization Needed to Reclaim Leveled Land

To produce high crop yields on land that has had its topsoil removed by leveling or erosion, farmers must apply heavy rates of manure or commercial nitrogen and phosphorus fertilizers. This has been indicated by tests that have been underway for eight years at the station.

Station workers have also found that more frequent fertilization is necessary for

high-nutrient requiring crops growing on this type of land.

Another significant finding in these studies gives a clue to carryover effect that might be expected from high phosphorus fertilization. Residual effects of phosphorus have appeared as long as five to nine years after heavy applications of the fertilizer.

Phosphate Has Long Carryover Effect

Station tests hint that operators of many highly fertilized Colorado farms may be able to reduce the amount of phosphate fertilizer they apply.

Cooperative tests with the USDA, the TVA, and other agencies show that after one year of cropping, the residual value of a phosphate application is 30 percent effective one or two years after the initial application.

Other investigations of phosphate fertilization show

—Phosphate fertilizer plowed under was just as available to potatoes growing

in the San Luis Valley as phosphate sidedressed by the conventional method.

—There was no significant difference in the availability of superphosphate and a 12-33-0 nitric phosphate, but calcium metaphosphate and Rhenania-type phosphate were less efficient sources.

—When moisture supply was low, highly water-soluble forms of phosphate fertilizer were more effective than phosphates low in water-soluble phosphorus.

—Application of phosphate to alfalfa appears to increase the protein content of the hay.

Tests Point Way to Better Hay Yields

Many ranchers can produce mountain meadow hay and beef more efficiently by following fertilizer and cultural practices tested in station studies.

For high yields of good quality hay, station workers have found that early harvesting and intermittent irrigation were necessary. Use of nitrogen fertilizer will give even greater boosts in yield and quality. Hay yields may be increased by one to two tons per acre with corresponding increases in crude protein content. In a one-year study, use of 200 pounds of nitrogen (N) per acre on meadows has increased beef production by about 300 pounds per acre.

Mountain meadow studies have also shown

—Use of water will be reduced when the above practices are followed.

—Nitrogen fertilization stimulates grasses and decreases the clover population.

—Phosphate fertilizer causes little increase in hay yield, but percentage of phosphorus in hay is increased.

—Hay produced from soils fertilized with nitrogen appears to have a feeding value at least as high as non-fertilized hay in spite of the change in plant species following nitrogen fertilization.

Poorly Drained Land Responding to Reclamation Measures

Can marginal, poorly drained saline soils found in the Upper Colorado River Basin be brought back into production? Station scientists working in cooperation with the USDA are in the midst of a study to find the answer to this question.

Actually, a search for the answer was begun in 1951. A drainage pump was installed on typical "poor" land in an effort to lower the water table in the immediate vicinity. It has operated continuously ever since. The pump is lowering the water table within a radius of 3200 feet . . . one of the first steps needed for reclamation of poorly drained marginal soils.

Progress has been made, too, in getting

rid of crop-killing salts. By leaching an experimental area with three acre-feet of water, the workers have successfully desalinized the soil to a depth of 30 inches. Six acre-feet of water removed salts to a depth of four feet.

Gypsum added to the soil before leaching did not influence results, since the soil is already high in this constituent. Stands of alfalfa already established by the scientists give testimony that improved drainage, lowering of the water table and salt removal can bring increased yields. Principles already developed show promise of helping prevent formation of poorly drained saline soils.

Nitrogen Pays on Light-Textured Eastern Colorado Soils

Application of nitrogen fertilizer on light-textured eastern Colorado cropland can mean better crop yields. Station tests show that under good moisture conditions, for every \$1 invested in applying 30 to 40 pounds of nitrogen fertilizer per acre on this type of soil, farmers can expect . . .

—A return of \$2 to \$3 in increased wheat yields.

—A return of \$1.50 to \$2 from increased corn and sorghum yields.

In addition, investigations show there was no significant difference between spring and fall application of nitrogen. Soil analyses over the past two years reveal that the light textured soils of eastern Colorado are considerably lower in nitrogen fertility than are the heavier type soils in the state.

Soil Samples Analyzed

More than 2,000 soil samples were analyzed in cooperation with the Soil Conservation Service. While examining the samples, more than 14,000 separate tests

were performed. This service was used by individual farmers, SCS technicians and scientists and county agricultural agents.

Alfalfa Contributes Vast Amount of Nitrogen

Alfalfa each year contributes nearly 12,600 tons of nitrogen to Colorado soils, according to station findings. This is in addition to nitrogen returned as manure from feeding the hay to livestock.

The value of this forage crop to Colorado agriculture has been emphasized in 18-year-old studies underway at the main station in Fort Collins. Results of the

test show that alfalfa has significantly boosted yields of each of five non-legume crops that followed it in a rotation. The yield increases were primarily a result of a greater supply of available nitrogen. Furthermore, results showed a higher level of available phosphorus in the alfalfa rotation when it was compared with a rotation without alfalfa.

Search for New Crop Varieties Continues

Station researchers continued their search for new crop strains and varieties for Colorado. The test work was carried at five different locations over the state, some of it in cooperation with the USDA.

The following developments resulted:

- More than 400 barleys collected in India and Turkey were grown to test their adaptability to Colorado conditions.
- Overland, a short-stawed oat, is being increased for release to farmers.
- Reliance shows promise of being more satisfactory than Norghum as a very early grain sorghum variety in the Akron area.
- Several selections from a three-way cross (Extra Early Pink x Early Kalo) x Midland continue to show promise as early combine types.

- Tests were begun to learn if X-ray or neutrons will hasten the mutation rate in plant breeding work, thus affording a valuable tool to plant scientists for developing new crop varieties or strains.

In other crop breeding and testing work

—A total of 180 commercial corn hybrids and experimental hybrids from other stations were tested at six different locations for their performance under Colorado conditions.

—Corn breeding yield tests at Fort Collins showed that 10 new hybrids outyielded significantly Colorado 152, a standard variety grown in the state. Fifty-four of those tested were Colorado hybrids.

—Yield tests at Rocky Ford on 22 new Colorado double-crosses brought forth one hybrid corn that significantly outyielded U. S. 13.

—Several hybrid barleys that show resistance to loose smut were inoculated with the smut for further testing.

—Eight new pinto bean selections were tested for yield at several locations throughout the state.



In the search for new and suitable corn varieties, certain plants are "bagged" during pollination.

Livestock and Poultry

Compare Hand Feeding and Self Feeding Lambs

In investigating methods of feeding heavy lambs to desirable market weights and in comparing hand feeding versus self feeding, station workers obtained best results by self feeding corn chop and alfalfa hay. Although slightly better gains were made by lambs hand fed grain several times a day, the gain increase did not off-

set the cost of the extra labor necessary with hand feeding.

Some self-fed rations actually can be harmful, station researchers found. A lot of heavy lambs self-fed a cut mixture of corn chop with sulfur and chopped alfalfa hay developed a type of malnutrition and final gains were small and costly.

Lamb Gains from Purdue A

When Purdue supplement A is fed to feeder lambs, gains are not comparable to those made by cattle fed this supplement. In station tests three lots of wether lambs furnished a comparison of Purdue supplement A, cottonseed meal and shelled corn. The lots also received corn silage and alfalfa hay.

Lambs fed cottonseed meal made the highest gains, followed by those fed Pur-

due supplement A. Lambs fed shelled corn made the cheapest gains.

Other results of lamb feeding tests:

—Lamb vaccinated against enterotoxemia can be self-fed corn chop with one percent sulfur.

—Lambs can be fed corn silage with supplements making good gains and yielding satisfactory carcasses.

Wool Shrinkage Varies Greatly

Wool shrinkage studies show:

- Wool shrinkage between fleeces of rams from the same flock may vary as much as 19 percent.
- It may be possible to estimate the shrinkage of individual fleeces by using a dirt penetration measure-

ment in combination with grease fleece weight, staple length, grade and body weight.

- Using rams that produce high-yielding fleeces on a flock can mean an increase amounting to as much as 45 cents per fleece for replacement ewes over their dams.

Diagnostic Service Important Function

The diagnostic service continues to be one of the most time-consuming but important functions. All members of the staff are partially engaged in this work,

since the various specimens submitted may require study in gross or microscopic pathology, bacteriology, serology, parasitology, clinical pathology or chemistry.

Causes of Shipping Fever Investigated

In an effort to isolate the cause of shipping fever, station veterinarians investigated the possibility that a virus might be the initial causative agent. They also made tests on the bacterial flora associated

with shipping fever in this area.

Plans call for continuation of virology, bacteriology and pathology studies on animals received in feedlots that develop shipping fever.

Animal Diseases

Work is underway to combat some of the more important diseases of livestock in Colorado. In some diseases increased knowledge is already being applied in prevention and treatment. In other diseases results are pointing the way for further experimental procedures.

It is conservatively estimated that the livestock diseases now being investigated cause a direct financial loss of about \$21½

million per year in Colorado alone. The loss of condition in sick animals and the inefficient utilization of feed may cost almost as much.

If, as the result of our research, we could prevent disease in three out of 100 animals which die from disease in Colorado each year, this saving would more than pay the annual cost of the animal disease research.

Are Rams Instrumental in Spread of Vibriosis?

Station scientists want to know the role of the breeding ram in the transmission of vibriosis. They used 48 ewes known to have aborted in 1953 and about 180 ewes from flocks not having a history of vibrionic abortion. In addition, six rams from infected flocks and five rams from non-in-

fectured flocks were used in the study.

Infected rams alternated between the infected ewes and a lot of 48 clean ewes during the breeding season. The infected rams also exposed but did not breed another lot of 48 clean ewes. Control lots, bred by clean rams, were established.

Progress Made in Necrobacillosis Study

Work on necrobacillosis in cattle and sheep was confined to a study of the rumenitis-liver abscess complex. Among the major findings were 1) rumenitis occurs almost exclusively in cattle receiving a ration high in concentrates, and 2) rumenitis is more extensive in cattle when the ration is changed from roughage to

concentrates in ten days, than when a thirty-day period is used.

Scientists found that rumenitis is caused by substances produced by the fermentation of concentrates in the rumen. One experiment with a small number of cattle indicated that a concentrate-roughage ratio of two to one results in much less rumenitis than a three to one ratio.

Purdue A Supplement Gives Good Gains

Steers fed a modified Purdue A supplement which contains 14 percent alfalfa meal along with corn silage gained practically as much as steers full-fed corn in station tests. Feeding this ration produced a saving of over 6 cents per pound of gain when compared with full feeding corn. The Purdue A-fed steers gained an average of 1.93 pounds per day.

Station researchers feel that much of the success in feeding Purdue A lies in the modification of the original formula to contain alfalfa meal rather than low-

grade filler materials such as oat hulls or ground corn cobs.

The tests also indicate that alfalfa hay can be substituted for a portion of the Purdue A fed cattle. However, attempts to substitute alfalfa hay for all of the Purdue A resulted in reduced gains due to lowered intake of total digestible nutrients.

In trials to find the best level to feed concentrates and roughages in cattle fattening rations, steers fed rations containing 2 parts concentrate to 1 part roughage made the highest gains.



Cattle which have been on experimental feed are now ready for marketing.

Vitamin A Valuable in Cattle Nutrition

Providing adequate vitamin A nutrition to cattle can be worth an estimated \$9 million each year to Colorado beef producers. Considering just the improvement in weaning weight that could be made by calves properly fed to meet their vitamin A requirements, the value is approximately \$2 million.

Those are startling figures that are

based on facts learned by station researchers in their studies of cattle in eastern Colorado. They have found that alfalfa . . . the prime source of carotene (vitamin A) in Colorado . . . added to either high or low protein supplement at the rate of 35 percent of the ration both increases gains and lowers costs of gains on winter range.

Young Grasses Benefit Milk Production

Dairy cows fed fresh-cut forage maintain their milk production as long as the forage is young and tender, but quickly drop in production as the forage becomes more mature and fibrous. That has been the experience of station workers in one-year pasture and soiling tests.

Researchers noted that milk production from cows grazing on brome grass-alfalfa

pasture dropped at a slower rate from the beginning of the tests. Cows fed this same pasture mixture fresh-cut kept their production constant as long as grasses were young and tender, but dropped to 60 percent of original production when grasses matured. Cows grazing on pasture dropped to 75 percent of their original production when grasses matured.

Poisonous Plants Cause Losses in Livestock

Toxicity of fescue hay was tested in the station feedlots. The hay was brought over from a farm on the Western Slope where "fescue foot" had developed in a number of cattle.

After 60 days on this feed, two 800-pound steers showed no symptoms of the disease. Some factor in the native en-

vironment apparently played some part in the development of the disease.

Field evidence indicates that pine needles cause a considerable amount of abortion in Colorado cattle. Scientists plan to devise a chemical test of the blood that will indicate the animals are consuming dangerous quantities of pine needles.

Workers Have Little Success With Profilometer

Colorado beef breeding studies during the past year have shown:

—Little success in predicting dwarf carriers by means of the profilometer.

—Year, age of dam, sex, age of calf, in-

breeding of calf and dam have significant effects on weaning weights.

—From nearly 4,000 records that cows have peak fertility at four to seven years; bulls under six have highest fertility.

Poultry Floor Space Needs Studied

Station poultry studies indicate that to do their best broilers need one square foot of floor space for each chick started. Chicks allotted less space compare unfavorably.

Compared with other spacings studied, one square foot produced the most economical response for body weight, feed con-

version, mortality and carcass grade. Compared with one-half square foot of floor space, birds with one square foot averaged 0.2 pound greater weight, 0.2 pound less feed required per pound of gain, 2 percent less mortality and 15 percent more "A" quality birds.

MC47 Stimulates Chicken Growth

MC47, a by-product of beet molasses, can be used in chick diets, replacing pound for pound up to 4 percent of the ground grains in the ration.

Feeding MC47 as a supplement, station workers found the material supplied as much betaine as feed grade betaine hydrochloride. MC47 contains a fraction that will produce an increase in rate of growth

of chicks if fed with a poultry diet complete in all known nutrients. According to station studies, the growth factor does not appear to be the same as that found in dried whey or fish solubles.

Researchers also found MC47 contains a fraction that influences the weight and maturation of the testes and weight of the pituitary gland.

Several Factors Affect Hatchability

The rate at which hens are laying at the time eggs are saved for hatching has a major effect on the eggs' hatchability.

Station tests show as egg production increases, the percent hatch of fertile eggs also increases. Only 51 percent hatch was obtained from eggs saved from hens at 20 percent production. Over 90 percent hatch was obtained from hens at 80 percent production.

Studying factors required from maximum hatchability at high altitudes, station workers recommended that, for high hatchability, the rate of egg production should be 70 percent during the period when eggs are saved for hatching purposes. If this rule is followed regarding rate of egg production, there is no need to use added oxygen and carbon dioxide to increase hatchability.

Control of Plant Diseases

Botanists Work to Control Costly Diseases

Cereal diseases—A greenhouse test of 280 samples of wheat produced 12 which showed some degree of resistance to rust. Assuming that one of these or other similar lots in some 420 samples still to be tested prove acceptable, it would mean an annual savings of about \$170,000 to the wheat growers of the state.

Fruit tree diseases—A major threat to fruit production in western Colorado is *Cytospora gummosis* of peach which has built up in the past few years. Recommendations for effective controls have been made but they are costly. Efforts are being continued to develop cheaper methods. This disease is costing growers an estimated \$100,000 a year.

Sugar beet diseases—Recent studies of improved chemicals for control of seed rot and seedling blight of sugar beets has indicated that manzate increased stands 32 percent. This has a potential annual value to Colorado of an estimated \$635,040. Tests also show that sugar beet variety B626 is highly resistant to *Fusarium* rot. This variety or a similar one eventually may mean an annual saving to growers of \$127,000.

Bean diseases—Greenhouse tests with foliar sprays of certain antibiotics have shown themselves to be highly effective in inhibiting disease symptoms of bacterial blight. If results carry over under field

conditions it may mean an effective cheap control of a disease which costs Colorado bean growers an estimated \$534,000 annually.

Miscellaneous truck crop and small fruit diseases—Researchers have found some promising soil chemical treatments for control of soil-borne diseases, particularly those caused by species of *Fusarium*. These experiments are of particular significance to the pea, cantaloupe and tomato growers of Colorado who often suffer serious losses from these diseases.

Carnation diseases—The relative resistance of several commercially desirable varieties to bacterial wilt and *Fusarium* wilt has been determined. It has been shown that the bacterial wilt organism may survive on wood for a period of at least 12 months and in soil for 10 months.

New grass killers—A new chemical has shown itself to be able to produce systemic effects on grasses when applied as a leaf spray at low acreage rates. This is significant because for the first time we have available a chemical which acts on grass leaves in a manner similar to the way 2,4-D acts on broad leaved plants. Its many possible uses are being explored. One of these uses is to remove grasses from sugar beets under certain conditions by post emergence sprays.

Engineering Research



Reclamation of alkali land in the Grand Junction area can be accomplished if the area is adequately drained. A good well in the right location is necessary to accomplish this.

Ground-Water Resources Studied

Approximately 250,000 acres of Colorado farm land are irrigated from ground water. To help prevent unreasonable use and exploitation of ground-water resources, station engineers in cooperation with the U. S. Geological Survey recorded ground water fluctuations in certain areas of the state.

The station observed 149 out of a total of 237 wells. Records show there is a def-

inite over-development of ground-water resources in certain areas of the state. In one area the water table has declined at a rapid rate for four years and this decline continues.

Information gained from observation wells is proving valuable in planning the proper use of water resources and protecting the more than \$50 million investment in ground-water development.

How Practical Is Sprinkler Irrigation in Colorado?

Station engineers have just completed the field work in which they observed the use and results of sprinkling on all crops in all parts of the state. They visited approximately 150 users of sprinkler irrigation.

The engineers found the greatest complaints leveled at sprinkler irrigation are high cost of operation and wind troubles. They also found there is a tendency to

apply too little water. There was an indication that sprinkler sales agents in some cases over-sell their product. As a result of this project, many of the misconceptions on the part of both salesmen and customers have been corrected. Information in the study will help establish a source of unbiased opinion on sprinkler irrigation to which the farmer may turn for advice and assistance.

Screens Have an Important Role in Good Wells

Engineers estimate that loss in the state due to well failure or abandonment of new wells is about \$20,000 per year. They say most of this loss could be eliminated if the proper well screen and gravel combination were used for the formations encountered when constructing a well. During the decade, 1940 to 1950, the number of irrigation wells in the state increased from 2,878 to 4,988. At least one in ten

of these new wells failed because of excessive sand pumping or low water yield.

The engineers are attempting to develop criteria for selecting the proper size of gravel for the gravel envelope, type of screen and the size perforations that will be most effective. Thus far, station tests show that if the gravel envelope is of the proper size the flow of sand can be controlled regardless of the discharge of water.

Researchers Attempt to Improve Sugar Beet Planters

Station workers are studying the planting units of several commercial sugar beet planters in an attempt to improve the seed distribution pattern of the planters. Goal of this investigation is to improve beet planting equipment in preparation for the widespread use of monogerm sugar beet seed when this seed becomes commercially available. Poor distribution of seed by

present planting equipment lessens the possibility of making full use of the monogerm characteristic in reducing sugar beet thinning problems.

In addition to studying the characteristics of domestic machines, plans are now underway to obtain foreign planters in order to study and evaluate their effectiveness.

New Developments for Snow Surveys Under Study

Station engineers in cooperation with the Soil Conservation Service continue to study new developments in forecasting procedure for use in determining irrigation water prospects from snow cover in the Colorado Rockies.

Some of the new developments include use of electrical resistance blocks to obtain soil moisture indices as well as use of aircraft for early snow depth measurements. Survey records indicated over the past season less than normal snow cover ranging from 60 to 90 percent with lower per-

centages in the southern areas of the state. Survey records also helped predict that stream flow would be reduced by deficient soil moisture conditions.

Forecasts made as a result of snow surveys are valuable in planning operation of power plants, reservoirs and canal diversion to make best use of the maximum amount of water that runs off. Using information based on the surveys in periods of low water, farmers and ranchers may restrict their activities to best use of the water that is available.

Engineers Developing New Planter for Dryland

Station engineers have designed and constructed a new type of grass planter intended to assist in the re-establishment of grasses on abandoned crop land and depleted range land. The machine is designed to scrape off the top inch or two of soil to remove weed seed and undesirable vegetation from the immediate area where the seed is planted.

The new planter also places fertilizer $2\frac{1}{2}$ inches below the center of the furrow where it is covered and the seed is dropped directly above the fertilizer.

Testing of the new planter has been under way in seven counties of eastern Colorado since October, 1953. The present planter is a three-row machine mounted on a tractor.

Drouth condition and wind erosion problems have brought to a focus the need for equipment to convert thousands of acres of eastern Colorado farm land into useful grazing land. Pending further testing, this new type of grass planter may be helpful in the control of wind erosion and the re-establishment of grasses.

New, Cheap Lining for Ditches Being Tried

According to the 1950 Census of Irrigation, 618,000 acre-feet of water were lost to seepage in Colorado during a one-year period. Station engineers estimate that if only 10 percent of this seepage loss were saved the returns from using the saved water would amount to over a quarter of a million dollars each year.

In an effort to help control this tremendous loss of water, station engineers in cooperation with the Bureau of Reclamation are investigating an entirely new kind of canal lining method. The material to be used in this lining method is bentonite clay, a colloidal clay substance. One

lining of this type has already been installed. Engineers in charge of the project believe if the new sediment lining method can be developed so that it is effective, it will be possible to line canals for a few cents per square yard. This is in contrast to the \$1 to \$5 per square yard for most conventional canal linings available at this time.

The research workers say that in addition to the loss of water a more important problem from seepy canals is the water logging of lands nearby. Sediment lining of irrigation canals and ditches may be a solution to this problem.

Bentonite is added to an irrigation canal without the benefit of a mixing unit for dispersion. The farmer in the foreground is using a compressed air hose to break up the caking of the bentonite.



Control of Insect Pests

Aerial Sprayers, Dusters Organize

Working closely with station researchers, pilots throughout the state have formed their own organization known as the Colorado Aerial Sprayers and Dusters Association. An estimated two million

acres of cropland in the state are treated each year with aerial applications of insecticides. Twenty-eight individual spraying and dusting companies now serve the state's agriculture.

Insecticides Play Important Role

Several hundred chemicals are now known to have insecticidal properties with more being added to this list each year. Station research on these chemicals has contributed much to the yields and quality of agricultural products in the state. Here are some examples:

Alfalfa—use of recommended chemicals to control alfalfa weevil, lygus bug and

grasshopper has increased hay tonnage 40 percent and boosted seed production from 60 to 200 pounds per acre.

Potatoes—control of potato insects has increased average potato yields from 125 to 258 bushels per acre.

Onions—control of thrips and onion maggot has increased yields from 190 sacks per acre in 1936 to 380 sacks in 1952.

Grasshopper Control Vital

Favorable conditions for the past few seasons have encouraged the buildup in numbers of rangeland grasshoppers. Surveys indicate that 1,340,000 acres in the

state may sustain serious insect damage.

Station tests show that 2 ounces of Aldrin per acre applied by aircraft gives more than 90 percent grasshopper control.

Bee Raisers Benefit from Research

Colorado's million-dollar honey industry is benefiting from station research on the use of antibiotics to control European foulbrood. Reliable estimates place the

loss from foulbrood at 10 percent of the honey crop. Successful control of this disease will save the industry \$100,000 annually.

Recommendations Available

Insect control recommendations resulting from the station's testing program and from the cooperative action of the Colorado

Agricultural Chemical Clearing Committee are available in Colorado Experiment Station General Series Paper No. 565.

Range and Pasture Management

Research Conducted in Three Areas

Revegetation, brush control and grazing trials were primary projects conducted on rangeland of the state. Experimental areas were at Great Divide, 30 miles northwest of Craig; the Eastern Colorado Range Station near Akron; and the Foothills Range, four miles west of Fort Collins.

In seeded pastures, tall wheatgrass was outstanding in pounds of beef produced per acre. Intermediate wheatgrass and Russian wild rye plantings also produced good gains. Seeded pastures showed an advantage of two to three times the amount of beef produced per acre over the native range.

In sagebrush control experiments, researchers found the 2,4-D sprays can be used economically by ranchers to restore the grass on ranges which have become densely covered with sagebrush.

Grazing of cattle was permitted on untreated sagebrush pasture, on range which had been purposely burned in 1947-48 and allowed to revegetate naturally, and on land which had been burned and reseeded. By far the best gains were made on the latter pasture.

Tests were started to determine the adaptability of several grasses and legume

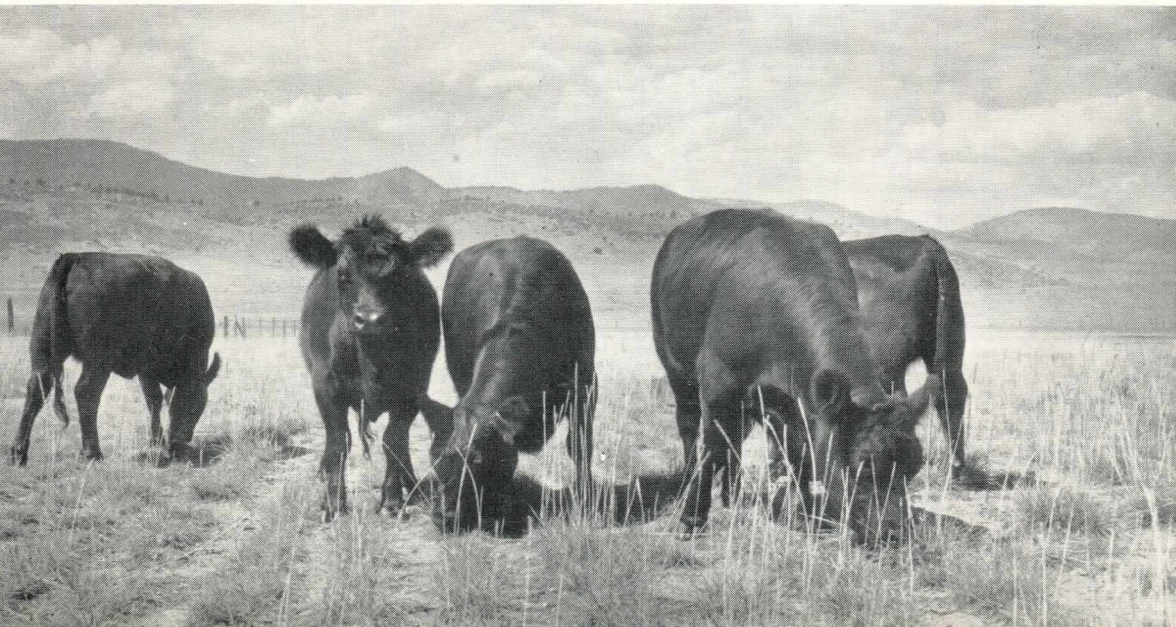
species for sandhill conditions in eastern Colorado. Seedling counts at the end of the growing season showed that intermediate, pubescent and tall wheatgrass gave better stands than crested wheatgrass and smooth brome grass.

The various species of grasses and legumes were planted on weed cover, barley stubble and cane stubble in 12-inch and 24-inch rows. On the whole, the resulting stands were not affected by the type of previous cover.

At the Fort Collins foothill range various adaptation and production studies were carried on in the dryland forage plant nursery. The 1953 yields of alfalfa strains show that Rhizoma alfalfa, although a creeping variety, is a high yielding variety under dryland conditions. Atlantic alfalfa also performed well in the 1951 plantings.

Other tests involved work with smooth brome grass, crested, intermediate and tall wheatgrass, each alone and in combination with alfalfa, sweet clover, and birdsfoot trefoil. The stands were established in 1950. The three-year average shows that the grass and alfalfa plots have given the greatest yields.

Yearling heifers graze on Russian wild ryegrass at the Foothills Experimental Range near Fort Collins.



Horticultural and Floricultural Crops

Phosphate Increases Sugar Yield

Only phosphate fertilizer increased the pounds of sugar from sugar beets grown in station crop rotation studies near Rocky Ford. Phosphate increased the yield of beets without greatly decreasing the percentage of sugar.

Manure was applied to the rotation plots three cropping seasons ago at the rate of 20 tons per acre. During the past cropping season the carryover effect of the manure failed to produce a significant increase in

beet yields; it decreased the sugar percentage significantly and decreased the total sugar produced per acre in comparison with yields from plots that received no manure.

On plots where nitrogen had been applied alone or in combination with other fertilizers beet yield was not affected significantly, but sugar content and total sugar both were decreased in comparison to plots receiving no nitrogen.

Early, High-Yielding Tomato Sought

Tomato improvement work by the station is aimed toward development of a high yielding tomato variety that is relatively early. A variety of this type could mean increased income to the growers of Colorado's most important canning crop.

During the past year twenty-four hybrids and 150 crosses were grown in station tests for comparisons and selections. Several of the lines being tested by station researchers look sufficiently promising to test in canning factory districts.

Study Damage to Fruit in Western Colorado

Cooperative studies with 10 western Colorado fruit growers show that fruit receives a high amount of bruising and puncture damage in the field, but the degree of damage increases as the fruit passes through the packing shed and into refrigerator cars.

Type of container used for fruit affects

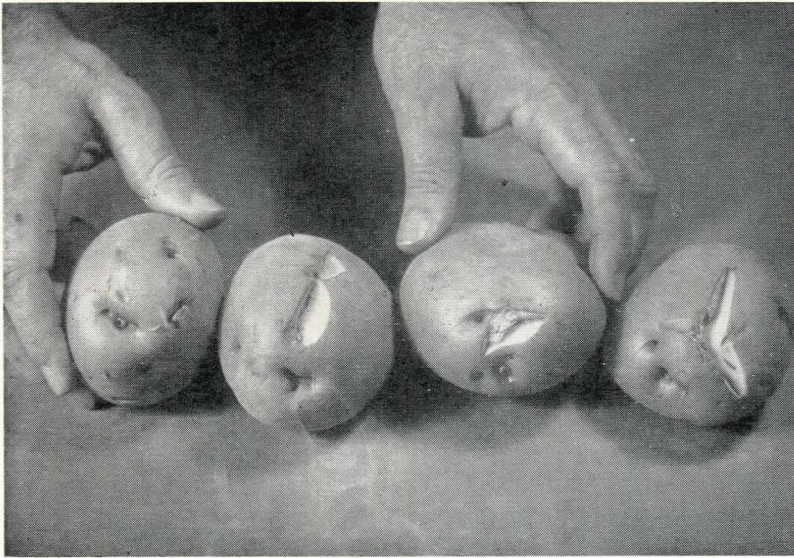
damage, too. There was more injury to fruit packed in bushel baskets than to fruit in packing boxes. Damage to peaches appears to vary from year to year. There was an 18 percent increase over the previous year in damage to bottom layers of peaches packed in lugs with wide spacing between center and bottom pieces of lugs.

Reducing Sugars Vary in Stored Potatoes

Some potato varieties accumulate only one-third as much reducing sugars as others while in storage at low temperatures. Fifty-three potato varieties were tested by station workers for sugar content after storage for 14 weeks at 33 degrees F.

More than 20 percent of the dry matter

was made up of reducing sugars in 13 of these varieties. Four varieties contained less than 6 percent of their dry matter as reducing sugars. This difference is important to potato chippers who face the problem of conditioning potatoes before processing by lowering their sugar content.



Taken out of storage, these potatoes show varying degrees of damage. Researchers are trying to find ways to minimize this damage.

New Method Speeds Potato Injury Study

A new method has been devised by station researchers for detecting injury to potatoes during harvesting, handling and other operations.

The new technique involves use of fluorescent dyes which pinpoint injury to tubers immediately after it occurs. When potatoes are immersed in the greenish-yellow dye, and all air is removed, the dye penetrates tiny breaks in the tuber skin.

Needle punctures that ordinarily could not be seen by the eye can be easily detected using the dye.

This new method speeds up detection of injury so that corrective measures can be applied without waiting for decay spots or cracks to develop in storage. It makes possible accurate and prompt study of the effects of harvest dates, handling methods and other causes of potato injury.

Russet Burbank Becoming Popular

There are good reasons why Russet Burbank potatoes may soon become popular in potato growing areas of northern Colorado. Tests indicate the variety can be grown with success in this region.

Market demand for the Russet has been greater than for other varieties and dur-

ing the past year a premium amounting to about \$1 per hundred was paid for the Burbank. Yields of this variety in test plots have compared favorably with other varieties and the percent of No. 1 tubers has been greater than for the Triumph commonly grown in the area.

Promising Potato Varieties Tested

Continuing their search for improved potato varieties, station workers in cooperation with the USDA tested 231 different lots of seedlings at three locations throughout the state. The past year

brought more promising varieties than ever before. Of 160 new seedling varieties tested at one location, 27 were kept for further testing; three of these promise excellent possibilities, several rated very good.

Dwarf Apple Root Stock Shows Promise

The most promising dwarf apple root stock for western Colorado as shown by station tests is Malling root stock No. II.

Station work on dwarf-type apple trees was begun in 1944 when five standard

varieties were grafted on Malling root-stocks. Smaller trees, closer spacing, earlier bearing, easier picking, pruning and spraying are important advantages in favor of dwarf-type apple trees.

Indexing Program Pays Off in Better Carnations

Colorado carnation growers are widely accepting the practice of renewing their stock regularly. Much of this acceptance is due to a five-year program carried on by station workers in which leading car-

nation varieties have been cultured and indexed for wilt and virus diseases. During the past year all clonal lines were indexed for performance and quality by station personnel.

Chemical Controls Weeds in Onions

The most promising early treatment for weed control in onions resulting from two years' testing by the station is a 300-pound per acre application of calcium cyanamid, plus 3 to 6 pounds of Chloro-

IPC. Some reduction in yield was noted by workers when the 6-pound rate of Chloro-IPC was used. These significant results are expected to help growers reduce their high labor costs for weeding onions.

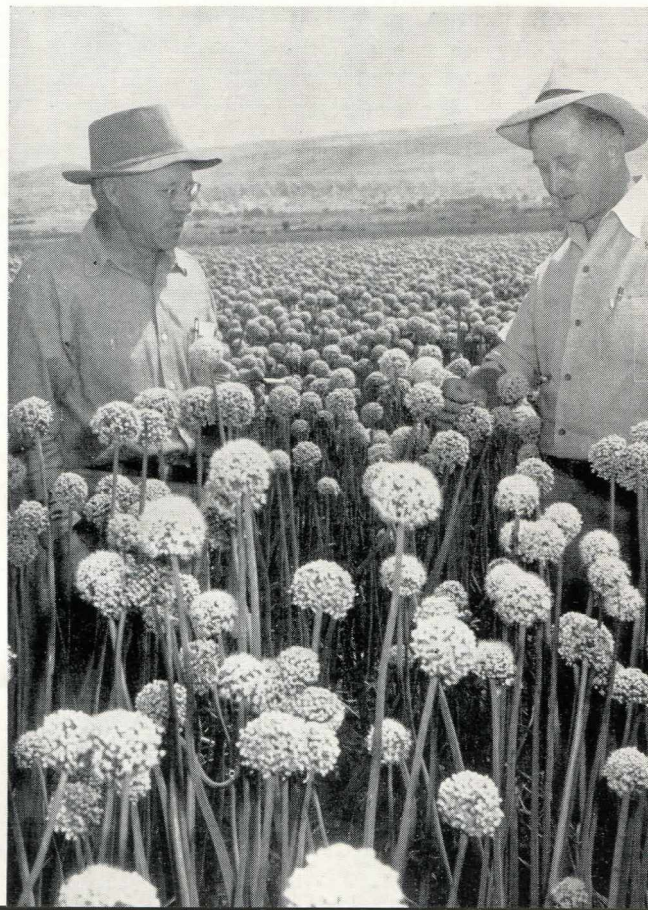
New Hybrid Onion Introduced

One new onion hybrid, "Pioneer," was named and introduced during the past year in cooperation with the USDA. It is recommended only for western Colorado growing conditions and is an excellent storage type.

One other hybrid has consistently out-yielded Mountain Danvers by 150 sacks per acre. On the basis of its increased yield over standard varieties the new hybrid could add extra income to western Colorado growers amounting to \$200,000 annually.

Station workers estimate that new hybrid onions being increased for use in the Arkansas Valley could be worth \$500,000 to growers in disease epidemic years as a result of reducing storage losses, better grade, and yields equal to present varieties.

Station horticulturists have conducted extensive tests in efforts to develop hybrid onion varieties for western Colorado and the Arkansas Valley.



Home Economics

Need for More Storage Space in Homes Pointed Up

Public health officials and sociologists agree that adequate dwelling space is essential for physical and emotional well-being of families. Decent housing for every family has been a widely accepted aim for many years and standards for some aspects of housing have been improved.

However, the need for light, warmth and air has received more attention than elbow room. Until the present regional housing research projects were started, no systematic study of family living as the basis for house design was underway.

Objectives of the project for the im-

provement of rural housing in Colorado were: 1) to develop basic planning data for clothes storage and dressing areas, and 2) to prepare graphic summaries of available environmental data for two of the physiographic provinces in the western region.

Appraisal studies of existing houses indicate that from one-half to two-thirds of them do not have enough storage facilities. Clothes storage space ranks near the top of this deficiency list. This study was carried on in cooperation with other western states.

Nutritional Status of Population Groups Surveyed

In a study of nutritional status of population groups in selected areas of Colorado, the home economics staff conducted a "recheck" of the elderly participants who were examined five years ago. Fifty men and women from Lake county were ex-

amined, using facilities at the local hospital.

The department also conducted studies on high altitude baking, baking of potatoes of different specific gravities and properties and processing of Colorado fruits and vegetables.

Unique in the United States, the high altitude laboratory is used to test recipes for baked goods at elevations up to 10,000 feet. Below, technicians compare two cakes made with different amounts of baking powder.



Information and Publications

As in past years, all available communications media were brought into play to help keep Colorado citizens informed of research progress made by the Colorado Agricultural Experiment Station.

More than 1,600 news releases were prepared by the News and Radio Service

and sent to weekly and daily newspapers, radio stations and farm magazines.

Regular editorial service for the Experiment Station consisted of processing the technical papers and bulletins listed below and the preparation and distribution of 400 radio programs on research.

General Series Papers

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- Daniels, L. B. "Insecticide Recommendations." Gen. Series 565.
- Dotzenko, A. D.; R. Tucker; Fauber, Herman. "Progress Report of Alfalfa Variety Tests in Colorado." Sta. Mimeo. Gen. Series 572.
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- 1953 Progress Report. Eastern Colo. Range Sta. Gen. Series 582.

Scientific Series Papers

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Financial Report

Colorado Agricultural Experiment Station

For Year Ending June 30, 1954

RECEIPTS 1953-1954

DISBURSEMENT OF FUNDS BY CLASSIFICATION FOR THE FISCAL YEAR ENDED JUNE 30, 1954

	RECEIPTS 1953-1954			DISBURSEMENT OF FUNDS BY CLASSIFICATION FOR THE FISCAL YEAR ENDED JUNE 30, 1954													TOTALS	
	Balance July 1, 1953	Receipts from U. S. Treasurer	Receipts Other Sources	Total Receipts	Personal Services	Travel	Transportation of Things	Communication Service	Rents and Utility Service	Printing and Binding	Other Contractual Services	Supplies and Materials	Equipment	Land and Structures	Contribution to Retirement	Total Expenditures	Balance June 30, 1954	Grand Total
Hatch		15000.00		15000.00	13131.04	721.62		36.47	212.78	141.70	25.02	206.55			524.82	15000.00	15000.00	
Adams		15000.00		15000.00	13320.47	242.89	1.20	21.20	89.32		168.91	609.11	101.50		445.40	15000.00	15000.00	
Parnell		60000.00		60000.00	43416.73	2695.07	25.06	165.83	285.90		392.98	7015.31	4370.51		1632.61	60000.00	60000.00	
Bankhead-Jones, Sec. 5		25460.16		25460.16	20380.23	859.32	3.00	25.15	197.74	5.15	761.85	2455.07	91.26		681.39	25460.16	25460.16	
Bankhead-Jones, Sec. 9bl & 2		50045.50		50045.50	38800.06	2009.91	64.91	143.50	175.29	26.95	1054.81	2930.92	3293.81		1545.34	50045.50	50045.50	
Bankhead-Jones, Sec. 9b3		44000.00		44000.00	23223.13	4144.34	53.02	325.26	462.80	326.15	1130.22	6531.64	7363.77	18.24	421.43	44000.00	44000.00	
Bankhead-Jones, Sec. 9b3 (trust)		8600.00		8600.00	429.90	6383.91		502.63		1000.00	11.55	159.55				8487.54	112.46	8600.00
Mill Levy Tax	14347.54		137482.16	151829.70	68095.70	3889.13	501.84	3324.58	5752.78		18793.42	17747.90	13510.14		3045.26	134660.75	17168.95	151829.70
State General Approp.			226000.00	226000.00	162529.53	2869.39	267.32	802.06	3832.56	106.56	14704.08	21889.95	12178.43	383.67	6434.57	225998.12	1.88	226000.00
Plant Disease			25000.00	25000.00	15411.99	521.80	43.93	78.83	898.46	10.50	2338.37	1934.81	3246.63		514.68	25000.00		25000.00
Pure Seed			8000.00	8000.00	7529.40	60.35		37.89	5.00		112.24	160.55	5.41		89.16	8000.00		8000.00
Vibrio Fund	15000.00		5059.47	20059.47	5449.50	78.74	104.00	6.35	69.13		1114.05	6979.81	177.28		150.00	14128.86	5930.61	20059.47
Mtn. Meadow Fund			7500.00	7500.00	720.00	94.15	149.75	66.50				570.97	110.89			1712.26	5787.74	7500.00
Bull Testing Fund			26548.00	26548.00	1077.67						2915.98	1188.90	6617.75	14178.87	20.83	26000.00	548.00	26548.00
Station Special	25122.92		155699.79	180822.71	32695.04	1871.74	190.67	241.85	13423.60	125.58	10589.49	54454.49	5915.81	17011.78		136520.05	44302.66	180822.71
Hybrid Corn	5136.61		3621.75	8758.36	574.94	235.49	8.10	43.65				1127.46				1989.64	6768.72	8758.36
CAMRF	114267.82		313702.50	427970.32	149785.67	7601.11	780.36	712.01	3754.33	230.10	65490.09	33423.35	9339.84	7557.21	2045.20	280719.27	147251.05	427970.32
TOTALS	173874.89	218105.66	908613.67	1300594.22	596571.00	34278.96	2193.16	6533.76	29159.69	1972.67	119603.06	159386.34	67263.03	39149.77	17550.69	1072722.15	227872.07	1300594.22

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AGRICULTURAL DIVISION

AGRONOMY

D. W. Robertson, Ph.D.	Chief Agronomist	D. R. Wood, M.S.	Asst. Agronomist (Crops)
R. E. Danielson, M.S.	Asst. Agronomist (Soils)	Cooperators:	
A. D. Dotzenko, Ph.D.	Asst. Agronomist (Crops)	Minoru Amemiya, Ph.D.	Assoc. Agronomist (USDA)
Robert Gardner, M.S.	Agronomist (Soils)	C. V. Cole, Ph.D.	Soil Scientist (USDA)
B. W. Greb, M.S.	Asst. Agronomist (Soils)	J. G. Dean, M.S.	Agronomist (USDA)
T. E. Haus, M.S.	Asst. Agronomist (Crops)	G. W. Deming, B.S.	Asst. Agronomist (USDA)
D. D. Johnson, Ph.D.	Asst. Agronomist (Soils)	S. R. Olsen, Ph.D.	Sr. Soil Scientist (USDA)
D. W. Koonce, M.S.	Asst. Agronomist (Crops)	J. L. Paschal, Ph.D.	Agric. Economist (USDA)
W. W. Leonard, Ph.D.	Agronomist (Crops)	E. M. Payne, B.S.	Soil Scientist (USDA)
D. S. Romine, M.S.	Assoc. Agronomist (Soils)	M. Robecker, B.S.	Soil Scientist (SCS)
S. D. Romsdal, B.S.	Asst. Agronomist (Soils)	H. K. Rause, C.E.	Irrigation Engr. (USDA)
W. R. Schmehl, Ph.D.	Assoc. Agronomist (Soils)	L. C. Sonntag, M.S.	Assoc. Agronomist (Bu. of Reclam.)
E. G. Seimer, B.S.	Asst. Agronomist (Soils)	F. S. Watanabe, M.S.	Soil Scientist (USDA)
R. S. Whitney, Ph.D.	Agronomist (Soils)	F. M. Willhite, M.S.	Assoc. Agronomist (USDA)

ANIMAL INVESTIGATIONS

L. E. Washburn, Ph.D.	Chief Animal Husbandman	C. W. Fox, B.S.	Asst. Animal Husbandman
W. E. Connell, M.S.	Animal Husbandman	E. K. McKellar, M.S.	Assoc. Animal Husbandman
F. C. Daugherty, M.S.	Assoc. Animal Husbandman	H. H. Stonaker, Ph.D.	Animal Husbandman
B. J. DeMott, Ph.D.	Asst. Animal Husbandman	G. E. Ward, Ph.D.	Asst. Animal Husbandman
A. L. Esplin, M.S.	Assoc. Animal Husbandman		

ANIMAL PATHOLOGY AND VETERINARY MEDICINE

A. W. Deem, D.V.M., M.S.	Chief Veterinary Pathologist	H. J. Hill, D.V.M.	Veterinarian in charge.
T. L. Chow, D.V.M., Ph.D.	Asst. Virologist		Artificial Insemination
Floyd Cross, D.V.M.	Veterinary Pathologist	E. T. Hedrick, B.S.	Field Supervisor.
Maxine Benjamin, D.V.M., M.S.	Asst. Veterinary Pathologist		Artificial Insemination
W. R. Graham, D.V.M.	Asst. Veterinary Pathologist	Rue Jensen, D.V.M., Ph.D.	Veterinary Pathologist
L. A. Griner, D.V.M., M.S.	Assoc. Veterinary Pathologist	V. A. Miller, D.V.M.	Asst. Veterinary Pathologist
		J. W. Tobiska, M.S.	Chemist

BOTANY AND PLANT PATHOLOGY

J. L. Fults, Ph.D.	Chief Botanist and Plant Pathologist	C. E. Seliskar, Ph.D.	Assoc. Plant Pathologist
R. M. Blouch, M.S.	Assistant Botanist	W. D. Thomas, Ph.D.	Plant Pathologist
N. R. Gerhold, M.S.	Asst. Plant Pathologist	Cooperators:	
H. D. Harrington, Ph.D.	Assoc. Botanist	R. W. Davidson, M.S.	Senior Plant Pathologist (USDA)
G. H. Lane, M.S.	Assoc. Plant Pathologist	J. O. Gaskill, M.S.	Plant Pathologist (USDA)
R. H. Porter, Ph.D.	Plant Pathologist	F. A. Lundgren, M.S.	Assoc. Plant Pathologist (USDA)
R. R. Baker, Ph.D.	Assistant Botanist	L. A. Schaal, Ph.D.	Assoc. Plant Pathologist (USDA)

CHEMISTRY

W. E. Pyke, Ph.D.	Chief Chemist	Gestur Johnson, M.S.	Asst. Chemist
R. E. Carlson, Ph.D.	Assoc. Chemist	Adeline Kano, B.S.	Research Assistant
L. W. Charkey, Ph.D.	Chemist	Catherine Kob, B.S.	Research Assistant
H. A. Durham, M.S.	Asst. Chemist	J. J. Lehman, Ph.D.	Research Assistant
P. R. Frey, Ph.D.	Chemist	D. D. Maag, M.S.	Research Assistant
F. X. Gassner, D.V.M., M.S.	Endocrinologist	Marjorie Mayer, M.S.	Research Assistant
C. O. Guss, Ph.D.	Assoc. Chemist	A. R. Patton, Ph.D.	Chemist
M. L. Hopwood, M.S.	Asst. Chemist	Merle G. Payne, M.S.	Asst. Chemist
Duane Johnson, B.S.	Asst. Chemist	H. S. Puleston, Ph.D.	Asst. Chemist

ENTOMOLOGY

L. B. Daniels, M.S.	Chief Entomologist	Cooperators:	
J. L. Hoerner, M.S.	Assoc. Entomologist	F. B. Knight, M.F.	Entomologist (USDA)
G. M. List, Ph.D.	Entomologist	Calvin Massey, Ph.D.	Entomologist (USDA)
J. O. Moffett, M.S.	Assistant Entomologist	R. H. Nagel, M.S.	Entomologist (USDA)
J. H. Newton, B.S.	Assoc. Entomologist	B. H. Wilford, Ph.D.	Entomologist (USDA)
T. O. Thatcher, Ph.D.	Assoc. Entomologist	N. D. Wygant, Ph.D.	Entomologist (USDA)

FORESTRY AND RANGE MANAGEMENT

D. F. Hervey, M.S.	Chief Range Conservationist	H. E. Troxell, M.F.	Assistant Forester
A. C. Everson, M.S.	Asst. Range Conservationist	C. H. Wasser, M.F.	Range Conservationist

HOME ECONOMICS

Elizabeth Dyar, Ph.D.	Chief Home Economist	Miriam Hummel, M.S.	Asst. Home Economist
Ferne Bowman, Ph.D.	Home Economist	Mariana Kulas, M.S.	Asst. Home Economist
May Combs, M. S.	Asst. Home Economist	Mildred J. Rausch, M.A.	Asst. Home Economist

HORTICULTURE

A. M. Binkley, M.S.	Chief Horticulturist	Robert Kunkel, Ph.D.	Horticulturist
G. A. Beach, M.S.	Horticulturist	C. W. McAnelly, M.S.	Asst. Horticulturist
A. C. Ferguson, Ph.D.	Assoc. Horticulturist	E. A. Rogers, M.S.	Asst. Horticulturist
C. J. C. Jorgensen, M.S.	Assoc. Horticulturist		

POULTRY

E. G. Buss, M.S.	Chief Poultry Husbandman
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RURAL ECONOMICS AND SOCIOLOGY

R. T. Burdick, Ph.D.	Chief Rural Economist	Cooperators:	
C. R. Creek, M.S.	Associate Economist	J. C. Crecink, M.A.	Agricultural Economist (USDA)
R. D. Rehnberg, Ph.D.	Assistant Economist	H. G. Sitler, M.S.	Agricultural Economist (USDA)

ENGINEERING DIVISION

CIVIL ENGINEERING

D. F. Peterson, D.C.E.	Chief Civil Engineer	A. R. Robinson, M.S.	Asst. Irrigation Engineer
M. L. Albertson, Ph.D.	Civil Engineer	H. N. Schweizer, M.S.	Asst. Civil Engineer
J. E. Cermak, M.S.	Asst. Civil Engineer	E. F. Schulz, B.S.	Asst. Civil Engineer
W. E. Code, B.S.	Assoc. Irrigation Engineer	Cooperators:	
N. A. Evans, M.S.	Asst. Irrigation Engineer	C. H. Rohwer, B.S., C.E.	Sr. Irrigation Engineer (USDA)
P. N. Lin, Ph.D.	Asst. Irrigation Engineer	H. J. Stockwell, B.S.	Irrigation Engineer (USDA)
Maxwell Parshall, B.S.	Asst. Irrigation Engineer		

MECHANICAL ENGINEERING

J. T. Strate, M.S.	Chief Mechanical Engineer	J. E. Dixon, B.S.	Asst. Mechanical Engineer
R. D. Barmington, B.S., M.E.	Assoc. Mechanical Engineer		

BRANCH STATIONS

Herman Fauber, M.S. Superintendent, Arkansas Valley
Verne Cooper, Jr., B.S. Superintendent, San Luis Valley
F. M. Green, B.S. Superintendent, Western Slope

H. O. Mann, M.S. Asst. Agronomist, San Juan Basin
Kent Riddle, B.S. Asst. Animal Husbandman
San Juan Basin

PERSONNEL CHANGES

Joining the staff during the fiscal year were:

G. E. Ward Assistant Animal Husbandman
B. J. DeMott Assistant Animal Husbandman
A. C. Everson Assistant Range Conservationist

R. R. Baker Assistant Botanist
T. L. Chow Assistant Virologist
E. G. Seimer Assistant Agronomist

Resignations from the staff during the fiscal year were:

G. C. Gatherum Assistant Range Conservationist
Miriam Hummel Assistant Home Economist
Mariana Kulas Assistant Home Economist

A. D. Farmanfarma Assistant Civil Engineer
J. R. Barton Assistant Civil Engineer
F. P. Browning Assistant Civil Engineer

Agricultural research in your area
... on your problems

Branch Stations and Experimental Areas
COLORADO

