

# *Research*

Serves Colorado Agriculture



Sixty-sixth Annual Report

**COLORADO AGRICULTURAL EXPERIMENT STATION**

**COLORADO AGRICULTURAL and MECHANICAL COLLEGE**

**FORT COLLINS**

**Letter of Transmittal  
Sixty-sixth 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-sixth Annual Report of the Colorado Agricultural Experiment Station for the fiscal year of July 1, 1952 to June 30, 1953.



S. S. Wheeler  
Director

Fort Collins, Colorado  
July 1, 1953

*Agricultural Building  
Colorado Agricultural Experiment Station*



*research serves colorado agriculture*

SIXTY-SIXTH ANNUAL REPORT – COLORADO AGRICULTURAL EXPERIMENT STATION

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# Field Crops



## Alfalfa Contributes Much Nitrogen

Alfalfa each year contributes around \$14 million worth of active nitrogen to Colorado crops and soils through symbiotic nitrogen fixation.

The value of this crop to Colorado farms and ranches is being demonstrated in station tests underway for the past 16 years. Results show that alfalfa included in a crop rotation contributes very materially to soil fertility. Heavier rates of nitrogen fertilizer are necessary in a rotation having no alfalfa than in a rotation where alfalfa is included.

Scientists have compared two rotations

that are similar with the exception that one contains three years of alfalfa and the second contains none. With no addition of fertilizers, yields of both rotations declined at about the same rate for the first seven years. During the next nine years, however, yields in the rotation containing alfalfa increased at an average rate of 4.5 percent per year. Yields in the rotation with no alfalfa continued to drop slightly.

Where nitrogen and phosphorus fertilizers were applied at high rates, yields of crops in the two rotations were about the same.

## Hybrid Corn Varieties Tested

At six different locations throughout the state, Colorado scientists are testing 221 hybrid corn varieties for performance. Recommendations resulting from these tests are made available to corn growers in Colorado through their county extension agents.

Corn breeding experiments are carried on under irrigated conditions at two locations in the state. Twenty-three experimental Colorado hybrids are being tested. During the past year, two of the new hybrids outyielded an old standby used as a check — Colorado 152.

## High-Yielding Sorghums, Sudans Determined

In sorghum variety tests under dry farming conditions, highest grain yields were obtained from the following varieties in the order named: Early-Early Hegari, Feterita, Coes and Early Hegari. These sorghums produced between 10 and 15 bushels per acre.

Forage sorghums which produced the highest yields were Fremont, Black Amber and Leoti Red. Sweet Sudan outyielded all other Sudan grass strains, followed closely by Piper.

*Farmers look over irrigated sorghums grown in variety tests in Colorado's Arkansas Valley. Other varieties are tested under dryland conditions in Eastern Colorado.*



## Sugar Beet Farming Becomes More Mechanized

Colorado sugar beet growers during the past year applied more of the basic principles of mechanization recommended as a result of station studies. The results added up to increased savings in labor and in money.

During the past year, some type of mechanical thinning machine was used on 72,757 acres of Colorado sugar beets — nearly 60 percent of the entire crop. Growers can cut labor costs from 9 to 72.5 per-

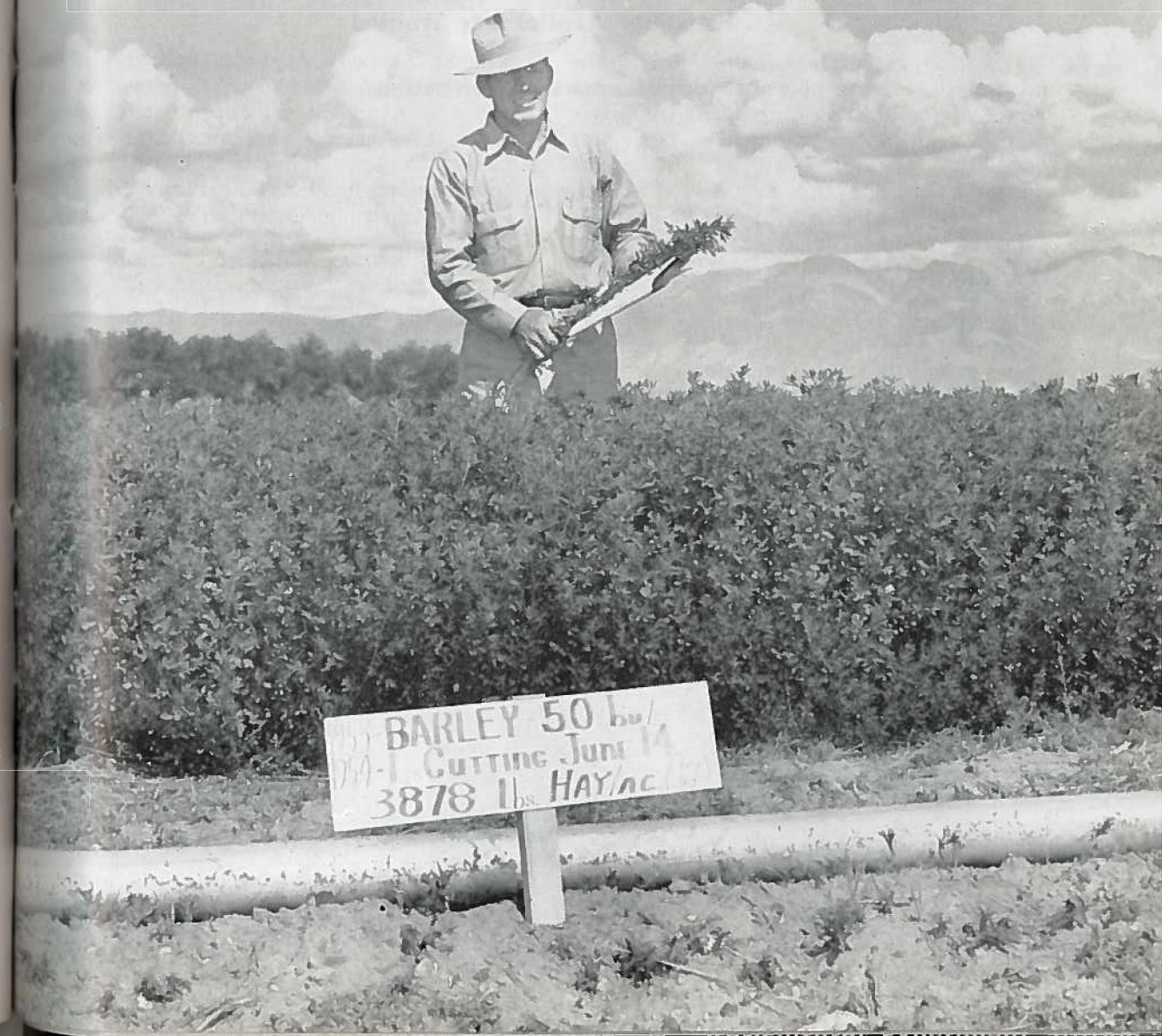
cent if they use mechanical thinners, according to studies by station personnel. The average saving in the studies was around 40 percent. If this were applied to the entire sugar beet crop in the state, the dollar-and-cents saving in labor costs would amount to more than \$790,000.

Machines harvested 83 per cent of Colorado's sugar beet crop last year. This is an increase of 4 per cent in machine-harvested beets over the previous year.



*Sugar beet thinners like the one shown here are helping Colorado sugar beet growers cut down labor costs. Mechanical thinners were used on nearly 60 percent of the state's sugar beet crop last year.*

# Soils and Fertilizers





## Soils Tested

The soils laboratory, operated cooperatively by the station and the Soil Conservation Service, performed 14,306 tests on the 1,802 samples of soil received during 1952.

This service is for individual farmers,

SCS technicians and for soil scientists with the SCS engaged in mapping and classifying land. The laboratory also serves as an aid to Extension Service workers in answering questions about farm and garden soils.

## Light-Textured Dryland Soils Are Low in Nitrogen

Lighter-textured soils in eastern Colorado are considerably lower in nitrogen fertility than are heavier-type soils in the dryland area.

Station scientists obtained a four to six-bushel increase in wheat yield from

nitrogen applications on three light-textured soils. There was no response to nitrogen on four summer-fallowed, silty-type soils. Scientists noted a significant increase of 2-3 percent in protein content of wheat and corn fertilized with nitrogen.

## Fertilizer Availability Studied

Station researchers have studied the availability of the phosphate in different types of fertilizer mixtures. As the nitrogen in such mixtures increases, the water solubility of the phosphorus often decreases. In field and greenhouse experiments, the availability of the phosphorus in nitrogen-phosphorus carriers was not affected by the water solubility of the phosphorus when the fertilizer was mixed with the soil. When the fertilizer was side-dressed, more water soluble phosphates were generally more available to the crop.

In field tests, two nitric phosphates,

Rhenania-type phosphate, and minus-40 mesh calcium metaphosphate proved to be about as available as concentrated superphosphate when the fertilizers were plowed under. When side-dressed in a concentrated band, the Rhenania-type and calcium metaphosphate were less available.

Concentrated and ordinary superphosphates were found to be equally available to the crop in greenhouse experiments.

The application of phosphate fertilizers showed considerable carry-over of the phosphate for succeeding crops.



*Station researchers are studying the availability of phosphate in different types of fertilizer mixtures as well as methods of application. These plots show the effect of method of application on growth of sugar beets during June. The plot on the right received 250 pounds of  $P_2O_5$  in band at planting; the plot on the left received the same amount plowed down two weeks before planting.*



*These experimental plots are located on land in the Upper Colorado River Basin where the water table has been lowered by pumping in an effort to furnish better drainage. Previously, this land was practically out of crop production because of an accumulation of crop-killing salts. Leaching, or washing salts down through the soil by flooding, is improving the productive capacity of the land.*

### **Inroads Made Into Salt Problem**

Farmers in the Upper Colorado River Basin have for years watched some of their rich farmland grow unproductive as saline-alkali salts accumulated in the plant-growing portion of the soil. Station scientists working with the USDA are making progress toward solving this problem of salty soils.

Poor drainage has been one of the factors contributing to the problem. This poor drainage has resulted from an upward pressure of ground water and a relatively impermeable soil layer. This condition, coupled with over-irrigation of crops, has caused a high water table and a consequent accumulation of salts and alkali.

A leaching experiment (washing the

salts down through the soil by flooding after drainage was improved) has shown it is possible to remove salts from land that has gone out of crop production. There is enough native gypsum in the soil profile below the surface nine inches to bring about reclamation without use of chemical amendments. Scientists decreased the salts in the soil to a depth of nine inches by leaching with one foot of water. When they leached with three feet of water, they obtained a marked decrease in salinity to a depth of 40 inches.

The workers lowered the water table in the immediate area by installing a drainage pump and keeping it in continuous operation.

### **Soil Classification Could Be Improved**

Classification of certain Colorado soils could be greatly improved by including types of minerals contained in the soils as well as their silt-clay ratios.

Station investigators have found that some Colorado soils — particularly those of the Billings series — have very poor structure which seems to be related to the

type of silt and clay minerals they contain as well as the silt percentages. Laboratory tests show that with certain mineral types, soils high in silt and clay will not form stable structure when silt comprises more than 50 percent of the total. With other soil types, however, structure is more stable at high silt percentages.

## Progress Reported in Reclaiming Saline-Alkali Soils

Progress has been made in the first intensive effort to solve the problem of bringing back into production thousands of acres of saline-alkali soils in Colorado's San Luis Valley.

The Valley is one of the few areas of the world where sub-surface irrigation can be practiced because of an extremely high water table. Station scientists, working with the USDA and the Bureau of Reclamation, are applying the following reclamation measures on an experimental plot basis: (1) providing adequate drainage with a combination drainage and irrigation pump; (2) leaching salts down through the soil by flooding the experimental area; (3) applying soil amendments (gypsum, calcium chloride and VAMA) in an effort to reduce the amount

of colloiddally adsorbed sodium (alkalinity).

First season results show that subirrigation may still be necessary for satisfactory yields, even though it aggravates the saline-alkali condition. It appears that a combination of leaching, subirrigation and soil amendments may result in satisfactory control of the saline-alkali problem. Scientists obtained higher crop yields on plots having a high water table than on those with a low water table. There were higher yields from plots receiving amendments than from plots receiving none; there was no significant difference among amendments. All amendments effectively received exchangeable sodium. There was a higher efficiency of leaching of salts on low water table plots.

## Fertilizers Increase Onion Yields

Onion yields in experiment station tests have been increased by 321 fifty-pound sacks per acre by the addition of phosphate fertilizer and manure. This yield boost from fertilizers was obtained in studies of crop rotations now underway in the Arkansas Valley.

The value of "home-grown" fertilizer was also brought out when workers, with the addition of manure alone, recorded an

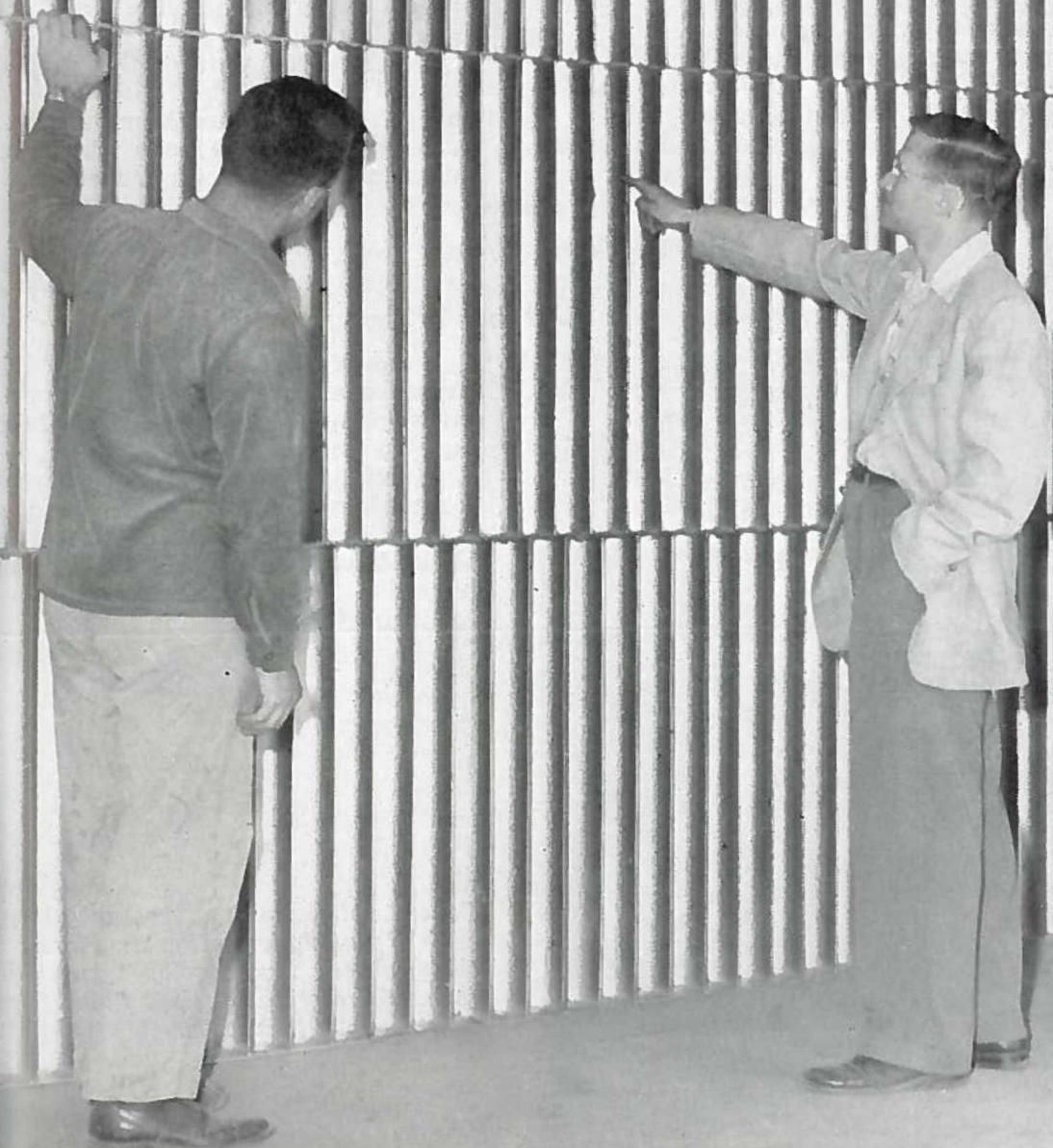
increase of 252 fifty-pound sacks of onions over untreated plots.

The scientists also noted that nitrogen fertilizer decreased yields when used alone, when used with gypsum or manure or when used with a combination of gypsum and manure. When phosphate was applied, it increased yields except in cases where it was used with gypsum and no manure.

*Onion yields have been boosted following application of fertilizers in station tests in the Arkansas Valley. The value of manure in furnishing needed plant nutrients has also been shown by the studies.*



# Engineering



## Water Table Observations Help Frame Legislation

Water table observations made by the station in cooperation with the U. S. Geological Survey are furnishing valuable information in forming proposed laws on ground-water use in Colorado.

There are a total of 275 observation wells located on two major drainages in eastern Colorado. Spring and fall water

table measurements are made annually by station and USGS personnel. Measurements during the past year indicated a continued decline of the water table in areas already considered critical. In only one case — on the South Platte drainage — was there a significant, small rise in the water table.

## Airplanes Used in Predicting Snowmelt Runoff

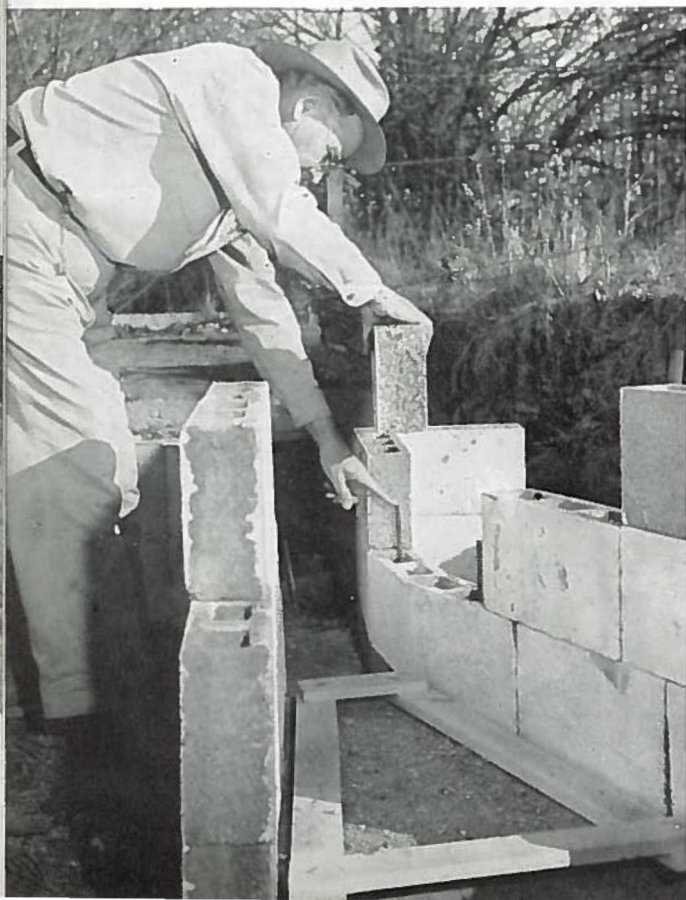
The airplane is playing an important role now in helping predict the snowmelt runoff from Colorado's Rockies. Expected irrigation water supplies are based on snow measurements made throughout the winter by the Soil Conservation Service in cooperation with the station.

Snow surveyors are now using the airplane to take snow depth measurements

from special measuring devices on the ground. This enhances snow-depth data and allows for more accurate and earlier seasonal predictions.

Other special work of this group has included development of electrical resistance gauges to measure the moisture stored in the ground so this factor may be taken into account in predicting runoff.

## Irrigation Structures Made of Concrete Blocks



In an effort to help cut costs of farm irrigation structures, station workers are investigating use of concrete block in making structures.

Knock-down forms have been developed for casting Parshall flume foundations made of blocks. Several of these concrete block structures have been installed in an irrigation ditch where they will be tested for their effectiveness and endurance.

*Concrete blocks such as these may help cut costs of making irrigation structures. Station workers have developed knock-down forms for casting Parshall flume foundations made of the blocks.*

## Irrigation Well Screens Tested

The type of well screen used has very little effect on flow of sand into a well if the screen is designed to fit the conditions and the gravel envelope that surrounds the well contains the proper sizes of gravel. This was found to be true in station studies of the effectiveness of well screens.

The tests also have shown that controlling the velocity at which water enters a well is a very important method which

can be used to control the flow of sand into the well.

Head losses in water entering wells were reduced after surging or making rapid, periodic changes in the rate of pumping.

In connection with irrigation wells, station workers have obtained information about how to properly install wells so they do not pump sand or cave in, yet at the same time will produce high yields.

## Wind Tunnel Used to Study Evaporation

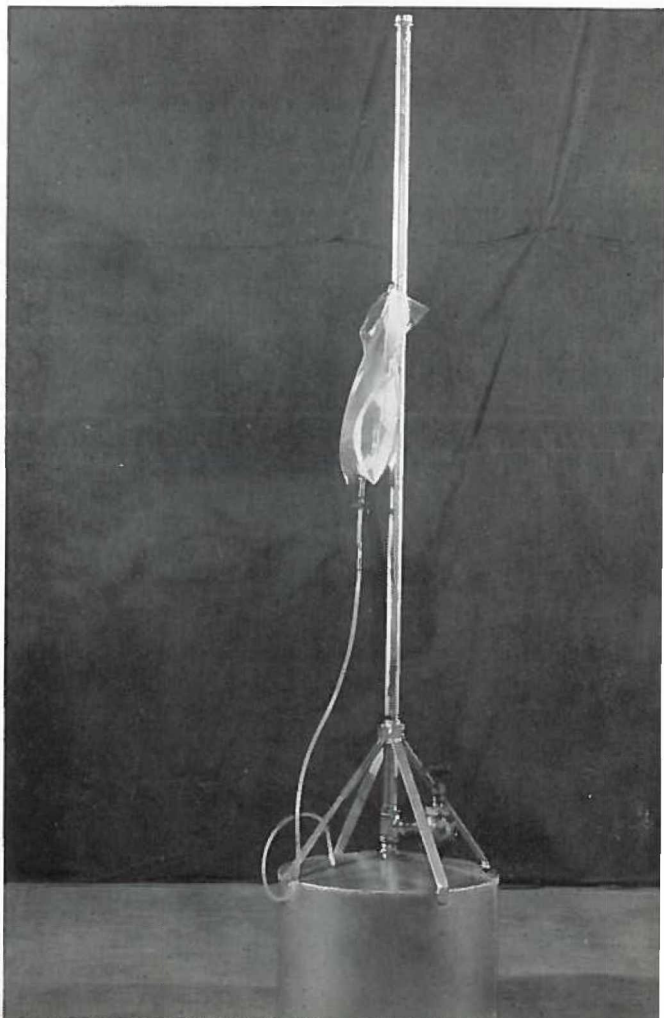
In cooperation with the Office of Naval Research, station engineers and scientists are using a specially-built wind

tunnel to discover factors influencing evaporation from lakes and reservoirs as well as how the evaporation occurs.

## Progress Made in Forecasting Seepage From Canals

A device known as a "seepage meter" has been used by station scientists, in cooperation with the USDA, to measure with reasonable accuracy the loss of irrigation water through sandy loam soil.

Measurements with the meter are part of an attempt by the workers to find better methods of measuring seepage from canals and forecasting seepage from proposed canals. In connection with these tests, it has been noted that seepage from canals decreases as ground-water levels increase.



*This type of seepage meter has been used by engineers to learn the degree of water loss from irrigation canal beds.*



*Station studies have shown one of the disadvantages of sprinkler irrigation lies in the labor difficulties. However, sprinklers have proved more satisfactory than furrow irrigation in apple orchards by placing a uniform amount of moisture on the ground and affording a more exact control of the amount of water applied.*

### **Trends Noted in Sprinkler Irrigation**

Colorado farmers and ranchers are increasing their use of sprinkler irrigation on pastures and alfalfa more than on any other crops.

Station engineers have compared this method of irrigation with furrow irrigation in apple orchards on Colorado's western slope. Sprinklers proved more satisfactory than furrow irrigation in placing

a uniform amount of moisture in the ground and in applying a desired quantity of water. A better cover crop was grown and the soil surface remained in better mechanical condition when the sprinkler system was used. Disadvantages noted in connection with sprinkler irrigation were in the labor management difficulties and cost of power.

### **Flow of Water in Canals and Rivers Investigated**

Better irrigation canals and better regulation of rivers are the two aims of a study underway by station engineers in cooperation with the U. S. Bureau of Rec-

lamation and Army engineers. This work includes laboratory study of how sediment is eroded and transported and effects of channel roughness.

### **Rainmaking Operations Evaluated**

Scientific evaluation of rainmaking operations in northern Colorado failed to dis-

close any evidence that cloud seeding significantly influenced precipitation.

# Horticultural and Floricultural Crops





# Horticultural Crops . . .

## Search Continues for New Potato Varieties

Colorado scientists, in cooperation with the USDA, are searching for a new scab-resistant potato variety that chips well. Such a variety could mean millions of dollars to the industry. No less important would be the development of a better red variety for the northern Colorado potato area.

Station workers are now testing a number of new varieties which could meet

these qualifications. Seedlings of four promising new red varieties were distributed to growers for increase during the past year. Of the white seedings, Iowa 376 — a scab-resistant, long white potato — is believed worthy of further trial. Colorado 10,185 — a russeted, round variety — also appears promising. A round, white potato — No. 120 — has yielded well and will be tested further in the state.

## Many New Vegetable Crops Tested

To answer growers' questions about how new vegetable varieties will produce under Colorado growing conditions, Colorado scientists, in cooperation with the USDA, are testing a number of new pickling cucumbers, canning tomatoes, sweet corn hybrids and canning beans.

Of the sweet corn tested, Iochief hybrid appeared best as a commercial canning type, followed by Carmelcross hybrid. Flagship looks promising for a fresh-market type although ears are large and yields not exceptional.

Improved National and National pickling cucumber varieties continue to out-lyield all other types tested, including Wisconsin SR6. To date, seedless watermelon hybrids do not show the quality of other standard types in Colorado tests. The hybrids are difficult to grow; the seed coat of each seed must be cut through before it will germinate. Workers have had difficulty establishing good stands of the seedless melons.

Yields of the "K" Stone canning tomato continue to be good.

## Earlier Planting of Potatoes Recommended

By planting their potatoes earlier, growers in northern Colorado's late potato area can increase yields and quality of their tubers.

Studies show that Burbank and Triumph varieties planted on April 28 significantly out-yielded and out-graded the same varieties that were planted May 26.

*Early planting can mean better potatoes as shown by these Russet Burbanks being loaded from the field. The larger, more even-sized potatoes on the right resulted from an April 28th planting. Lower grade potatoes on the left were planted May 26th.*



## Combination of Chemicals Causes Sprout Inhibition



Station scientists have obtained almost complete sprout inhibition in potatoes and sugar beets following applications of 2,4-D and maleic hydrazide.

Initial tests with these two chemicals indicate they have possible value both as herbicides and for the prevention of sprouting in stored table potatoes. Under favorable conditions, treatments with these chemicals also caused favorable changes in vitamin A content, free amino acids, protein qualities and specific gravity.

*Station scientists have found a new clue that may help prevent sprouting of stored potatoes. Applications of 2,4-D and maleic hydrazide have almost completely inhibited sprouting in both potatoes and sugar beets in storage.*

## Hybrid Onions Being Developed for Disease Resistance

Four of 12 adapted hybrid onions being grown by the station in cooperation with the USDA have proved superior to Mt. Danvers in yield and equal to this variety in keeping quality. In other tests, four early maturing and four later maturing hybrids show promise for Colorado growing conditions.

Resistance to diseases as well as yield and maturity are being emphasized in the breeding program.

*Hybrid onions for Colorado were developed by inbreeding and selection within the commonly grown onion varieties. In the first stages of the experimental work hundred of inbreds were grown. Many have been eliminated because of their poor resistance to disease and other undesirable horticultural characteristics.*



## Tomato Yields Can Be Increased With Hybrids

The station's tomato breeding program during the past year involved field testing and greenhouse crossing in an effort to combine good yields with good canning quality.

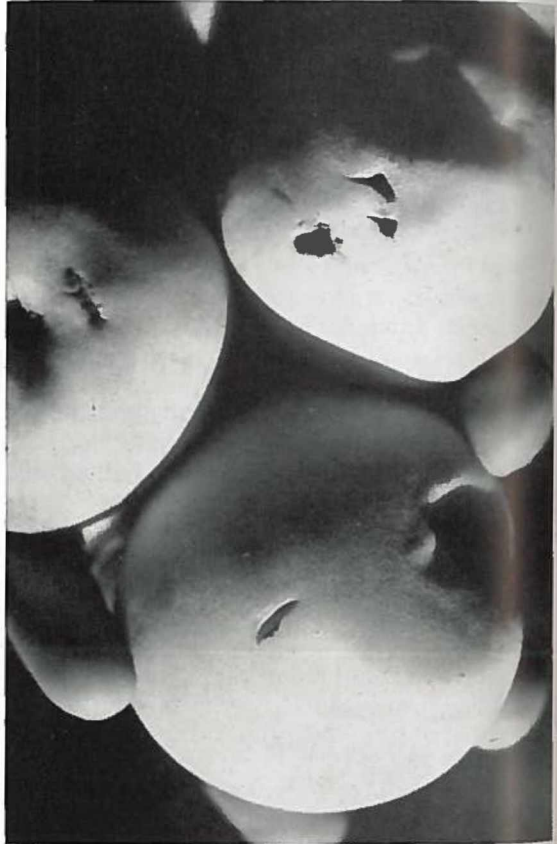
Twenty-five varieties and hybrids were field tested at two locations in eastern Colorado. Results from these tests indicate that yields can be improved with hybrid varieties.

## Greatest Damage to Peaches Occurs in Packing Shed

Studying maturity and handling of peaches in Colorado, station workers have found that greatest damage to peaches occurred in the packing shed. Improvement in equipment in many cases could lessen damage.

Testing the value of pre-cooling fruit, the scientists have found this practice re-

moves appreciable field heat from the outer lugs of fruit in a car but has less effect on the center of the load. Station scientists have also determined a measurable point at which peaches ship most favorably by analyzing the fruit for weight, color, pressure test, refractive index and acidity.



*Researchers have found the greatest damage to peaches during handling occurs in the packing shed. Here are types of puncture damage found in packed units of Colorado Elberta peaches. The punctures shown in the picture on the left were made by accidentally forcing peaches against sharp edges of packing shed machinery or containers. Two peaches in the other picture show punctures made by protruding nails and wire in picking containers and grading machinery. The lower peach was punctured by a packer's fingernail.*

## Machine Developed to Measure Resistance to Skinning

Station workers have devised a machine for measuring the resistance of potatoes to skinning during harvest and storage. It will aid the scientists in their efforts to pinpoint cultural practices that

will reduce skinning and mechanical injury.

Studies are underway to determine the effect of vine killing, maturity and irrigation on the toughness of potato skins.

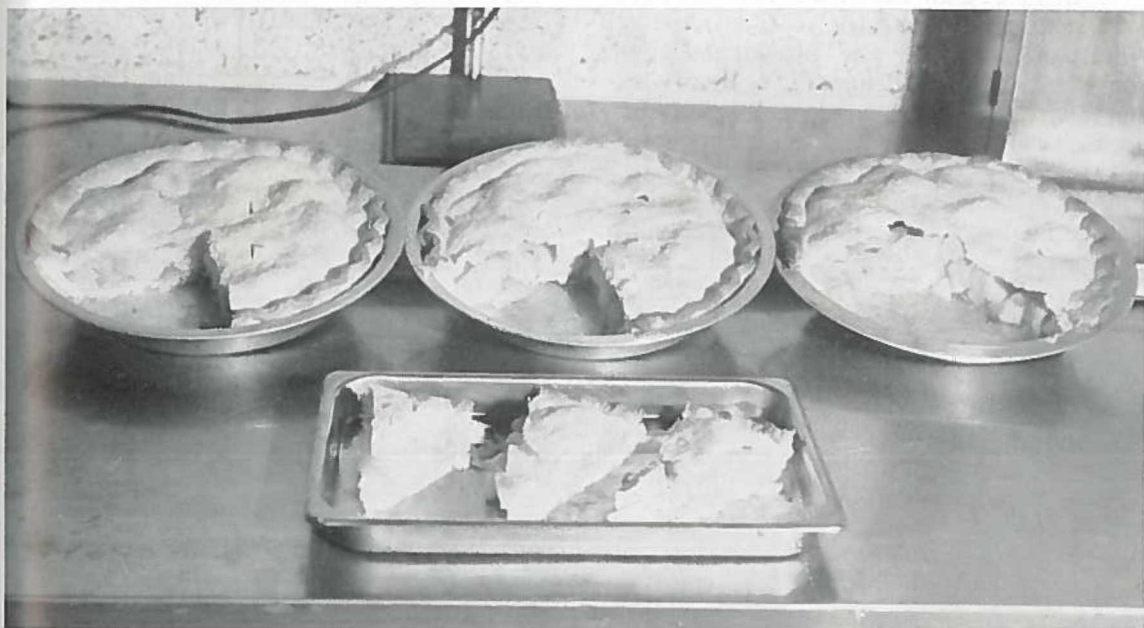
## Quality, Composition of Colorado Fruit Checked

Investigating the properties and processing of Colorado fruits, station workers are testing hundreds of varieties of fruit for their composition, quality, freezing and pie-baking characteristics. Thorough chemical analysis has been useful in evaluating the fruits. In connection with the work, the scientists have found that Delicious apples — ordinarily not considered for pie-use — will produce excellent pies

if they are treated with a special sirup.

The sirup contained ascorbic acid, salt and citric acid. Tasty pies resulted from impregnating apple slices with this sirup, then freezing as a pie mix. Taste tests proved the flavor, acidity and texture to be excellent.

The same sirup, minus the citric acid, also improved flavor and texture of Jonathan apples used as a frozen pie mix.



*Although baked with three different varieties, these pies look nearly alike. Actually the pie on the extreme left is the least desirable because it was prepared with a poor baking variety. The apple slices lost their shapes and became mushy upon baking. Acidity and aromatic flavor are also important to good baking varieties.*

# Floricultural Crops . . .

## Heat, Not Intense Light, May Cause Trouble in Rose Growing

Colorado's bright sunshine causes some problems for florists growing roses in greenhouses. It is not the high intensity of light but high temperatures that accompany intense light which cause the dif-

ficulty, station scientists have discovered.

This fact has led to the recommendation that growers use shaded glass to reduce temperatures and help prevent harm to the roses.

## Flower Research Conducted

Floricultural investigations resulted in the following significant findings:

*Dithane* successfully controlled wilt when tested — along with six other chemicals — by 12 carnation growers.

Five named carnation varieties show

natural resistance to *Fusarium wilt*, bacterial wilt and rust.

Preliminary tests indicate it may be possible to *index carnations* for presence of mosaic by *chromatographic analysis* of their free amino acids.

## Four New Carnations Named and Introduced

Marking continued progress in the development of new carnation varieties, station scientists during the past year named four new varieties and introduced them for commercial testing. Two new seedlings were also released to growers.

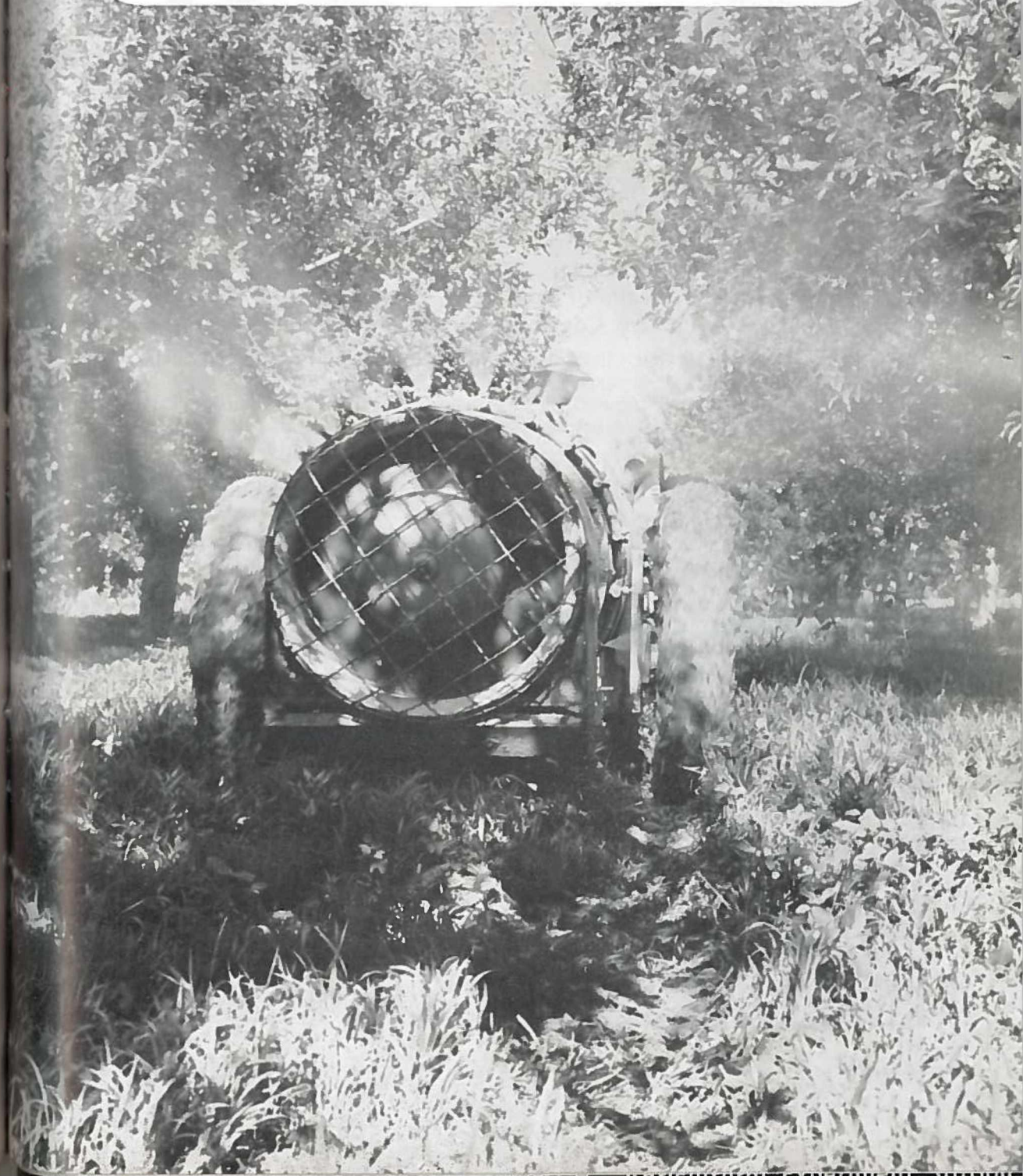
Scientists reported a significant development which may alter methods used in making uniformity trials of carnations and help make more efficient use of greenhouse

space used for the trials. From a study of uniformity trial data on two carnation varieties, they found that a 4 replication of 4 plants is statistically reliable when used in a full year's production of cut flowers. Ten times less square footage of greenhouse space will be necessary for these uniformity trials as a result of this finding, and more work can be carried on each bench.

*Flower breeding is considered a time-consuming and tedious process which requires much greenhouse space. Station workers have improved upon methods of making uniformity trials. As a result of their developments, ten times less greenhouse space is needed for these trials and more work can be carried on each greenhouse bench.*



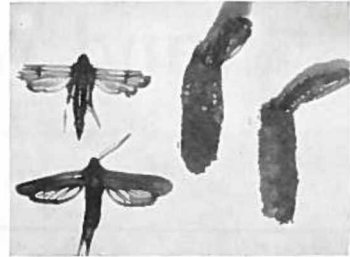
# Insects, Plant Diseases and Weed Control



## Peach Borer Recognized as "Number 1" Pest on Several Fruits

The peach tree borer is now recognized as the "number 1" fruit pest damaging peaches, apricots, cherries and plums in Colorado. Studying the life history of the borer, station scientists found during the past year that moths of the borer emerged continuously from late June until early September.

Using special peach plantings, the workers now plan to test new insecticides in their search for the control of this pest.



*On the left are adult peach tree borers, along with the cocoons and pupae cases from which they emerged. The peach borer is now recognized as the "number one" fruit pest damaging several fruits in Colorado.*

## Nearly 100 Percent Control of Green Peach Aphid Obtained

Station scientists have controlled green peach aphid with nearly 100 percent ef-

fectiveness by applying parathion sprays around mid-October.

## Attention Focused on Corn Earworm



Station scientists have focused their attention on corn earworm, a major pest on Colorado's western slope and in the Arkansas Valley. Growers are helping finance a detailed study of this pest.

Tests for control of the earworm were carried out using 10 insecticides. Aircraft applications were made with several materials. Results thus far indicate that DDT is most promising if application is carefully timed just as the corn silks begin to appear and the material is applied two times within a four-day interval.

*Young corn earworm larvae are often found on the silk at the extreme tip of a corn ear. One larva is capable of denuding the entire tip. They also commonly feed in a straight line paralleling the rows of kernels.*

## Results of Tests for Insect Control Measures

Control measure tests for several of the serious insect pests this year brought the following results (in some cases, tests were cooperative with USDA) :

*Peach Silver Mite* — Preliminary tests with miticides show wettable sulfur may have some control value.

*Tuber Flea Beetle* — Significant control obtained with DDT, Endrin, Toxaphene, and Parathion, in order named.

*Clover Mite or Brown Mite* — Lime-sulfur in dormant or delayed dormant application gave satisfactory control on peaches, pears and apples.

*Two-spotted Mite* — Ovatan gave best control of four miticides used on ground cover.

*Pale Western Cutworm* — Twelve days after application, Dieldrin brought 99 percent mortality; TDE, 94 percent mortality.

*Wheat Head Army Worm* — Combination of DDT and Toxaphene gave 95 percent kill; DDT and Aldrin gave 92 percent kill.

*Alfalfa Weevil* — Economical control with Chlordane, Dieldrin, and Heptachlor used in early stubble treatments.

Advantages of early spring treatment:

- (1) Protects the weevil parasite.
- (2) Reduces problem of residues.
- (3) Gives maximum protection to growing alfalfa by eliminating egg-laying adults.

*Say's Plant Bug* — A combination of DDT and sulfur is considered most economical. Systox, Lindane and Malathion are also good toxicants.

*Yellow Woollybear Caterpillars* (on sugar beets) — Endrin gave best control with 80 percent kill.

*Mexican Bean Beetle* — In order of control value are Dilan, Parathion, Malathion, Rynania and Rotenone.

*Western Yellow Blight* (transmitted by leafhopper) — To date no satisfactory control has been found, except treatment of leafhopper breeding areas with high concentrations and large amounts of DDT.

## European Foulbrood Reduced

Since 1951, incidence of European foulbrood disease in honeybees has dropped from 11 to 9 percent. A part of this reduction is believed to have come from the use of dihydrostreptomycin in a preventive feeding treatment.

When station scientists fed the drug to bees, they noted a significant reduction in foulbrood. Ten colonies of bees fed terramycin also showed significant improvement over 10 comparable check colonies.

*Station workers sprinkle syrup containing special drugs into empty frames in tests designed to prevent European foulbrood disease in honeybees. They found that a preventive feeding treatment which includes the drug, dihydrostreptomycin, has brought significant reduction in foulbrood.*





## Quick Test for Scab Resistance in Potatoes

A quick test for identifying scab-resistant potatoes would be of great value in speeding up potato breeding programs. Station scientists, cooperating with the USDA, are at work on just such a test.

The spot test involves placing a drop of two percent ferric chloride ( $\text{FeCl}_3$ ) on the scraped surface of a tuber. During the past year it was tried on 114 commercial

and seedless varieties. Varieties highly resistant to scab produced a dark-green color reaction in the area where the droplet was placed. Susceptible varieties showed a very pale-green to a no-color reaction. The color is produced by the reaction of ferric chloride with chlorogenic acid, an acid found in relatively large amounts in potatoes resistant to scab.

## New Fruit Disease Enters Pruning Wounds

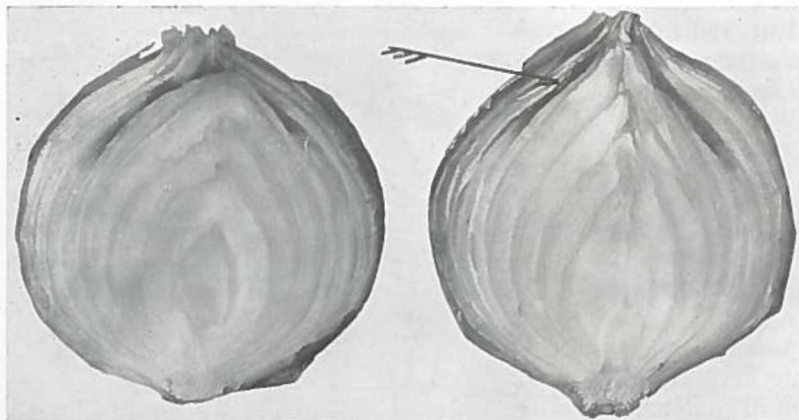
Reducing tree injury caused from pruning wounds can lessen infection from a new bark and wood canker disease. The new disease rivals mosaic in destructiveness. Studies show that 90 percent of the cankers start from pruning wounds.

Cankers are caused by a fungus. They sometimes accompany winter injury but actually are independent of this injury. Station scientists have discovered that an asphalt wound paint will protect pruning wounds from infection.

## Onion Disease Losses Reduced

Two chemicals — Cuprocide and Vanicide 51 — have reduced onion losses from Purple Blotch. Investigating other onion diseases, station workers noted that there

is less onion rot in relatively dry soils than in wet soils. They also found that some strains of *Fusarium cepae* can invade onions without prior damage by pink root.



*This onion bulb, cut lengthwise, is infected with purple blotch. Note the rot damage at the top of the bulb which indicates the infection spread down from the neck.*

## Bean Diseases Studied

The chemical "Ortho 406" has proved outstanding in controlling *Rhizoctonia root rot*. Copper oxochloride has given very good results in limited trials when used as a dust to control *bacterial blight*.

In variety tests, several Mexican bean varieties proved highly resistant to *Fusarium root rot*; 15 other bean varieties from foreign countries were resistant to blight.

*These are first lesions noticed when bacterial blight attacks field beans. Dusting with copper oxochloride has given good control of the disease in limited tests by station workers.*



## Chemical Helps Control Potato Seed Rot

Catechol causes tubers to form a cork-like layer over wounds that will keep out disease organisms and prevent rot. The chemical is harmless to human beings and

animals. Station workers have found it acts in much the same way as the chlorogenic acid which is found naturally in potato tissues.

## Results of Sugar Beet Disease Studies

Sugar beet disease studies indicate the following:

A new chemical called "Maneb" used for field seed treatment to prevent pre-emergence damping-off is significantly

better than standard products generally recommended.

Station tests show that maintaining high soil fertility does not prevent *Rhizoctonia* infection in sugar beet seedlings.

# Weed Control . . .

## Radioactive 2,4-D Used in Tracer Studies

In tracer studies, station workers have found that radioactive 2,4-D will penetrate plants and its translocation within the plant can be traced.

The workers have noted a lack of re-

sponse in drouth-injured plants. This is caused by failure of the 2,4-D to enter into the metabolism of plants rather than any failure to enter and be translocated within the plant.

## Competitive Crop Valuable in Weed Fighting

A grass crop that is competitive with weeds provides a valuable ally when fighting weeds with 2,4-D. This has been evident in station tests with the weedicide.

Researchers have found that an irrigated pasture provides the ideal situation for effective control of a large infestation of serious perennial weeds.

## Detrimental Weeds Controlled

Investigation of control measures for weeds which are classified as detrimental to crops and livestock have shown the following:

*Wild Oats* and *volunteer grain* can be controlled successfully in sugar beet fields with IPC applied at 3 to 6 pounds per acre rates before planting.

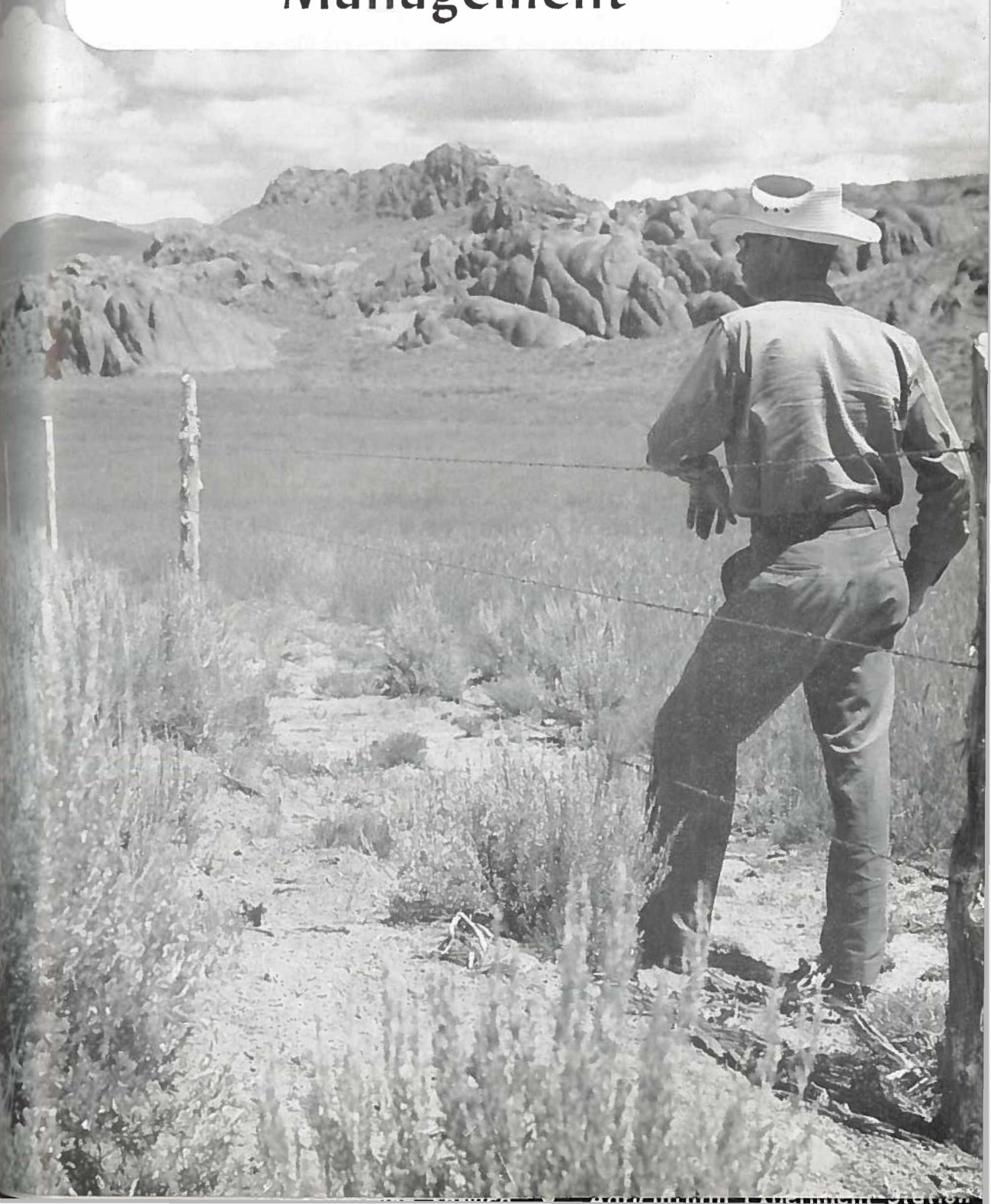
*Cheatgrass* growing in blue grama and wheatgrass range can be controlled with a pre-emergence application of Cl-IPC at rates of 8 to 12 pounds per acre.

*Footail barley* in first-year alfalfa was controlled with success when Cl-IPC was applied at 9 pounds per acre in the fall or early spring.



*Here is cheatgrass in an old stand of blue grama. The weed is unmatched for its ability to invade depleted perennial grass range. It re-seeds itself at an amazing rate. Station tests show it now can be controlled in blue grama and wheatgrass ranges by a pre-emergence application of CL-IPC.*

# Range and Pasture Management



## Pasture Rotation Pays

Station tests over the past five years show that rotational grazing pays off. Rotated pastures have produced 13.8 percent more pasture feed than pastures that have been continuously grazed.

Choosing the right kinds of plants for

the pasture mixture also is important. A mixture which included four legumes and three grasses produced 11.8 percent more pasture forage than a mixture that contained the same grasses but only one legume.

## Wheatgrasses Produce Highest Gains

During the past year's grazing trials on dryland pasture, tall wheatgrass and fertilized intermediate wheatgrass pastures produced greater weight gains on yearling beef animals than did chiseled interme-

diate wheatgrass and Russian wild rye pastures.

Trials are designed to find improved range practices to increase cattle production.

## Rhizoma Alfalfa Looks Promising

Nursery tests show Rhizoma alfalfa is a very promising variety for use in revegetating depleted rangeland and abandoned cropland. Rhizoma is a spreading

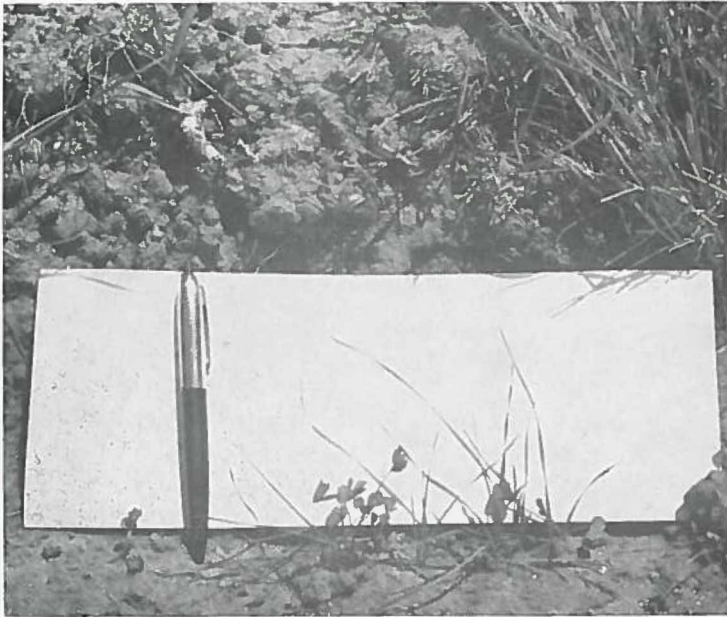
alfalfa. Forage yields indicate that Ladak, Sevelra and Ranger alfalfas are still outstanding varieties for dryland foothill areas.

## New Grass Planter Developed

Station scientists have developed a new type of grass planter designed to help renovate dryland pastures and abandoned cropland.

The machine incorporates a number of desirable features. It is designed to plant both fine and trashy seed and to apply

fertilizer. The planter scrapes off the top layer of soil in front of the fertilizer boots and seed shoes to help eliminate weed competition when grass is small. By "roughing up" the soil surface, this system of planting helps protect the small seedlings from wind erosion.



*Taking steps to reseed abandoned cropland and renovate depleted rangeland, station engineers have designed a new experimental grass seeder (top picture, opposite page). The seeder handles grass and legume seeds, protecting the mixture from wind erosion in a shallow furrow (left) and placing fertilizer below the seed. Parts of the planting units are (left to right, bottom picture) 10-inch lister blade, fertilizer tube, split press wheel, seed tube, drag chain and final press wheel.*





## Yield and Quality of Mountain Meadow Hay Can Be Improved

Yield and quality of Colorado's high altitude meadow hays can be improved, according to station tests in cooperation with the USDA.

Knowledge of how to do this may help overcome one of the greatest deficiencies in mountain meadow production — lack of crude protein in hays.

Following usual practices — late-cut harvest, continuous flooding of meadows and no special soil treatment — many ranchers average about 400 pounds of crude protein per acre in the hays they harvest.

By irrigating intermittently rather than flooding and by harvesting two times during the season, Colorado scientists

tripled the crude protein production to 1,200 pounds per acre. Following these same irrigation and harvest practices and, in addition, applying 160 pounds per acre of nitrogen (N) also raised crude protein to 1,200 pounds per acre. In this case, the crude protein was due to grasses encouraged by the nitrogen which, at the same time, discouraged the growth of clovers. Where no nitrogen was used, the crude protein increase was due to clovers.

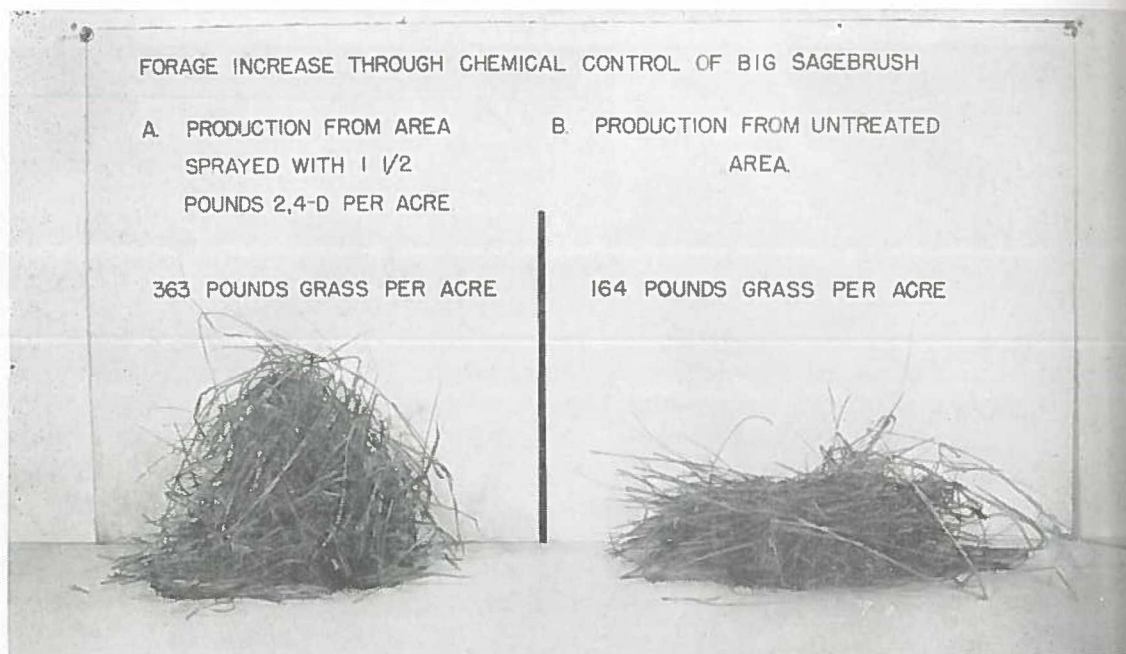
If this 200 percent increase in crude protein production were applied to the 500,000 acres of mountain meadows in Colorado, station researchers say it could mean a very great increase in efficiency of present ranching operations.

## Sixty Percent Kill of Big Sage Reported

Station technicians have obtained around 60 percent kill of big sagebrush by using 1½ pounds of butyl ester 2,4-D acid equivalent per acre.

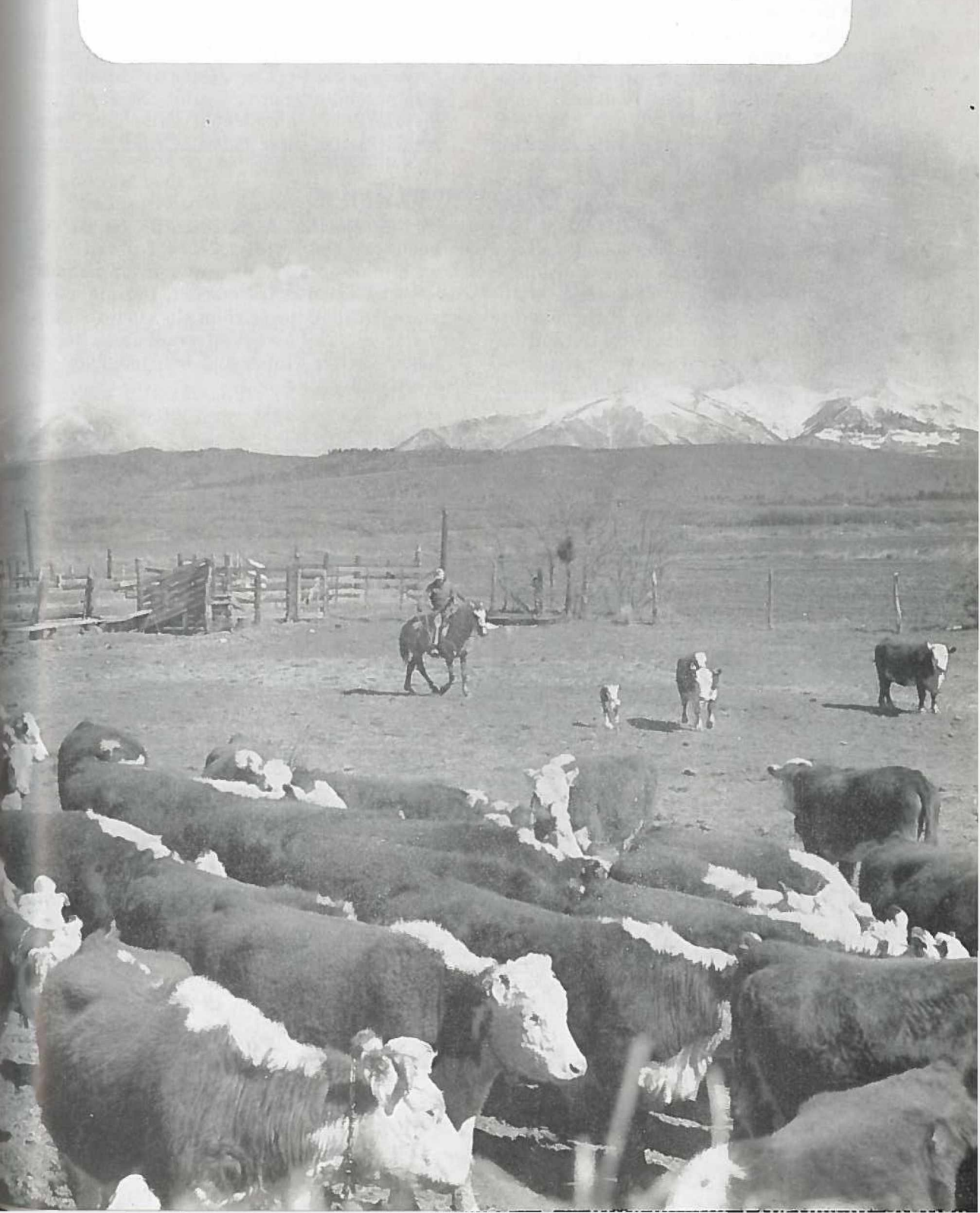
For ground spraying, the chemical was

mixed in water and applied at the rate of 25 gallons per acre. For aerial application, the herbicide was mixed in diesel oil and applied at the rate of two gallons to the acre.



*Rangeland from which the grass on the left was taken was sprayed with one and one-half pounds of isopropyl ester of 2,4-D, acid equivalent, per acre in a water solution, 25 gallons per acre. Spraying was done two years prior to taking the two grass samples.*

# Livestock and Poultry





# Livestock . . .

## Development of New Milk Product Hastened

Station scientists have been instrumental in hastening the development of a brand-new milk product — canned whole milk. A canned fresh milk sterilizing machine has been developed which can be used to adapt the Winger process for canning whole milk to operation on a commercial basis.

Using the basic Winger process, station

scientists also developed a canned sterilized chocolate milk drink which soon will be produced commercially.

Animal feeding trials are underway to compare the nutritional values of Winger process milk, regular pasteurized milk and commercial evaporated milk. So far, little difference in nutritional value has been found in the three types of milk.

## Popular Supplement Tested

Constantly alert to new developments in livestock feeding, station scientists have tested the popular supplement, Purdue A. They fed the supplement at the rate of  $3\frac{1}{2}$  pounds per day along with corn silage in amounts up to 50 pounds per day. Fattening steers fed these rations were compared with steers full-fed corn. The animals re-

ceiving Purdue A gained 1.9 pounds per head per day while steers full-fed corn each marked up daily gains of 2.2 pounds.

Appraised at the market, Purdue A-fed steers graded lower than the corn-fed animals. Steers on corn alone showed better bloom, better finish and less tendency toward paunchiness.

## Dried Beet Pulp Can Replace Corn

Dried beet pulp can replace up to one-half the corn in a steer fattening ration with about equal feeding value. In station tests, one lot of fattening cattle was fed  $\frac{1}{3}$  dried beet pulp and  $\frac{2}{3}$  corn; a second lot received  $\frac{1}{2}$  corn and  $\frac{1}{2}$  pulp as

their ration. When compared to cattle full-fed corn, the two pulp-fed lots made gains equal to, or greater than, those made by the steers full-fed corn. Gains in the pulp-fed lots were cheaper than those made by steers full-fed corn.



*Investigating ways to make better use of Colorado-grown feed products, station workers have found that dried beet pulp can replace up to one-half the corn in a steer fattening ration with about equal feeding value. Gains made by pulp-fed steers were cheaper than those made by steers full-fed corn.*

## **Feedlot Cattle Respond to Hormone Treatment**

Fattening beef cattle have responded both in increased gains and higher dressing percentage as a result of treatment with two hormones. Hormones used in the experiments are testosterone and andro-  
nedione.

When steers were implanted with a mixture of testosterone and estrogen, there was a more pronounced effect on gain and dressing percentage. Feedlot heifers implanted with testosterone showed a quieting effect.

## **Alfalfa Meal in Storage Can Lose Important Feed Factor**

Dehydrated alfalfa meal in storage can lose the nutritional factor that promotes the conversion of carotene to vitamin A in the animal body.

Meal that has been stored for two years at room temperature and later fed to

chicks in station tests was found to have lost this important factor. Since the factor has been shown to be heat stable, station workers now believe that a chemical change which takes place when the meal stands in storage may be responsible.

## **Hybrid Vigor Put to Work Within One Cattle Breed**

Putting hybrid vigor to work within one breed of beef cattle is one aim of the Colorado beef breeding program. This means a different kind of beef hybrid—one that results from crossing two highly inbred lines of Herefords or from crossing bulls from an inbred line on unrelated commercial females. The latter method offers promise for Colorado's commercial herds.

In the experimental herd, the past year's crop of calves resulting from crossing inbred bulls to unrelated cows had two advantages over inbred calves sired by the same bulls. They were 12 percent

heavier at weaning and 11 percent higher in grade.

Yearling bulls in the herd (also the result of crossing inbred bulls on unrelated females) were 9 percent heavier, had 4 percent faster gain and had 6 percent higher yearling grades than did inbred bulls the same age.

A rancher cooperating with the station in the breeding work reports good results from using inbred bulls on his commercial cows. Calves sired by the inbred bulls averaged 19 pounds heavier at weaning than calves sired by other herd sires which were not inbred.

## **Use of More Roughage in Cattle Feeding Possible**

Cattle feeders can possibly make greater use of Colorado-grown roughages in fattening rations than has been believed possible up to this time. This knowledge could be especially valuable during years when roughages are able to show a considerable

price advantage over feed concentrates.

This was indicated in station tests when cattle fed about two parts grain and one part roughage made gains nearly equal to those made by steers fed grain at higher rates.

## **Feeders Report Losses**

Station workers secured numerous business records from Colorado farmers.

Business records obtained from north-eastern Colorado farmers and summarized by station economists indicate heavy losses were suffered in the area during the 1951-

52 season in both cattle and lamb feeding operations.

Cooperating ranchers in western Colorado reported in their business records that expenses were heavier in 1951 than for any year previously reported.

## Diagnostic Service Offered

Constantly on the alert for outbreaks of known and new diseases, the station maintains a diagnostic service which is available to individual farmers and ranchers as well as veterinarians.

During the past year, autopsies were performed on 567 farm animals and on one or more birds in 233 consignments of chickens and turkeys. Trips are made to all sections of the state to make diagnoses.

## Urinary Calculi Studied

Station scientists are studying factors which influence development of urinary calculi in cattle and sheep. They are investigating the feeds, mineral ration and the water supply in cattle and sheep herds where the disease occurs. Test cattle are

being fed a ration conducive to urinary calculi; others are being fed calcium carbonate in an attempt to balance the mineral ration. The effect of increased water consumption on the development of calculi is being noted in animals force-fed salt.

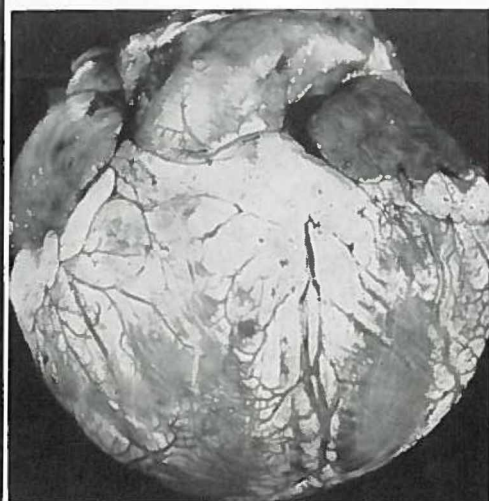
## Brisket Disease Related to Faulty Breathing Mechanism

The heart failure that is characteristic of brisket disease in cattle is caused by overwork of the heart in the rarified atmosphere of high altitudes. This condition occurs in animals with inadequate respiratory systems.

This fact has been brought out in studies made by station scientists. The faulty breathing mechanism is believed caused by diseased lungs or by an anemia in which the animal's oxygen-carrying capacity is reduced.



*Compare the normal heart (left) with the heart of a cow infected with brisket disease (below). Increased resistance to blood circulation through the lungs caused the right side of the faulty heart to become enlarged.*



## Shipping Fever Is Not a Specific Infection

Shipping fever is not a specific bacterial infection and the commonly used immunizing agents are not effective for prevention or treatment.

This has been the finding from studies now underway at the station, including work on the pathology, bacteriology and prophylaxis of the disease.

## Calf-Killing Organism Identified

A disease organism responsible for the deaths of many baby calves in Colorado and neighboring states has been identified through station investigations. The organism is *Clostridium perfringens*, type C. It causes a disease in calves that is

characterized by acute and usually fatal enteritis.

This disease is already widespread in Colorado and appears to be on the increase. Immunization measures are being studied. Results indicate they have some value.

## Pituitary Substance Tested in Bull Sterility Study

A substance obtained from the pituitary glands of hogs has given excellent results in correcting sterility in a number of bulls. The material is a follicle-stimulating fraction. Two of the bulls treated are now

serving as sires in Colorado beef herds.

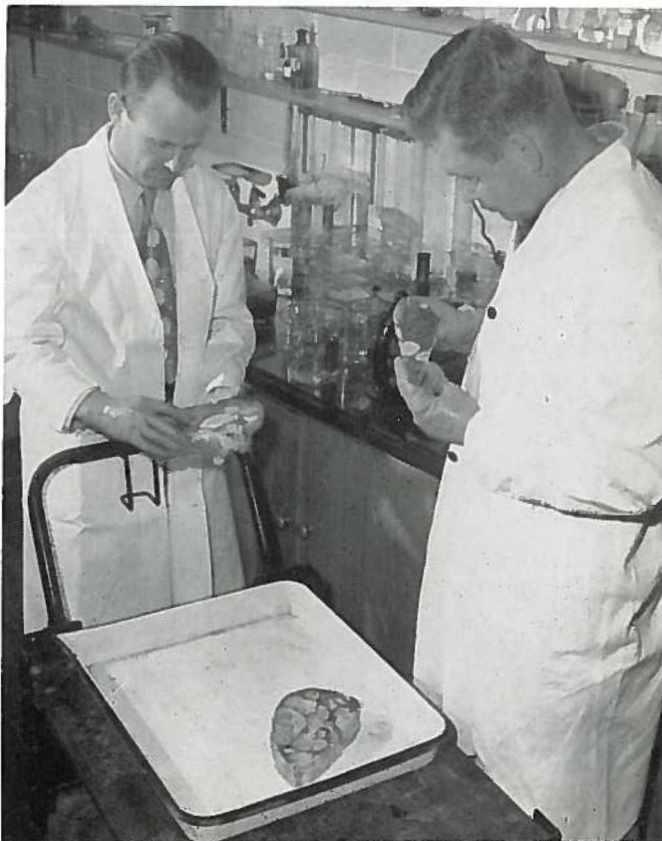
Another substance obtained from pituitary glands appears effective in increasing milk production and inducing lactation in dry cows and heifers.

## Stomach Troubles and Liver Abscesses in Cattle Believed Related

Station workers have found a definite relationship between stomach ulcers (rumenitis) and liver abscesses in cattle. The finding resulted from a study of stomachs of over 1,500 animals in Denver packing plants.

Rumenitis has been produced experimentally in station feedlots. Scientists accomplished this by making a rapid switch from a ration of hay to one high in concentrates.

*Station scientists examine abscessed cattle livers which are believed related in some way to stomach ulcers in cattle. Incidence of liver abscesses in feeder cattle is greater in the intermountain region than in any other area of the world.*



## Bacterial Toxins May Cause Cow Asthma



Observations of animals with cow asthma have led scientists to believe the disease may be caused by bacterial toxins. These toxins appear to be produced in the intestines and then are carried to the lungs by the blood.

Trials are planned in which animals will be immunized against the disease.

*This is the lung of an animal infected with cow asthma, believed caused by bacterial toxins. Lungs of cattle literally blow up when they contact the ailment. Note large air pockets formed in the lung of this animal killed by cow asthma.*

## Wool Shrinkage Estimated

Station scientists are conducting tests to give wool growers a means of estimating shrinkage of wool clips as well as shrinkage of wool from individual animals.

Records show that wool yield from fat lambs coming out of the feedlot was 50.1 percent (based on 14 percent impurities). The average fleece weight was six pounds. The average grade was half blood and the

percent dirt in the lamb fleeces varied from 7 to 10 percent.

A summary of yields from 821,786 pounds of 1952 Colorado wool was as follows: Fine original bag 39.3 percent; fine graded 38.7 percent; half blood graded 42.2 percent;  $\frac{3}{8}$  blood graded 45.8 percent. For all of these wools, the weighted average recorded a yield totalling 41 percent.

## Core Test Accurate in Predicting Wool Shrinkage

Station scientists have found the core test to be an accurate means of predicting wool shrinkage. In tests so far, there has been no consistent difference between core test shrinkage and actual mill shrinkage.

A more accurate prediction of the average length of top was obtained from the average unstretched grease staple length than from the stretched grease staple length.

## Negative Results Reported in Lamb Crop Experiment

Two years of experimentation with various hormones show that a negligible percentage of treated ewes produced a second lamb in the same year.

These results are in contrast with those which were reported from similar

treatments by a commercial concern several years ago.

Treatments included two different levels of pituitary extract, E. C. P., Ovesterol and a combination of pituitary extract and E. C. P.

## Self Feeding Versus Hand Feeding Lambs

In an effort to determine better methods of feeding heavy feeder lambs to desirable market weights, station tests compared the hand feeding and self feeding of several different rations. The lot of lambs that produced the largest and cheapest gains was hand-fed alfalfa hay in addition to being self-fed corn chop. The lot show-

ing the poorest gains and highest cost was self-fed a cut mixture which averaged  $\frac{2}{3}$  corn chop and  $\frac{1}{3}$  alfalfa hay.

The amount of grain the lambs would eat was slightly increased by more frequent feedings, but these increased gains did not pay for the labor cost of hand feeding.

## Does "Purdue A" Fit Into Lamb Feeding?

What place does Purdue A supplement have in the lamb feeding ration? One-year tests by the station indicate that gains made by lambs fed Purdue A are not comparable to those made by cattle fed the supplement.

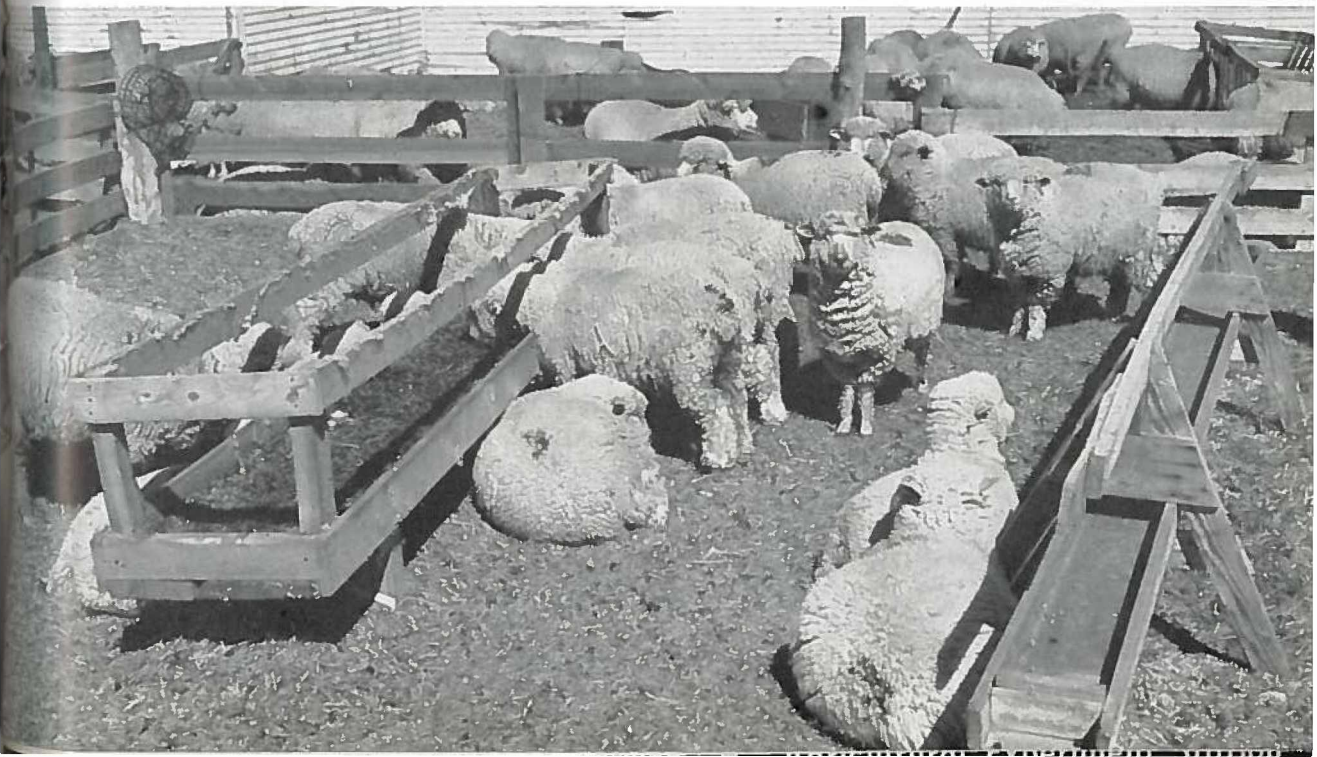
Tests with Purdue A involved one group of ewe lambs and a group of wethers. Ewe lambs that made the best gains (.26 pound per lamb per day) were fed daily  $\frac{1}{4}$  pound of shelled corn,  $11\frac{1}{2}$  pounds of corn silage and  $21\frac{1}{2}$  pounds of good quality alfalfa hay. A lot fed  $\frac{1}{2}$  pound of Purdue A and  $5\frac{1}{2}$  pounds of corn silage gained .16 pound per head per day. A third lot barely maintained its weight on a ration consisting of  $\frac{1}{2}$  pound of Purdue A

and  $3\frac{1}{3}$  pounds of poor quality alfalfa hay.

The three lots of wether lambs offered a comparison between Purdue A supplement, cottonseed meal and shelled corn when fed with corn silage, alfalfa and shelled corn.

Lambs fed cottonseed meal ( $\frac{1}{4}$  pound per lamb per day) had the heaviest gains and second cheapest gains (\$20.87 per 100 pounds gain). Purdue A supplement fed at the same level gave the second-best gains but at the highest cost (\$21.71 per 100 pounds gain) of the three lots. Lambs fed shelled corn — to afford approximately the same concentrate level as the other lots — made the lowest gains but at the cheapest cost (\$20.00 per 100 pounds gain).

*One-year tests by station scientists indicate that gains made by lambs fed Purdue A supplement are not comparable to those made by cattle fed this same supplement. Purdue A supplement produced the second-best gains in the lamb test, but at the highest cost.*



## Waste Product Stimulates Poultry Growth

A waste product of the sugar beet industry — liquid betaine concentrate — has stimulated growth when fed to poultry in station tests.

Trials included a comparison of the growth factors in dried whey, fish solubles

and the liquid betaine — which is also known as MC47. Dried whey and MC47 produced about the same growth response. When MC47 was fed in combination with fish solubles, the combination gave better growth than fish solubles plus whey.

## Reproductive Performance in Turkeys Improved

Scientists are investigating the effect of inbreeding and crossbreeding inbred lines of turkeys on reproductive performance. Inbred lines used included Beltsville White turkeys and Bronze turkeys.

Egg production of hens from top crosses (where a bird from an inbred line

was crossed with a bird from a non-inbred, unrelated strain) was noticeably increased when compared with production from strain crosses and non-inbred sources. There was no consistent improvement noted in percent fertility and perfect fertile-hatch.

## Antioxidant Found Non-Poisonous to Chicks

An antioxidant chemical (6-ethoxy-2,3,4-trimethyl-1,2-dihydroquinoline) being tested in cooperation with the USDA has been found relatively non-poisonous to chicks, even when fed at levels 100 times normal intake.

Dehydrated alfalfa treated with this chemical retains between 60 to 80 percent of its natural carotene which ordinarily would be lost in storage. As a result of these tests, one state has already released treated alfalfa for use as poultry feed.

## "IAA" Supplement Increases Chick Gains

In tests to evaluate the growth-promoting possibilities of certain materials, a 5.4 to 7.95 percent increase in body weight was obtained in chicks fed a substance known as IAA over chicks fed a standard balanced diet. The chemical name for IAA is indole-3-acetic acid.

Supplementing the chick's diet with this substance produced an average increase of 32 percent in testis weight and a 19 percent increase in liver weight. In tests involving supplementation of a commonly fed ration with three levels of IAA, all levels increased body weight gain.

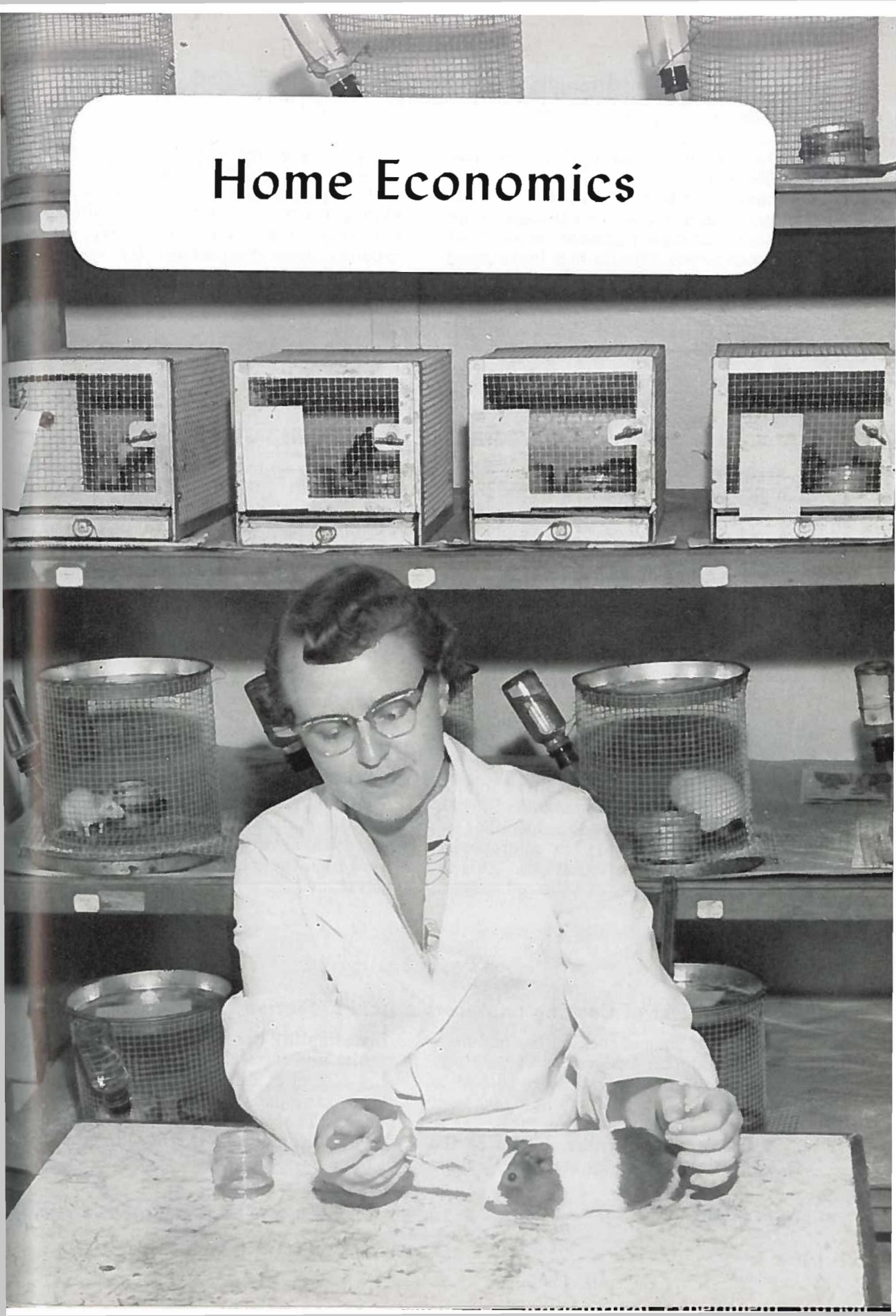
## Hormones Used in Fattening Broilers

In a study of hormone fattening of broilers, several steroids have brought favorable gains in tests involving more than 3,000 birds.

Pullet broilers produced good gains

when androstenedione was implanted or fed. Cockerel broilers fed estradiol also showed improvement in weight and fleshing. Dressing percentage and carcass quality also were significantly increased.

# Home Economics





## Nutritional Status of Selected Groups Studied

Twenty-seven percent of the women questioned in one Colorado county reported they did not eat breakfast; 18 percent said they did not eat a noon meal.

These are some of the interesting facts coming from a study of the nutritional status of population groups in selected areas of Colorado. The study is being made in cooperation with the USDA and other states.

Station workers found the diets of

mothers in the same county were markedly low in calcium and ascorbic acid. Calories in the diets of persons questioned proved to be a good index of the level of most nutrients. Intakes of vitamin A were high; intakes of calcium and thiamin were unusually low. Home-produced dairy products were responsible for adequate levels of riboflavin and calcium. Home-grown meat, poultry and eggs apparently increased the riboflavin content of diets.

## High Altitude Baking Studied

Studying the baking of flour mixtures at high altitudes, station workers found altitude exerted a highly significant influence on volume, compressibility and oven-spring of yeast breads. Type of flour used in the yeast breads also significantly affected the same three factors.

Increasing the percentage of non-fat milk solids in yeast breads brought vari-

able results on loaf volume at 5,000 feet in altitude. At 7,500 feet and 10,000 feet, however, loaf volume generally increased as milk solids were increased. Breads having the highest percentage of milk solids were increased. Those breads having the highest percentage of milk solids always had a dark brown, almost burned, crust color.

## Ingredients Vary With Altitude in Cakes

Special attention must be given to altitude for successful cake-baking. Station workers have found that proportions of certain ingredients vary in a step-wise manner with altitude variations. This is true with several types of balanced recipes.

The scientists are working to standardize the ingredient proportions in a two-egg cake formula at five different altitudes. Water-sugar ratios and the leavening agent have been the controlling factors at all test elevations.

## Effect of Cooking on Ascorbic Acid Retention Investigated

Length of time of cooking has had little effect on ascorbic acid values of potatoes. Potatoes used in the tests were cooked to three stages of "doneness" at 5,000 feet, using 5 and 15 pounds of pressure.

Ascorbic acid retention is one of the factors being studied by station scientists

investigating the properties of Colorado fruits and vegetables. Vegetables are being cooked at different pressures in pressure saucepans commonly used in the home. The studies will be continued at 5,000 feet, and then extended to other altitudes.

# 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 disseminated by the News and Radio Serv-

ice 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 explaining research activities.

## General Series Bulletins

- Bul. 357-A (revised) "Improving Colorado Home Grounds." Geo. A. Beach and Chas. M. Drage. 10,000 copies, 56 pages, November 1952.
- Bul. 392-A (revised) "Colorado Lawns — Planting and Maintenance." Geo. A. Beach and Chas M. Drage. 10,000 copies, 24 pages, March 1953.
- Bul. 400-A (revised) "Colorado Dairy Barn and Milk House," O. J. Trenary and H. A. Sandhouse. 5,000 copies, 15 pages, March 1953.
- Bul. 404-A (revised) "Mile-High Cakes." 10,000 Copies, 32 pages, January 1953. Eliz. Dyar and Elizabeth Cassel.
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- Circ. 176-A "Diseases of Grasses on Range and Irrigated Land in Colorado." W. J. Henderson, N. R. Gerhold. 5,000 copies, 8 pages, April 1953.

## Scientific Series Papers

- Beach, Geo. A. "Effect ammonium sulfate and potassium chloride on patrician carnation in soil." Vol. 59, 484-486. A.S.H.S. 1952. Sci. Series 317.
- Beach, Geo. A. "Plot Technique with carnation." A.S.H.S. Vol. 60, 479-486. 1952. Sci. Series 389.
- Beach, Geo. A. "Plot Technique with carnations, a second-year study." A.S.H.S. Sci. Series 435.
- Beach, Geo. A. Application of covariance in a plot—technique study with carnations." A.S.H.S. Sci. Series 436.
- Blouch, Roger M. "Grass Herbicides in today's agricultural economy." Sci. Mon. LXXXVI (1)36-41, January 1953. Sci. Series 406.
- Blouch, Roger M., Fults, Jess L. "The influence of soil type on the selective action of chloro-IPC and sodium TCA." Weeds II. (2):119-124. 1953. Sci. Series 405.

- Blouch, Roger M., Payne Merle G., Fults, Jess L. "Free amino acid in sugar beet leaves altered by zinc dimethyldithiocarbamate." *Bot. Gaz.* 114:248-251. 1952. Sci. Series 392.
- Fifield, C. C., Robertson, D. W. "Milling, baking, and chemical properties of Marquis and Kanred wheat grown in Colorado and stored 19 to 27 years." *Agron. Jour.* Vol. 44, No. 11. 1952. Sci. Series 387.
- Fults, Jess L., Hay, Ruth J., Payne, Merle G. "Nitrate content of Red McClure potatoes unchanged by 2,4-D treatment." *Amer. Pot. Jour.* 29:97-98. 1952. Sci. Series 370.
- Fults, Jess L., Payne, Merle G., Gaskill, John O., Hac, Lucille R., Walker, Albert C. "Glutamic acid in sugar beets increased by zinc dimethyldithiocarbamate." *Bot. Gaz.* 113:207. 1952. Sci. Series 350.
- Gardner, R., Robertson, D. W. "The effect of alfalfa on the yields of non-leguminous crops in a rotation." *Amer. Soc. Sug. Beet Tech. Proc.* pp. 224-228. 1952. Sci. Series 385.
- Griner, L. A., Bracken, Frank. "Cl. perfringens (type C) in acute hemorrhagic enteritis of calves." *Journal of the Amer. Vet. Med. Assoc.*, Vol. 122, No. 911, February 1953. Sci. Series 399.
- Guss, Cyrus O. "Reaction of w,4,6-trimethylstyrene oxide with phenol." *Journal of Amer. Chemical Society*, 75,3177 (1953) Sci. Series 400.
- Guss, Cyrus O. "The reaction of P-methozystyrene oxide with phenol." *J.A.C.S.* 74, 2561 (1952) Sci. Series 373.
- Guss, Cyrus O. "The reactions of M- and O-nitrostyrene oxide with phenol." *J. Org. Chem.* 17, 678 (1952) Sci. Series 372.
- Johnson, Gestur. "Chlorogenic acid a possible metabolite in the terminal oxidase system of the white potato." *Science* 115, 675 (1952) Sci. Series 375.
- Olsen, O. Wilford. "An evaluation of drugs, past and present for removing fringed tapeworms from livers of sheep." *Amer. Journal of Vet. Med. Assoc.* Vol. 122, No. 911, P. 616-620, February 1953. Sci. Series 397.
- Puleston, H. S., Fults, Jess L., Payne, Merle G. "Uracil protection against ultraviolet radiation damage to a higher plant." *Science* 115, 402 (1952) Sci. Series.
- Salander, R. C., Patton, A. R. "Free amino acids in chick livers by vitamin B-12 and fasting." *J. Nutr.* 47, 469 (1952) Sci. Series 371.
- Schmehl, W. R., Olsen, S. R., Gardner, R. "Effect of type of phosphate material and method of application on phosphate uptake and yield of sugar beets." *Amer. Soc. Sug. Beet Tech. Proc.* pp. 154-158. 1952. Sci. Series 384.
- Schmehl, W. R., Brenes, E. J. "The availability of high-temperature process alkali (Rhenania-type) phosphates to crops when applied to calcareous soils." *Soil Sci. Soc. Amer. Proc.* 17:375-378. Sci. Series 404.

## General Series Papers

- Barmington, R. D. "Sugar beets succeed under adverse conditions." *Sta. Mimeo. Gen. Series* 524.
- Esplin, Lamar, Connell, W. E. "Feeders Day Report." *Sta. Mimeo. Gen. Series* 535.
- Fults, Jess L., Payne, Merle G. "The effects of synthetic plant hormones on Red McClure potatoes." *Sta. Mimeo. Gen. Series* 503.
- Gaskill, John O., Seliskar, Carl E. "Effect of temperature on rate of rotting of sugar beet tissue by two storage pathogens." *Proc. Amer. Soc. Sug. Beet Tech.* pp. 571-574. 1953. Gen. Series 381.
- Greb, Bentley W., Whitney, Robert S. "Commercial fertilizer experiments with non-irrigated crops in eastern Colorado." *Sta. Mimeo. Gen. Series* 526.
- Hervey, D. F. "Range management invest." *Sta. Mimeo. Gen. Series* 550.
- Kunkel, Robert, Binkley, A. M. "Effect of planting date on the yield and quality of potatoes in northern Colorado." *Colo. Growers (Potato) Assn. Gen. Series* 543.
- Leonard, Warren H., Koonce, Dwight, Fauber, Herman, Brandon, J. F. "Performance tests of hybrid corn varieties grown in various regions of Colorado in 1952." *Sta. Mimeo. Gen. Series* 531.
- Livingston, Clark, Payne, Merle, Fults, Jess. "Chromatograph spotting apparatus." *Science. Gen. Series* 525.
- "Progress Report, Arkansas Valley." *Gen. Series* 527.
- "Progress Report, High Plains Field Station." *Gen. Series* 530.
- "Progress Report, San Juan Basin." *Gen. Series* 544.
- "Progress Report, San Luis Valley." *Gen. Series* 529.
- "Progress Report, Western Slope." *Gen. Series* 528.

## Other Published Articles

- Beach, Geo. A., Rutt, A. E. "Variety trials with early and late chrysanthemums at Fort Collins." Colo. Flower Grower Assn. Bul. 41, March 1953.
- Beach, Geo. A. "Cut flowers keep longer." Colo. Flower Grower Assn. Bul. 36, October 1952.
- Binkley, A. M. "A report on new potato varieties and seedlings tested in 1951." Mimeo. cir. 1952.
- Blouch, Roger M. "The herbicidal control of annual grass weeds." Journ. Colo.-Wyo. Acad. Sci. IV:67. 1952.
- Blouch, Roger M. "Reduced viability of seeds from *Setaria* plants treated with maleic hydrazide. Res. Prog. Report. Western Weed Control Conference, pp. 78-79. 1953.
- Blouch, Roger, Fults, Jess L. "Correlation between soil type and rates of sodium TCA and 3-chloro IPC application for pre-emergence grass control. Res. Prog. Rpt., Western Weed Control Conference. p. 148. 1952. Proc. Amer. Sugar Beet Tech. 7:136. 1952.
- Blouch, Roger, Fults, Jess L. "Control of foxtail barley in alfalfa." Res. Prog. Rpt. Western Weed Control Conference. p. 48. 1953.
- Blouch, Roger, Fults, Jess L. "Control of cheatgrass with spring applications of chloro-IPC, Oktone, and CMU." Res. Prog. Rpt. Western Weed Control Conference, p. 79. 1953.
- Blouch, Roger, Fults, Jess L. "Residual life of 3-chloro-IPC on a blue grama-cheatgrass range. Res. Prog. Rpt., Western Weed Control Conference. p. 16. 1953.
- Blouch, Roger, Gerhold, Norman "Interrelationship of C-IPC Krilium, and Arasan in sugar beet culture." Res. Prog. Rpt. Western Weed Control Conference p. 79. 1953.
- Blouch, Roger, Fults, Jess L., Garber, R. H. "Control of foxtail barley in alfalfa." Res. Prog. Rpt., Western Weed Control Conference. P. 48. 1953.
- Blouch, Roger, Fults, Jess L., Thornton, B. J. "Chemical control of annual grasses in alfalfa, sugar beets, onions, and certain truck crops." Res. Prog. Rpt., Western Weed Control Conference. p. 103. 1952. Also Proc. Amer. Sug. Beet Tech. 7:136. 1952.
- Blouch, Roger, Fults, Jess L., Thornton, B. J. "Controlling fall-germinating downy cheat with 3-chloro IPC and P-162." Res. Prog. Rpt., Western Weed Control Conference, p. 22, 1952.
- Burdick, R. T. "Denver cattle prices 1947-1952." Sta. Mimeo.
- Coons, G. H., Stewart, Dewey, Bochstahler, H. W., Deming, G. W., Gaskill, J. O., Lill, J. G., Schneider, C. L. "Report of 1951 evaluation tests of leaf spot and black root-resistant sugar beet varieties of the US Dept. of Agric." Proc. Amer. Soc. Sug. Beet Tech. 7th Gen. Meeting: 445-451. 1952.
- Dickens, Lester E. "The pathogenesis of *Fusarium* on onions." Journal Colo.-Wyo. Acad. Sci. 4:44. 1953.
- Dickens, Lester E. "The sugar content of carnation varieties as related to their susceptibility to *Fusarium* wilt." Jour. Colo.-Wyo. Acad. Sci. 4:42. 1953.
- Dickens, Lester E., Thomas, W. D. "Results of spray tests for the control of carnation rust." Jour. Colo.-Wyo. Acad. Sci. 4:73. 1952.
- Ferguson, A. C. "New varieties and adapted varieties for Colorado." Mimeo. 1952.
- Frey, Paul R. "The utilization of carotene in the animal body." Feedstuffs, p. 31a, Nov. 22, 1952.
- Fults, Jess L., Payne, Merle G., Livingston, Clark. "The direct and interacting effects of 2,4-D and maleic hydrazide on the sprouting of Red McClure potatoes." Res. Prog. Rpt., Western Weed Control Conference. p. 62, 1953.
- Fults, Jess L., Payne, Merle G., Hay, Ruth J. "Interactions of maleic hydrazide and 2,4-Dichlorophenoxyacetic acid as they affect skin color in Red McClure potatoes." Jour. Colo.-Wyo. Acad. Sci. 4:67. 1952.
- Fults, Jess L., Blouch, Roger M., Livingston, Clark, Thornton, B. J. "Pre-emergence and post-emergence chemical control of annual weeds in Red McClure potatoes in the San Luis Valley of Colorado." Res. Prog. Rpt., Western Weed Control Conference. p. 62. 1953.
- Gassner, F. X., Hill, H. J., Sulzberger, L. "The relationship of seminal fructose to testis function in domestic animals." J. Fertility and Sterility 3, 121, 1952.
- Gassner, F. X. "Some physiological and medical aspects of the gonadal cycle of domestic animals." Proc. Laurentian Hormone Conference, VII, p. 165, Academic Press, 1952.
- Gassner, F. X., Hill, H. J. "Correlation of fructose content of semen and rate of fructolysis to breeding efficiency of bulls." Copenhagen Proc., p. 62, July 1952.
- Gassner, F. X., Hopwood, M. L. "Seminal amino acid and carbohydrate pattern of bulls with normal and abnormal testes function." Proc. Soc. Exptl. Biol. and Med. 87, 37, 1952.

- Gassner, F. X., Rutherford, E. R., Hopwood, M. L., Hill, H. J. "Effect of castration and steroid therapy on seminal plasma with respect to fructose utilization by normal bull sperm." Proc. Soc. Exptl. Biol. and Med. 81, 43, 1952. Also to be printed Ciba Symposia.
- Gerhold, N. R., Henderson, W. J. "Soil treatment for the Control of pea root rot." USDA Plant Dis. Rptr. Spmt. 213. 1952.
- Gerhold, N. R., Henderson, W. J. "Relief from alfalfa killers in sight." Farm and Home Colo. Res. 2: (6). 1952.
- Gerhold, N. R., Twomey, J. A. "Control of damping-off of sugar beets." USDA Plant Dis. Rptr. Spmt. 213. 1952.
- Green, Ferris. "Western Slope Fruit Research Fruit Thinning." Colorado Farm and Home Research Vol. 2, No. 6. March-April 1953.
- Guss, Cyrus O., Rosenthal, Rudolph. "The reaction of diphenylethylene oxide and stilbene with 2-naphthol." J. Colo.-Wyo. Acad. Sci. IV (4), 29, 1952.
- Guss, Cyrus O. "The Chemistry of browning." "Contributions of browning research to ration item stability." Research and Development Associates Food and Container Institute. p. 26. August 1952.
- Harrington, H. D. "Orchidaceae of Colorado. Jour. Colo.-Wyo. Acad. Sci. 4:62. 1952.
- Hervey, D. F., Wasser, C. H. "Sagebrush to Grass." July 18, 1952.
- Holley, W. D. "Carnation Timing from a single pinch." Colo. Flower Grower. Bul. 44, June 1953.
- Holley, W. D. "Cold Storage of carnation cutting brought up to date." Colo. Flower Grower. Bul. 35, September 1952.
- Holley, W. D. "Can calyx splitting on carnations timing from a single pinch." Colo. Flower Grower. Bul. 38, December 1952.
- Holley, W. D., Wagner, David L. "Carnation timing from second pinches." Colo. Flower Grower. Bul. 40, February 1953.
- Holley, W. D. "Can calyx splitting on carnations be reduced by delay of disbudding?" Colo. Flower Grower. Bul. 34, August 1952.
- Holtzman, Oliver J. "Comparative studies of the pathogenity of three *Fusaria*." Jour. Colo. Wyo. Acad. Sci. 4:75. 1952.
- Holtzman, Oliver J. "Nature of pathogenicity in bacterial wilt of carnations." Jour. Colo.-Wyo. Acad. Sci. 4:74-5. 1952.
- Hubbard, Wm. H. "Malformation studies on better times rose." Colo. Flower Grower Assn. Bul. 39, January 1953.
- Hubbard, Wm. H., Farmer, Roger, Holley, W. D. "A comparison of two cutting methods on better times and pink delight roses." Colo. Flower Grower. Bul. 33, July 1952.
- Johnson, Gestur, Schaal, Lawrence A. "Relation of chlorogenic acid to scab resistance in potatoes." Science 115, 627, 1952.
- Johnson, Gestur, Johnson, Duane K. "Natural flavor retained in new frozen uncooked apple pulp." Food Tech. 6(7), 242, 1952.
- Jorgensen, Carl. "Prepare and enjoy frozen fruits and vegetables from your own gardens." Colo. A and M News. Vol. 7, No. 12, June 1952.
- Kunkel, Robert, Binkley, A. M. "Early Potato Planting Better?" Colo. Farm and Home Research. Vol. 4, No. 1, May-June 1953.
- Kunkel, Robert, Binkley, A. M. "Potato planting late comparisons." Colo. Potato Grower, May 1953.
- Livingston, Clark. "Relationship of the free amino acid content of sugar beets to disease resistance and susceptibility." Jour. Colo.-Wyo. Acad. Sci. 4:45. 1953.
- Matsumura, Hoshiharu. "Aquatic plants of Colorado and their comparison with aquatic flora of Japan." Jour. Colo.-Wyo. Acad. Sci. 4:70-71. 1952.
- McAnelly, Charles, Thomas, W. D. "Control of purple blotch of onions by sprays." Jour. Colo.-Wyo. Acad. Sci. 4:72. 1952.
- McAnelly, Charles, Thomas, W. D. "Variable sensitivity of different strains of *Fusarium* sp. toward fungicides." Jour. Colo.-Wyo. Acad. Sci. 4:72-73. 1952.
- Nelson, R. T., Deming, G. W. "Effect of bolters on weight and sucrose percentage of sugar beets." Amer. Soc. Sug. Beet Tech. Proc. pp. 441-444. 1952.
- Odom, R. E. "The carnation in legend and fable." Colo. Flower Grower Assn. Bul. 35, September 1952.
- Payne, Merle G., Fults, Jess L., Hay, Ruth J., Livingston, Clark. "Protein and nitrate nitrogen content and specific gravity changes in Red McClure potatoes due to 2,4-D treatment." Res. Prog. Rpt. Western Weed Control Conference. p. 77, 1953.
- Pyke, W. E. "The control of non-enzymatic browning in potatoes." Res. and Develop. Associates Food and Container Institute. p. 24, August 1952.
- Robertson, D. W. "Irrigated agriculture." Agron. Jour. Vol. 44, No. 12. 1952.
- Salander, R. C., Marcus Piano, Patton, A. R. "Quantitative aspects of paper chromatography." Jour. Colo.-Wyo. Acad. Sci. IV(4), 38, 1952.

- Schaal, Lawrence A., Johnson, Gestur. "Relation of chlorogenic acid in potato tubers to scab resistance." J. Colo.-Wyo. Acad. Sci. 4:72. 1952.
- Schaal, L. A., Johnson, Gestur. "Relation of chlorogenic acid in potato tubers to scab resistance." Jour. Colo.-Wyo. Acad. Sci. 4:72. 1952.
- Seliskar, C. E. "Cause and control of peach tree gummosis (*Valsa Leucostoma*). West. Colo. Hort. Soc. Proc. 9:53-57, 59-60. 1952.
- Simonds, A. O., Schaal, L. A., Johnson, Gestur. "Effect of chemical compounds on suberin formation in cut potato tubers." Jour. Colo.-Wyo. Acad. Sci. 4:69. 1952.
- Stewart, Dewey, Gaskill, John O. "Results of field tests with triploid sugar beets in 1951." Proc. Amer. Soc. Sug. Beet Tech. 452-453. 1952.
- Stonaker, H. H. "Plans for genetic increases in productivity of Indian cattle." Allahabad Farmer. November 1952.
- Stonaker, H. H. "Plus and minus effects of selection." Record Stockman. January 1953.
- Stonaker, H. H. "Heavier calves from inbred bulls." Colo. Rancher and Farmer. Dec. 13, 1952.
- Thomas, W. D. "Bacterial leaf blight, a new disease of onions." Jour. Colo.-Wyo. Acad. Sci. 4:68. 1952.
- Thomas, W. D. "Effect of aster yellows virus on carnation blossoms." Jour. Colo.-Wyo. Acad. Sci. 4:68. 1952.
- Twomey, James A. "Factors affecting the growth of *Fusarium oxysporum f. betae*." Jour. Colo.-Wyo. Acad. Sci. 4:73. 1952.
- Wagner, David L., Holley, W. D. "Unusually high day temperatures cause carnation calyxes to split." Colo. Flower Grower. Bul. 43. May 1953.
- Wasser, C. H., Hervey, D. F. "Fundamentals underlying the selection of species for range reseeding." Proceedings, Sixth International Grasslands Congress.
- Whitney, R. S., Peech, M. "Ion activities in sodium-lay suspensions." Soil Sci. Soc. Amer. Proc. 16:117-122. 1952.

**Financial Report**  
**Colorado Agricultural Experiment Station**  
**For year ending June 30, 1953**

<i>Receipts 1952 - 1953</i>				<i>Distribution of Funds by Classification</i>													
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, 1953	Grand Total
Hatch	15000.00		15000.00	9848.59	1107.34	39.80	31.39	245.22	179.55	177.37	1606.79	1310.25		453.70	15000.00		15000.00
Adams	15000.00		15000.00	12002.57	247.05	49.65	19.30	45.90		236.62	884.63	1109.59		404.69	15000.00		15000.00
Purnell	60000.00		60000.00	45252.71	3056.57	94.40	142.00	83.49	65.26	954.41	6559.69	1936.70		1855.04	60000.00		60000.00
Bankhead-Jones, Sec. 5	25460.16		25460.16	20002.25	910.37	4.36	61.15	252.91	39.15	229.59	2385.68	811.21		763.49	25460.16		25460.16
Bankhead-Jones, Sec. 9b1&2	41704.57		41704.57	32976.25	1642.63	4.55	51.15	203.06	16.68	409.39	3848.07	1252.53		1300.26	41704.57		41704.57
Bankhead-Jones, Sec.9b3	32800.00		32800.00	20987.00	2529.69	17.71	98.75	824.43	109.61	737.78	3293.04	3566.85		635.13	32800.00		32800.00
Bankhead-Jones, Sec.9b3 (Trust)	3050.00		3050.00		1850.00				1200.00						3050.00		3050.00
Mill Levy	30361.74	132527.43	162889.17	88645.91	2618.73	414.31	3713.75	4663.39	4979.08	9879.87	26127.22	4349.50		3149.87	148541.63	14347.54	162889.17
State General		226000.00	226000.00	131569.56	4560.72	545.94	936.17	7766.12	342.21	10801.97	48318.55	16257.36	45.00	4856.40	226000.00		226000.00
Plant Disease		25000.00	25000.00	14964.62	565.00	109.80	70.18	648.50		2942.78	2093.07	3159.85		446.21	25000.00		25000.00
Pure Seed		8000.00	8000.00	7541.55			59.72	2.75	49.20	34.88	119.24	103.50		89.16	8000.00		8000.00
Station Special	28762.85	107550.22	136313.07	25677.70	1024.78	109.84	103.59	11177.26	1293.03	4132.56	37848.82	29636.64		185.93	111190.15	25122.92	136313.07
Hybrid Corn	3360.28	3045.23	6405.51	388.26	169.36		42.00	16.00	96.95		556.33				1268.90	5136.61	6405.51
CARF	107994.17	208244.45	316238.62	110103.65	6756.02	229.21	603.49	10887.13	1079.80	37292.30	20909.96	12636.52		1472.72	201970.80	114267.82	316238.62
<b>TOTALS</b>	<b>170479.04</b>	<b>193014.73</b>	<b>710367.33</b>	<b>519960.61</b>	<b>27038.26</b>	<b>1619.58</b>	<b>5932.64</b>	<b>36816.16</b>	<b>9450.52</b>	<b>67829.25</b>	<b>154551.09</b>	<b>76130.50</b>	<b>45.00</b>	<b>15612.60</b>	<b>914986.21</b>	<b>158874.89</b>	<b>1073861.10</b>

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#### ANIMAL PATHOLOGY AND VETERINARY MEDICINE

A. W. Deem, D.V.M., M.S.....Chief Veterinary Pathologist  
Floyd Cross, D.V.M.....Veterinary Pathologist  
Rue Jensen, D.V.M., M.S.....Veterinary Pathologist  
Lynn A. Griner, B.S., M.S., D.V.M.....Assistant Veterinary Pathologist

Maxine M. Benjamin, B.S., D.V.M.....Assistant Veterinary Pathologist  
Walter R. Graham, D.V.M.....Assistant Veterinary Pathologist  
J. W. Tobiska, M.S.....Assistant Veterinary Pathologist  
V. A. Miller, D.V.M.....Assistant Veterinary Pathologist  
D. D. Maag, B.S., M.S.....Assistant Chemist (Pathologist)



## BOTANY AND PLANT PATHOLOGY

L. D. Durrell, Ph.D.....	Chief Botanist and Plant Pathologist	George H. Lane, M.S.....	Associate Plant Pathologist
Jess L. FuIts, Ph.D.....	Botanist	Norman R. Gerhold, M.S.....	Assistant Plant Pathologist
Bruce J. Thornton, M.S.....	Associate Botanist in Charge of Seed Laboratory	Carl E. Seliskar, Ph.D.....	Assistant Plant Pathologist
R. H. Porter, Ph.D.....	Plant Pathologist	Cooperators:	
Walter D. Thomas, Jr., Ph.D.....	Plant Pathologist	J. O. Gaskill, M.S.....	Plant Pathologist (USDA)
A. O. Simonds, Ph.D.....	Associate Botanist	L. A. Schaal, Ph.D.....	Associate Plant Pathologist (USDA)
H. D. Harrington, Ph.D.....	Associate Botanist	E. A. Lungren, M.S.....	Associate Plant Pathologist (USDA)
		Ross Davidson, B.S., M.S.....	Senior Pathologist (USDA)

## CHEMISTRY

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

## ENTOMOLOGY

Leslie B. Daniels, M.S.....	Chief Entomologist	Cooperators:	
John L. Hoerner, M.S.....	Associate Entomologist	F. B. Knight, M.F.....	Entomologist (USDA)
J. H. Newton, B.S.....	Associate Entomologist	Calvin Massey, Ph.D.....	Entomologist (USDA)
Theodore O. Thatcher, Ph.D.....	Associate Entomologist	R. H. Nage, M.S.....	Entomologist (USDA)
Joseph O. Moffett, M.S.....	Assistant Entomologist	B. H. Wilford, Ph.D.....	Entomologist (USDA)
George M. List, Ph.D.....	Professor Emeritus	N. D. Wygant, Ph.D.....	Entomologist (USDA)

## FORESTRY AND RANGE MANAGEMENT

C. H. Wasser, M.S., M.F.....	Chief Grazing and Range Management	Donald F. Harvey, M.S.....	Chief Range Conservationist
		H. E. Troxell, Jr., M.F.....	Assistant Forester

## HOME ECONOMICS

Elizabeth Dyar, Ph.D.....	Chief Home Economist	Marianne Kulas, M.S.....	Assistant Home Economist
Ferne Bowman, Ph.D.....	Home Economist	May E. Combs, M.S.....	Assistant Home Economist
Miriam E. Hummel, M.S.....	Assistant Home Economist		

## HORTICULTURE

A. M. Binkley, M.S.....	Chief Horticulturist	W. D. Holley, M.S.....	Associate Horticulturist
George A. Beach, M.S.....	Horticulturist	R. F. Farmer, B.S.....	Associate Horticulturist
Robert Kunkel, Ph.D.....	Horticulturist	C. W. McAnelly, M.S.....	Assistant Horticulturist
Carl J. C. Jorgensen, M.S.....	Associate Horticulturist		

## POULTRY

E. G. Buss, M.S.....	Acting Chief Poultry Husbandman	T. E. Hartung, B.S.....	Assistant Poultry Husbandman
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## RURAL ECONOMICS AND SOCIOLOGY

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

## CIVIL ENGINEERING

D. F. Peterson, D.C.E.....	Chief Civil Engineer	Maxwell Parshall, B.S.....	Assistant Civil Engineer
W. E. Code, B.S.....	Associate Irrigation Engineer	A. R. Robinson, M.S.....	Assistant Civil Engineer
M. L. Albertson, Ph.D.....	Associate Civil Engineer	Cooperators:	
S. D. Resnick, M.S.....	Assistant Civil Engineer	H. J. Stockwell, B.S.....	Irrigation Engineer (USDA)
Jack E. Cermack, M.S.....	Assistant Civil Engineer	J. N. Washichek, B.S.....	Engineering Aide (USDA)
E. F. Schutz, B.S.....	Assistant Civil Engineer		

## MECHANICAL ENGINEERING

J. T. Strate, M.S., M.E.....Chief Mechanical Engineer  
R. D. Barmington, B.S., M.E.....Associate Mechanical Engineer

John E. Dixon, B.S., A.E.....Assistant Agricultural Engineer

## BRANCH STATIONS

Herman Fauber, M.S.....Superintendent, Arkansas Valley  
Branch Experiment Station  
Ferris M. Green, B.S.....Superintendent, Western Slope  
Branch Experiment Station  
Verne Cooper, Jr., B.S.....Superintendent, San Luis Valley  
Branch Experiment Station  
Kent Riddle, B.S.....Assistant Animal Husbandman,  
San Juan Basin

H. O. Mann, B.S.....Assistant Agronomist, San Juan Basin  
Cooperators:

W. C. Edmundson, M.S.....Senior Horticulturist, USDA,  
Colorado Potato Station  
J. F. Brandon, B.S.....Associate Agronomist, USDA,  
Dry Land Field Station

## PERSONNEL CHANGES

Joining the staff during the fiscal year were the following:

F. P. Browning.....Assistant Civil Engineer  
Dorothy Brown.....Laboratory Assistant, Chemistry  
Verne Cooper, Jr.....Superintendent, San Luis Valley  
Branch Experiment Station  
Ford C. Daugherty.....Associate Animal Husbandman  
Alex D. Dotzenko.....Assistant Agronomist  
John R. Douglas.....Assistant Chemist  
N. A. Evans.....Assistant Civil Engineer

Richard H. Garber.....Assistant Superintendent,  
San Luis Valley Experimental Farm

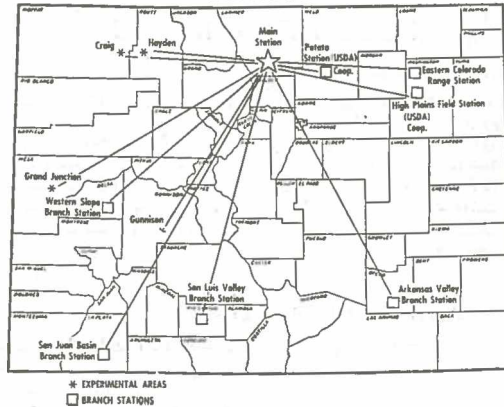
D. D. Johnson.....Assistant Agronomist  
Pin-Nam Lin.....Assistant Civil Engineer  
C. W. McAnelly.....Assistant Horticulturist  
V. A. Miller.....Assistant Pathologist  
Kent Riddle.....Associate Animal Husbandman

Resignations from the staff during the fiscal year were the following:

John R. Douglas.....Assistant Chemist  
Roger Farmer.....Assistant Horticulturist  
Richard H. Garber.....Assistant Superintendent,  
San Luis Valley Experimental Farm

James E. Ingalls.....Assistant Animal Husbandman  
Lois Lucas.....Research Assistant  
Ivan L. Madsen.....Assistant Poultry Husbandman  
C. E. Yih.....Associate Civil Engineer

## Branch Stations and Experimental Areas COLORADO



Colorado's great variations in growing season, soil, water and other factors create agricultural problems that must be solved by research on a sectional basis. To work on these problems where they occur, the Colorado Agricultural Experiment Station operates seven Branch Experiment Stations. In some cases, Federal agencies cooperate in the operation of these branch stations.

In four experimental areas, applied research is underway with the cooperation of farmers, ranchers and Federal agencies. Research carried out at both the branch stations and the experimental areas performs a vital role in our total service to agriculture, Colorado's principal industry and principal producer of new wealth.