

serves COLORADO AGRICULTURE

Sixty-fifth Annual Report COLORADO AGRICULTURAL EXPERIMENT STATION OLORADO AGRICULTURAL and MECHANICAL COLLEGE FORT COLLINS



Agricultural Building Colorado Agricultural Experiment Station

Letter of Transmittal Sixty-fifth Annual Report Colorado Agricultural Experiment Station

Honorable Daniel I. J. Thornton Governor of Colorado Denver, Colo.

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-fifth Annual Report of the Colorado Agricultural Experiment Station for the fiscal year of July 1, 1951 to June 30, 1952, inclusive.

Sherman S. Wheeler.

Fort Collins, Colorado July 1, 1952 Director

Branch Stations and Statewide Testing Program

The cash income from Colorado crops and livestock exceeds 500 million dollars annually. Few states have more widely diversified and specialized patterns of production and marketing of agricultural products. Great variations in growing season, soil, water, and other factors create problems requiring area or sectional approach. To solve these problems where they occur, the Colorado Agricultural Experiment Station, with the cooperation of Federal agencies at a number of locations, operates seven Branch Experiment Stations. Applied research is also being conducted in four experimental areas through cooperation with Federal agencies and local farmers or ranchers. The location of these out-state research establishments is shown on the map below.

COVER PICTURE

Performing the simple new test developed at the Colorado Experiment Station to determine the scab resistance in potato varieties. The test is made by removing a portion of the skin of a tuber, then applying a drop of $FeC1_2$ to the wound. If a potato is resistant to scab, the wound turns a dark green in color, as shown on the center tuber.

Branch Stations and Experimental Areas



BRANCH STATIONS

CONTENTS

Page

Field Crops-	
Efforts of Alfalfa in Rotation	4
Effects of Moisture Stress on Plant Growth	4
Effect of Moisture Stress on Frant Growth	E
Corn Breeding Studies	
Hybrid Coin Performance Tests	0
Seed Laboratory	6
Improved Seed	6
Foundation Seed	6
Pinto Bean Varieties	6
a u I Frankilianua	
Soils and Fertilizers-	0
Availability of Fertilizers to Plants	ð
Potato Fertilization	8
Use of Urea as a Fertilizer Sprayed on	0
Crops	8
Irrigation, Drainage and Soil Fertility	9
Onion Fertilization	9
Cooperative Soil Testing Laboratory	10
Restoring Productive Capacity to Land Af-	
ter Surface Soil Removal	11
Soil Management Practices	11
Reclamation of Alkaline, Saline Soils	12
Rechanged of Frances, States	
Irrigation Engineering-	
Evaluation of Weather Modification	14
Snow Surveys	14
Groundwater	14
Well Screens	14
Canal Seenage Measured	14
Canal Seepage Measured Intrigation	15
Sprinkler versus Fullow Hilgation	
Horticultural and Floricultural Crops-	
Horticultural Crops-	
Improvement of Canning Tomatoes	18
Botato Broading Variaty Testing	18
Polato Breeding, variety resting	10
Union Breeding	10
Effect of 2,4-D on Potatoes	18
Non-Enzymatic Browning	18
Processing Quality of Colorado Fruits and	
Vegetables	19
Floricultural Crops—	
Carnation Nutrition	20
Malformation of Roses	20
T I THE I DIE & Dies and	
Insects, weeds and Plant Diseases-	
Insects	22
Plant Diseases-	
Disease-Resistant Barley	23
Discase of Field Poars	00
Diseases of Stone Emile	40
Diseases of Stone Fruits	20
Gummosis—A New Peach Disease	23
Diseases of Ornamental Plants	24
Sugar Beet Diseases	25
Diseases of Onions	25
Disease Fighting Chamical in Potatoos	or
Disease-Fighting Chemical III I Clarges	20
Weed Control	20

Range and Pasture Management	
Grasses	28
Range Condition Guide	28
Improved Range Practices	28
Range Revegetation	28
Legumes in Dryland Pastures	29
Improving Sagebrush Range	20
Irrigated Pasture for Dairy Cattle	29
Fence Post Treatment	20
Mountain Meadow Improvement	30
Livestock and Poultry-	00
Livestock—	
Range Grasses, Vitamin A	29
Concentrate-Roughage Ratios in Cattle Fat-	92
tening Rations	32
New Feeds in Cattle Rations	32
Feeding to Obtain Desirable Market Weights	
in Lambs	33
Effect of Hormones on Reproduction in	00
Lactating and Anestrous Ewes	33
Necrobacillosis in Cattle and Sheep	34
Shipping Fever	34
Diagnostic Laboratory	34
Studies on New and Increasingly Important	
Diseases	35
Chemical Compounds Affecting Thyroid Physiology	35
Assay and Characterization of Pituitary	
Protein Hormones	35
Fertility of Bulls	35
Effects of Certain Agents on Pituitary Hor-	0.5
mones	30
to Metabolism and Reproduction	36
Poultry—	0.0
Large Hock Studies	00
Growth Stimulus in Chicks from Molasses	36
Becommended Louds of Fooding Chaling	00
Equivalent	36
Mechanical Engineering—Economics and Sociology—	
Mechanization of the Sugar Beet Industry	38
Mechanical Thinning	38
Debudration of Sugar Best Tons	38
Economics and Sociology	38
Home Feeromics	
Improved Breed Formulae	40
Nutritional Status Among Croung in Cala-	-10
rado	40
Housing Needs of Rural Families	40
Information and Publications	41
Financial Report for Year Ending June 30	
1952	48
Administrative Officers and Staff	49
Personnel Changes	51

Page



What effect does alfalfa have on the crops that follow it in a rotation? Sixteen-year-old tests by the agronomy section comparing two rotations, neither fertilized, showed that crops in an 8-year rotation containing 3 years of alfalfa outyielded crops in a 5-year rotation without alfalfa. However, yields declined in both rotations.



Scientists illustrate the increased height of grain growing on soil where the crop rotation has included alfalfa.

The role of the fertilizers nitrogen and phosphorus in the same rotations has also been illustrated by the study. Phosphate applications gave greater yield increases in the 8-year rotation. In the 5-year rotation containing no alfalfa, greater yield responses were obtained from nitrogen, or from nitrogen in combination with phosphorus.

When both nitrogen and phosphate were applied to the two rotations, there was little difference between them, except that the character of the crops showed a much higher nitrogen level in the 8-year rotation which contained alfalfa.

Effect of Moisture Stress On Plant Growth

An agronomy experiment is demonstrating that maximum crop yields in Colorado may depend heavily on two limiting factors: amount of water available and level of soil fertility.

Barley sown with alfalfa, the test

crop used in the 1951 study of these factors, yielded increasingly more grain and straw as nitrogen applications were increased. Grain yields decreased markedly at lower moisture levels, while straw yield also showed a decrease.

Corn Breeding Studies

Two new hybrid corn varieties were released to Colorado growers in 1951, the products of corn breeding studies. They are Colorado 120, for northern Colorado growing conditions and Colorado 330 for southern Colorado.

Tests at Fort Collins have brought to light five new hybrids which significantly outyielded Colorado 152, which, itself has been a consistently high yielder in the northern irrigated areas of the State. The highest yield among the experimental hybrids was 81.7 bushels of shelled corn per acre, compared with 71.9 bushels per acre for Colorado 152 grown in the same tests.

Yield tests of 22 Colorado experimental hybrids in the Arkansas Valley in comparison with 3 standard varieties indicated that 10 of the new hybrids outyielded Colorado 332 while 7 outyielded U. S. 13.

Hybrid Corn Performance Tests

The Colorado farmer has a wide choice of good hybrid corn varieties regardless of where in the State his farm is located, according to performance tests carried on in 5 different regions and evaluated for 5 years.

Under irrigation, the highest yielding varieties for northern Colorado in 1951 tests at Fort Collins were: Colorado 152, DeKalb 240, Pfister P.A.G. 56 and Colorado 120. The high variety in Arkansas Valley tests at Rocky Ford was Keystone 45; in tests in the South Platte Valley at Brush, the high yielder was Iowa 4297.

Results from dryland hybrid tests indicate that some of the better hybrids will outyield local open-pollinated varieties. Average yields at the Akron Field Station indicate that two hybrids, Colorado 152 and DeKalb 65 yielded 34 percent more shelled corn per acre than did open-pollinated Akron White during the 5-year period from 1946 to 1951 (no yields in 1949). Dryland tests in Phillips county at Haxtun showed that Colorado 152 outyielded the local open-pollinated Phillips County Yellow Dent by 10 percent. Other varieties that yielded high for a 4-year period included Cornhusker 107 and Pfister P.A.G. 270.

Hybrid corn, such as this growing in the Arkansas Valley of Colorado, has generally replaced open-pollinated corn grown in the State since 1940. More than 90 percent of the irrigated corn grown is hybrid.



Seed Laboratory

Continuing its main function of testing seeds for the citizens of Colorado, the Colorado Seed Laboratory this year took stock of the trends in number of samples sent to the laboratory during the past 10 years. From a low of 1,525 samples sent t_0 the laboratory in 1941, the number of samples increased steadily to a peak of 4,420 samples in 1945. In 1950, 3,414 samples were tested for growers.



Much tedious hand-work is necessary in performing accurate germination tests in the Colorado Seed Laboratory. Here, seed is being counted out to be placed on moist blotters. It will then be put in an automatic, temperature-controlled germinator for 7 to 10 days to test germination

Improved Seed

Lee wheat has been found suitable for Colorado growing conditions in variety tests conducted by the agronomy section. This rust-resistant spring wheat produced by the Minnesota Station in cooperation with the U. S. Department of Agriculture was recommended for certification.

Foundation Seed

A total of 33,135 pounds of foundation seed was sold to growers during the past year.

Pinto Bean Varieties

Results of variety tests on pinto beans have prompted agronomists to recommend Idaho III, a bush-type pinto bean, for close row planting under irrigation. Under dryland conditions, San Juan, a vining type pinto, is being recommended where a late bean is desired.

The Geiger counter becomes an essential instrument to the scientist in this atomic age. It is used in determining the uptake of radio-active fertilizers by crops. This information affords the key to how much fertilizer various crops need for best growth.

-6-

Soils and Fertilizers

Availability of Fertilizers to Plants

F ield tests in cooperation with the Tennessee Valley Authority, the USDA and the phosphate industry in 1951 indicated that the phosphoric acid in nitric phosphates and Rhenania phosphate were equal to concentrated superphosphate in availability for plant use. This indication was borne out by radioactive test data as well as crop yield results.

Calcium metaphosphate was as available as superphosphate when the fertilizer was plowed under 1 month before planting, but was not available when both materials were applied at the time of planting.

An indication that consideration should be given to the placement of fertilizer in relation to plant roots was also shown in the tests. Phosphate fertilizer that was plowed under was more available to the test crops, sugar beets and barley, early in the season than was phosphate side-dressed.

Further tests showed that penetration of phosphate application will increase with an increase in the water solubility of the fertilizer, with an increase in the rate of fertilizer application, with an increase in the amount of water added, as well as an increase in the rate that the water is applied. Penetration also increased in the coarser textured soils.

Potato Fertilization

Results of tests in northern Colorado by horticulturists in cooperation with the USDA, the agronomy section of the Experiment Station and the Extension Service, indicate that little response can be expected from application of commercial fertilizer to late planted (June 15) potatoes.

There has been no response in either the late or early districts from copper, iron, manganese and zinc applications. In the San Luis Valley, the standard placement of phosphate fertilizer (2 inches to the side and 2 inches below the seed piece) appears to be superior to the highlow band method.

Fertilization of potatoes in years of limited moisture supply fails to produce profitable returns on the fertilizer and may even be detrimental.

Use of Urea as a Fertilizer Sprayed on Crops

8

Negative results were obtained in 1year-old tests aimed at determining the value of urea solutions as a means of fertilizing crops by spraying the nitrogen solutions on the foliage.

Yield of dryland wheat at the Agronomy farm was not materially influenced by urea solutions at any rate, concentration, or date of application.

However, when 25 pounds of N was applied per acre to a nitrogen-deficient oat crop 5 days after the crop headed, yield was increased by about 9 bushels per acre. A 50-pound rate per acre proved no better than the 25-pound application.

Irrigation, Drainage and Soil Fertility

... in relation to alfalfa production in Upper Colorado River Basin.

A nitrogen deficiency of soil producing corn and other non-leguminous crops and a phosphate deficiency may be seriously affecting alfalfa production in the Grand Junction area, agronomists have found.

Cooperative drainage and soil reclamation studies with the civil engineering section and the USDA near Grand Junction indicate low transmissability of the soil materials. Factors contributing to this condition have been found in the laboratory to be: high exchangeable sodium percentages, high silt percentage, and clay mineral types which do not readily form aggregates.

Onion Fertilization

Onion yield increases obtained from tests by horticulturists at the Arkansas Valley branch station from application of more than 450 pounds per acre of $1-4-\frac{1}{2}$ ratio have not been sufficient to justify applications above the 450-pound rate. Increasing the ratio of application up to 1,000 pounds per acre did not increase yields enough to justify the costs over the 450 pounds per acre rate.

Nitrogen and phosphorus appear to be the important combination in an onion fertilizer for the area and potash seems of slight importance.

__9__

Samples of one of eight new hybrid onion varieties developed by Colorado Experiment Station scientists. The hybrids produce higher marketable yields after storage than varieties now grown. Scientists estimate the hybrids will be ready for growers by 1956.



Cooperative Soil Testing Laboratory

Continued wide use is being made of the services offered by the cooperative soils laboratory operated by the Colorado Experiment Station and the Soil Conservation Service.

During 1951, the laboratory processed 2,177 soil samples, involving 16,402 tests. The samples were submitted by SCS personnel, farmers, gardeners and Extension Service personnel.

Several thousand soil samples are analyzed by the Cooperative Soil Laboratory each season. Samples are carefully recorded and stored in the laboratory for a period, pending further questions by farmers about their particular soil.





Soil samples undergo laboratory tests to determine acidity, alkalinity, soluable salt percentage, and the amount of phosphates, nitrogen, potash and organic matter available in the soil.

Electronics are brought into use when testing soil for soluble salts. A tone sounds in the earphone held by the technician indicating the presence of salts.

Restoring Productive Capacity to Land After Surface Soil Removal

Erosion or land leveling operations remove surface soil and with this valuable component goes much of the land's productive capacity. In an effort to restore this productivity, agronomists in cooperation with the USDA have experimented with various fertilizer treatments applied to crop rotations grown on land exposed by leveling.

On one experimental area, where alfalfa appeared for the first time in the rotation in 1951, phosphorus gave the greatest increase in yield. The phosphatetreated plot yielded almost twice (1.92 tons) as much alfalfa at the first cutting as did the non-fertilized plots.

On a second area, where the 1951 crop was barley, manure plus applications of phosphate (500 and 1,000 pounds per acre of treble superphosphate) produced yield increases that were significantly better than those made on non-fertilized plots. Alfalfa green manure, applied 2 years earlier, boosted the barley yield by 2 bushels per acre.

Soil Management Practices

In a cooperative search with the USDA for the best tillage practices to reduce the tendency for storm crusting and formation of tillage pans on arid and semiarid land in Colorado, agronomists have found that the pans can be caused by a single tillage operation with heavy equipment on silty soils where soil moisture is from three-fourths to full field capacity. Chisel-type implements have proved more effective than the duckfoot or Noble blade in breaking the tillage pans.

Sheet and gulley erosion on slopes up to 8 percent can be effectively reduced through stubble mulching, the agronomists found. Stubble mulch has also materially reduced the formation of storm crusts on hardland soils.





This 20-acre tract in Colorado's San Luis Valley may furnish information that will help ma 100,000 acres of alkaline soil in the area more productive. Tests are being made here of the posbility of leaching accumulated salts from the soil and neutralizing salts with various soil ame ments.

Reclamation of Alkaline, Saline Soils

-12-

The possibility of reclaiming large acreages of saline and alkaline soils in the San Luis Valley of Colorado is being studied through a cooperative project involving the agronomy and civil engineering sections of the Colorado Experiment Station, state and local agencies and the Bureau of Reclamation.

Drainage and soil amendments are the two restorative measures being investigated. A combined drainage and irrigation well and a pump have been installed on a plot at the experimental site in the valley, which is one of the few sub-irrigated areas of the world. Soil amendments are being applied to plots, which will later be leached.

The large area of light-textured, poorly drained soils in the valley, estimated at 100,000 acres, is high in replaceable sodium and now unproductive. If the sodium could be replaced and soil structure improved, the area has possibilities of becoming productive crop land.

Irrigation Engineering

Evaluation of Weather Modification

Engineers at the Experiment Station have reached a strong conclusion backed by statistical results that the efforts of a commercial company to increase rainfall by artificial nucleation were not effective in producing any major change in rainfall.

Snow Surveys

Snow accumulation for 1952 on practically all mountain areas in northern Colorado was at a record high since snow surveys were started in 1936.

The surveys, which are conducted in cooperation with the USDA, made pos-

sible advance preparations for floods in the San Luis Valley and elsewhere saving possibly many millions of dollars in flood destruction. The forecasts also allowed greatly increased energy production on the North Platte Reservoir system during February, March and April 1952.

Groundwater

Water tables continued to recede in many critical areas as shown by spring and fall measurements made at observation wells over the State. The critical areas included Bijou, Kiowa and Beaver valleys. Observation wells in pumping areas under canals of the South Platte and Arkansas valleys in general showed a somewhat lower water table in the fall of 1951 than in the fall of 1950.

Well Screens

Criteria for the design and construction of gravel envelopes to reduce or stop the flow of destructive sand into irrigation wells have been developed by engineers at Colorado A and M College working cooperatively with the USDA. The amount of sand carried through the envelope depended primarily on the velocity of flow and the size of the gravel in relation to the size of the sand.

Canal Seepage Measured

-14-

Seepage meters designed to estimate the amount of seepage from irrigation canals are being tested by Station engineers in cooperation with the USDA. Results obtained with meters are compared with those noted in seepage rings located in sandy soil and clay soil.

Although results vary considerably at times, engineers believe the devices indicate magnitude of seepage quite well.

Sprinkler Versus Furrow Irrigation



Orchard irrigation with lowangle sprinkler.

No significant differences have shown up in comparisons of sprinkler and furrow irrigation in fruit orchards on Colorado's western slope. Engineers working with the Experiment Station-USDA cooperative study have noted, however, that orchard cover crops seem somewhat better under sprinkling.

Experienced users of sprinkler irrigation throughout the State are being interviewed to obtain information regarding best design and proper use of the equipment.



Water loss from seepage in irrigation channels is as old as the art of irrigation. The tank above is useful in determining rates of water seepage through several types of soil. This information will be valuable in predicting the amount of water that will be lost through seepage as canals and ditches pass through various soil types.



Flow of 50 second-feet through a 15-foot concrete block Parshall measuring flume. Developed cooperatively by the Colorado Experiment Station and the USDA, the Parshall flume is now used throughout the world. Use of concrete block has simplified construction of the irrigation device.



Flow of 400 second-feet through a 25-foot concrete block Parshall measuring flume, Greeley No. 2 Canal.

Horticultural and Floricultural Crops

Horticultural Crops

Improvement of Canning Tomatoes

Hybrid tomatoes tested by horticulturists are giving better yields than standard varieties now grown, but early maturity of the hybrids has not yet been obtained. With major emphasis on earliness of maturity, 73 tomato hybrids were tested for yield and quality at Longmont and Platteville in cooperation with canning companies.

In connection with transplanting tests the technicians have found that better and earlier yields of tomatoes can be obtained by giving consideration to plant source, plant spacing and improved methods of handling plants.

Potato Breeding, Variety Testing

Fifteen varieties of potato seedlings have shown sufficient promise in their disease resistance, type performance and quality to warrant increasing the seed supply for further testing. This work is cooperative with the USDA, Colorado Certified Seed Growers and the potato growers Administrative Committee, Area "3".

Onion Breeding

Hybrid onion trials were conducted by horticulturists in the Arkansas Valley, western Colorado and northern Colorado to compare their yielding ability and resistance to field and storage diseases. They found several hybrids which were superior in yield and had fair resistance to disease. The superior hybrids are being increased now so that more seed will be available for more extensive testing. The trials are in cooperation with the USDA and local groups.

Effect of 2,4-D on Potatoes

Protein in Red McClure potato tubers has been significantly increased by treatment with 2,4-D in cooperative tests with the USDA and local groups. The same treatment produced significantly higher amounts of free glutamic acid and lower amounts of all other amino acids studied than did untreated potatoes.

Non-Enzymatic Browning

-18-

Station workers working with the USDA, Quarter Masters' Corps and others have found that the carbohydrate portion in fruits and vegetables is destroyed by non-enzymatic browning much faster than the amino acid portion.

Marked differences in susceptibility to browning exist in the several amino acids. Apparently the major loss in nutritive value during browning is due to the formation of undigestible linkages, rendering amino acids unavailable, although still present.

Processing Quality of Colorado Fruits and Vegetables

While determining the processing qualities of 18 varieties of apples, 6 varieties of pears and 2 varieties of prunes, Station technicians found that the Orleans apple, which has many of the characteristics of the Delicious, has the additional qualities of being more acid to taste and having a very low rate of enzymatic browning.

The technicians successfully stored Jonathan apples for 1 year at 35°F. in polyethylene bags.

-19---

Five major fruit crops are grown in Colorado: apples, peaches, pears, and sweet and sour cherries. On the average, 187,000 bushels of the delicious pears shown below are marketed.

Much of the Experiment Station's research on fruits is carried out at the Western Slope branch station located near Austin in the heart of a major fruit-producing area.



Floricultural Crops

Carnation Nutrition

In a cooperative study with the botany and plant pathology section of the Experiment Station and a State flower-growing association, of the nutrition of carnation plants, horticulturists have found that high yields of the flowers can be obtained with the high nitrogen treatment tested at any moisture level. The most economical method, however, was determined to consist of medium moisture and high moisture levels in the soil.

Malformation of Roses

Light and temperature have been indicated as the two principal trouble-making factors in the malformation of rose flowers.

Results of research involving the cooperative efforts of a state flower-growing association, also point up the importance of heredity and indicate the development of clonal lines may offer possibilities for reducing losses as well as improving flower color.

Nationally famous high-altitude carnations are under constant experimentation in the Colorado A and M greenhouses.



Insects, Plant Diseases and Weed Control

Insects

Study of effective control measures for insects harmful to Colorado crops brought out the following results in 1951:

Green Peach Aphid

DDT and parathion used as fall sprays will give effective control.

Insect Vectors of Potato Viruses

- 1) Parathion applied either in two or three applications gave effective control of the potato aphid.
- 2) DDT applied three times gave better control than two applications.
- 3) Compound 269 (Julius Hyman) applied three times during the season gave control sufficiently effective to justify further tests at varying rates.
- 4) Metacide applied three times during the season gave, along with parathion, the most effective controls of all materials tested.

Honeybees—European Foulbrood

- 1) Feeding streptomycin .1 gram per quart gave 62 percent recovery on 58 colonies.
- 2) Feeding penicillin gave very poor results
- 3) Spraying with streptomycin on each frame apparently stopped spread of the disease, but a satisfactory method of application must be found.

Apple and Pear Insects and Pests

- 1) EPN gave the best control for both codling moth and red banded leaf roller.
- 2) EPN, parathion, TDE and compound 4049 gave excellent control of red banded leaf roller.
- 3) TDE in combination with sulfur was comparable to DDT and sulfur combination for control of mites, codling moth and leaf roller.

Lesser Bulb Fly (Onions)

Best results were obtained with aldrin at 8 ounces and 1 pound per acre in fine applications at 14-day intervals.

Army Cutworm

Sodium fluosilicate bait gave the most satisfactory control. A bait containing aldrin was second best.

Pale Western Cutworm

Aldrin applied as a spray has shown promise.

-22---

buildup of susceptible stock.



Improvement of management factors for bee colonies receives prime attention of Experiment Station entomologists. Here, (left) a technician uses the gas of calcium cyanide to kill weak, diseased colonies and (right) the colony is "re-queened" to prevent



Sugar Beet Webworm

Field application gave excellent control with EPN (lindane, toxophene, parathion, metacide and established pyrethrins). Best results were from aircraft apnlication with toxophene at 2 to 3 pounds ner acre in high-grade kerosene.

Alfalfa Weevil

Four ounces of technical dieldrin and 2.5 pounds of technical chlordane gave positive protection as evidenced by larval counts and condition of hay at harvest time.

Plant Diseases

Disease-Resistant Barley

Stocks of barley resistant to a disease similar to virus yellows have been obtained through crossing and selection. to be used in efforts to transfer the resis-

Experiment Station scientists have identified the organism causing gummosis of fruit trees, which reveals its presence in orchards through cankers similar to those shown on the tree below.



tance to commercial types of barley

Diseases of Field Beans

Dithane was found in comparative tests to be a good treatment for root rot of field beans in experimental test plots.

Diseases of Stone Fruits

GUMMOSIS . . . a new peach disease

Plant pathologists have identified the organism causing gummosis, a new disease in peaches in Colorado. They have also determined the most active time of development of the gummosis canker and the time of infection. In a survey of 13,000 trees. 15 to 40 percent were found to be affected by the canker.

Peach trees have been found to be a host for rasp leaf virus disease which occurs in plums. Yakima plum is suspected of being a carrier of X-disease.

Tests for a number of years indicate that the mild form of peach mosaic known as "hairy break" does not develop into the severe form and does not affect the commercial value of the peach. Evidence indicates that presence of the mild form inhibits the development of trees inoculated with the severe form.

-23---

Control measures and disease findings connected with ornamentals took on the following aspect in 1951:



Carnation rust.

Carnation Mosaic Virus

Technicians have determined that more than one strain of carnation mosaic virus exists.

Carnation Rust

Manganese ethylene-bis-dithiocarbamate and captan are superior to other agents for control of carnation rust.

Resistant Carnation Stocks

Three parent stocks of carnations proved highly resistant to both bacterial wilt and Fusarium branch rot. Four other strains are resistant to Fusarium branch rot alone.

Rose Mildew

Iscothane and manganese ethylene-bis - dithiocarbamate have been found to be better than sulfur for controlling rose mildew. 50-P-334 gave excellent control of carnation rust and rose mildew.

Bacterial Wilt Organism

... can survive at least 6 months in the soil and even on the dry wood of greenhouse benches.



Rose mildew

Carnation Fusarium

... can be harbored by other crops and the Fusaria which attack beans and tomatoes will mildly attack carnations.

Sugar Beet Diseases

Fusarium Yellows

Beet varieties No. 304 and 359 showed moderate resistance to Fusarium yellows.

Seedling Blight

Progress of seedling blight is favored by high temperatures around 85"F., soil acidity and low soil moisture.

Fusarium Fungus

Apparently sugar beets are susceptible to the Fusarium fungus at any stage of development. Where Pythium fungus and Fusarium fungus are both present, infection is more rapid and severe. The Fusarium fungus will also attack alfalfa and field beans.

Diseases of Onions

During the past year, which brought the appearance of a new bacterial leaf spot on onions, the following significant results were obtained by Station plant pathologists and botanists:

Downy Mildew

Yellow cuprocide and tribasic copper sulfate have proven superior to other chemicals in the control of downy mildew.

Purple Blotch

Yellow cuprocide and Vancide 51 afforded effective control of purple blotch.

Disease-Fighting Chemical in Potatoes

Two chemical substances were discovered to form a thick corking on cut potatoes that tends to prevent infection and seed piece rot.

The substances, catechol and chlorogenic acid, work with extreme rapidity to form the excess cork development.

A New Vinyl Resin

... has proved very effective as a sticker which alleviates the problem of making toxic materials stick to glossy onion leaves.

Determining scab resistance in potato varieties.



Weed Control

Investigations of weed control methods brought the following significant findings:

Plant Growth Regulators

2,4-D and Perennial Weeds

Best results in treating perenniai weeds with 2,4-D are obtained when treatment is made in a competitive crop. A thrifty, well-irrigated pasture furnishes an ideal situation.

Canada Thistle

This weed has been virtually eliminated in 3 to 4 years and Russian Knap-

The red color of potatoes can be in-

creased, thus enhancing their market value, by application of maleic hydrazide late in the season following an early treatment with 2,4-D.

Researchers have also determined that soil treatment of potatoes with 2,4-D and pentachlorophenoxyacetic acid increases the development of chlorogenic acid in the potatoes. Chlorogenic acid causes potatoes to be resistant to scab. weed in 4 to 5 years with 2,4-D treatment when treated under conditions indicated above.

Bindweed

State.

Tests for 5 years at the Arkansas Valley Branch Station indicate that when treating bindweed alone without benefit of competitive crop, little is accomplished after the second year.

Chemicals known as IPC and TCA along with a new chemical manufactured by a local chemical company are being tested for successful control of wild barley, a problem weed in the San Luis Valley and in other scattered areas of the

Plants and human skin can be protected from ultra-violet radiation by a substance known as uracil, Station workers have found.



Scientists have found that a 50-cent piece can be used as a good guide for determining proper tuber size for spraying potatoes with 2,4-D. The hormone spray intensifies the color of Red McClure potatoes, produces a tuber containing more vitamin C, and helps form a tougher skin on potatoes.

-26-

Range and Pasture Management

Nutritive Value of Native Range and Seeded Grasses

Greater protein content and narrower nutritive ratio along with greater forage yields are attributed by range technicians as the main reasons for the increased beef production on fertilized seeded pastures.

Forage samples show that this nutritive advantage is present in all seeded grasses in the early spring and remains throughout the season in Russian wild rye. Good rainfall years also favor higher nutritive content of the grasses.

Range Condition Guide

Station range scientists have prepared a range condition guide for upland plains ranges which is proving valuable to ranchers in their efforts to stock ranges and

A range condition guide prepared by Station scientists is helping this stockman determine the best rate to stock his rangeland.



accomplish good range improvement. It is also an aid in evaluating results of past management in terms of kind and amount of forage which a site can produce.

Improved Range Practices

Grazing capacity of ranges can be increased two to six times and beef production boosted as much as two to four times through proper range reseeding with adapted grass species.

These conclusions drawn from grazing comparisons of native and seeded ranges near Fort Collins also point out that tall wheatgrass, Russian wild rye and intermediate wheatgrass are outstanding beef producers and more productive than crested wheatgrass and smooth bromegrass commonly grown.

Range Revegetation

November and April appear to be the better dates for seeding cool-season grasses, Station scientists have found. Early fall seeding of grasses at Great Divide, Colorado, has produced superior stands.

They have also determined that native range responds to nitrogen fertilization, but not to a degree that would be economical.

Legumes in Dryland Pastures

Testing dryland legumes in an effort to alleviate the sod-bound condition that often exists in nitrogen-starved seeded pastures, technicians have found that Sevelra, Ladak, and Nomad are outstanding in alfalfa forage production. Rhizoma and Utah Creeping pasture-type alfalfas appear promising.

Mixtures of sweetclover and various grasses produced up to $1\frac{1}{2}$ tons more forage than the same grasses alone during the second season after planting. However, during the third growing season the biennial sweetclover was not present and these plots produced no more forage than the grasses planted alone. Mixtures of alfalfa and various grasses gave only a slightly greater forage yield than grasses alone during the second growing season, but up to 1 34 tons more forage during the third season. Grasses tended to suppress both the stand and yield of birdsfoot trefoil.

Improving Sagebrush Range

Tests in 1951 show that chemical control methods improve sagebrush range containing fair stands of grass.

Application of 1 pound of 2,4,5-T or 2 pounds per acre butyl ester of 2,4-D produces a 65 percent kill and 90 percent defoliation of sagebrush. Use of 2,4-D is cheaper. More effective kills are obtained at 7,000 feet elevation in northwestern Colorado by spraying with 2,4,5-T in late May, or with 2,4-D in mid-June.

Technicians also obtained more effective kills in moist, fertile sites, such as along drainages.

Irrigated Pasture for Dairy Cattle

Twenty-nine extra days of grazing were furnished by an irrigated pasture mixture containing brome grass, orchard grass, meadow fescue, alfalfa, red clover, alsike clover and ladino clover when compared to a mixture containing the same grasses but with sweetclover as the sole legume. Yield from the mixture was increased further by 28.5 more grazing days per acre per year when rotational grazing was practiced rather than continuous grazing. Technicians determined that the mixture, when rotational grazing was used, furnished grazing for 0.46 additional cows per acre per year than did the grass-legume mixture containing sweetclover when grazed continuously.

Fence Post Treatment

Life expectancy of fence posts may be quadrupled by preservative treatment, analyses of Station tests have shown. Penta and Creosote preservatives appear to be superior to others.

-29-



Hay yields from Colorado's mountain $m_{ead}ows$ may be doubled if more consideration is given to proper fertilization and water management, Station scientists believe.

Mountain Meadow Improvement

Present mountain meadow hay yields can likely be doubled, agronomists believe, if their recent findings are put to use. Two key steps must be taken to realize this benefit: fertilization, and improved water management. At the same time, quality of the hays can be improved if the crop is cut early in the season. These are results of tests by the agronomy and civil engineering sections in cooperation with the USDA and local groups. Pronounced increases have been obtained in grass yields when nitrogen fertilizer was applied, however, high nitrogen treatments inhibited legumes in grasslegume mixtures. Excessive irrigation showed disadvantages that were threefold: it reduced hay yields, protein content and feeding quality. Phosphorous application increased legume production in mixtures not excessively irrigated; but under excessive irrigation, legume growth was reduced on both phosphated and nonphosphated plots.

Long-time tests shown in the photo at the left, are aimed at finding the best methods and materials to use in treating wood for fence posts. They also indicate the more desirable kinds of wood for posts. In the photo at the right, a technician points to the end of post of native Colorado wood which, because it was not treated, rotted within 2 years after setting.



Livestock and Poultry

Livestock

Range Grasses, Vitamin A

The protein content of range grasses on eastern Colorado rangeland remains at maintenance level or above for cattle for only 4 months of the year. Carotene in the same grass stays at maintenance level for 8 months of the year.

These facts were derived from 5 years of collected data. In the process of experimentation with vitamin A nutrition, animal husbandmen have also observed that dehydrated alfalfa pellets appear to cause scouring in calves whose dams received the pellets as supplement.

Weights of calves weaned in the fall of 1951 from cows fed alfalfa hay or alfalfa pellets during the winter were greater than for calves from cows fed no vitamin A supplement.

Concentrate-Roughage Ratios in Cattle Fattening Rations

Higher gains are possible but costs rise, too, as the ratio of concentrates to roughage in cattle fattening rations is increased. Scientists obtained the most costly gains when the concentrate-roughage ratio was 1:2 in feeding tests conducted at the Station. Carcass grades were also elevated as the amount of concentrate fed was increased. Steers receiving relatively large amounts of roughage were criticized for lack of firmness. However, following slaughter, steers fed the 1:2 ratio were also criticized for having a color that was slightly yellow in the fat and dark in the lean.

New Feeds in Cattle Rations

Molasses Filtrates

Molasses filtrates that have been merely waste products may soon take on considerable value as livestock feed as a result of Experiment Station feeding tests.

Two years of testing have shown that

Molasses Pulp and Grain

Dried molasses beet pulp can be fed with grain in equal parts to fattening cattle with satisfactory results, animal husbandmen have found.

Safflower Oil Meal

On a protein unit basis, safflower oil meal (safmeal) has been found to compare favorably with soybean oil meal.

Researchers at the Experiment Sta-

the filtrates have a feeding value equal to "B" molasses which is sold commercially and commonly fed. The filtrates are: Concentrated Steffens Filtrate, or CSF; and neutralized CSF, or MC 47, from which glutamic acid has been recovered.

When dried molasses pulp and rolled barley were fed in equal parts, cattle made excellent gains.

tion obtained satisfactory gains from fattening cattle when safmeal ranging from 18 to 28 percent protein was fed as onethird of the concentrate part of the ration.

-32-

Feeding to Obtain Desirable Market Weights in Heavy-, Medium- and Light-Weight Lambs

Consider the weight of your lambs first, then feed accordingly . . . this may become a rule-of-thumb for Colorado lamb feeders on the basis of 1951 feeding tests at the Station.

The tests involved 500 heavy-, medium-, and light-weight lambs. Greatest gains were made by the heavy-weights and medium-weights. Rations producing the high gains were, for the heavy-weights, shelled corn and chopped alfalfa; and for the medium-weights, shelled corn, chopped alfalfa and linseed oil meal.

Cheapest gains in the test were put on by the light-weight lambs fed shelled corn and chopped alfalfa and the most expensive gains were made by heavy-weights fed shelled corn, corn silage and chopped alfalfa.

First rank on market grade was made by heavy-weight lambs fed shelled corn, linseed oil meal and chopped alfalfa.



Products of one of Colorado's major industries.

Effect of Hormones on Reproduction in Lactating and Anestrous Ewes

Hormone treatments on 530 ewes in 1951 failed to materially influence the number of lambs produced.

To test the effects of gonadotrophins

and sex steroids on reproduction in lactating and anestrous ewes, the following treatments were used: high and low levels of pregnant mare serum and high and low levels of purified pituitary extracts.

- 33 -

Necrobacillosis in Cattle and Sheep



Abscessed livers, like the one above, cause thousands of dollars in loss to the Colorado meat industry each year. The affliction appears to be magnified in the Rocky Mountain region.

Shipping Fever

Studies of shipping fever have been made primarily on cattle in the feedlots of cooperating local feeders where animal specimens have been collected for laboratory studies with the aid of a local practicing veterinarian.

Further studies are being made in the fields of histopathology, bacteriology and virology in an effort to correlate the pathology with the infectious agent present.

Diagnostic Laboratory

To April 1 of the 1951-52 fiscal year the diagnostic laboratory at the Station performed 1,301 autopsies on various species of an imals and received a total of 1.369 animal cases for bacteriological, histological or chemical studies. In addition, miscellaneous tests for blood samples, poisoning and other reasons totalled 8.107.

B e e f animal showing typical symptoms of shipping fever.



Immunization Against Liver Abscesses

Technicians have found no significant difference in the incidence of liver abscesses when comparing immunized sheep against those not immunized.

Substances used in the immunizations were polyvalent culture filtrates of Actinomyces necrophorus.

Correlation of Lesions of the Liver with Lesions of the Stomach

Livers and stomachs of approximately 1,000 cattle were studied with the cooperation of Denver meat packers to determine the correlation between lesions of the liver and lesions of the stomach.

> Rabbit is inoculated in the labor tory in an attempt to find the organism causing shipping fever.



__34__

Studies on New and Increasingly Important Diseases

The following new diseases and diseases that have increased in importance in the past year were studied by pathologists:

Fescue Foot

A condition in which the consumption of a sufficient amount of a certain species of fescue seems to be responsible for cattle shedding their hooves. Number of cases reached alarming proportions in Colorado in 1951.

Enteritis of Baby Calves

A disease shown to be caused by an anaerobic organism (Cl. perfringens) (Type C). The affliction is similar to enterotoxemia in sheep.

Chemical Compounds Affecting Thyroid Physiology

A drug synthesized by Station workers in cooperative work with the University of California and several other research groups and found to be very effective in combatting thyroid disease is now being marketed for human medicine. Known as Iodothiourcil in the laboratory, the drug is being marketed under the name of Itrumil.

Assay and Characterization of Pituitary Protein Hormones

Using certain pituitary hormone fractions Station technicians working in cooperation with a drug firm and meat packing firm, have been able to restore breeding ability in several valuable Hereford bulls which had been sterile for at least 1 year. The work was done in connection with research designed to obtain effective hormones for enhancing breeding and reducing sterility in livestock.

Fertility of Bulls

An improved method of evaluating performance may be in the offing as a result of Station work in cooperation with the USDA.

Examination of bull semen disclosed that the fructose content and rate of fructolysis of the semen provided a much better evaluation of breeding performance than criteria now used. It also appears that the method will permit the characterization of bulls at a much earlier age than heretofore possible.

Effects of Certain Agents on Pituitary Hormones

A finding of importance in relation to iodine metabolism was revealed as Station scientists working cooperatively with industrial firms studied the effects of iodine on pituitary hormones. Four successive trials have indicated that inactivation of pituitary thyrotrophin is irreversible, contrary to other reports.

Moreover, the study revealed that not only thyrotrophin, but also gonadotrophin was inactivated.

Relation of Natural and Synthetic Hormones to Metabolism and Reproduction

The first demonstration that the adrenal gland may serve as the site from which an androgen may be released at appropriate times was made by Station workers, working cooperatively with the University of Utah and the laboratories of a meat packing firm. By specially developed methods, technicians collected adrenal venous blood from cows both before and after stimulation with injected ACTH. In addition to appreciable amounts of cortisone, compound F and desoxycorticosterone, two compounds were isolated which proved to be strongly androgenic when tested on chicks.

Poultry Large Hock Studies

High levels of choline or betaine fed to turkey poults on the premise that they may reduce the incidence of large hock (perosis) failed to have any apparent effect. The data from the study indicated however, that for growth, present recommended amounts of choline equivalent for turkeys may be below the optimum.

Growth Stimulus in Chicks from Molasses By-Products

A growth stimulus in chicks was demonstrated by poultry husbandmen by the supplemental feeding of molasses byproducts.



Station scientists have demonstrated that chicks like the one above may receive a growth stimulus when fed molasses by-products.

A commercially prepared dry feedstuff made up of approximately 65 percent Steffen's molasses solids and 35 percent dried beet pulp when supplemented at the 2 percent level brought a consistent increased growth response at about 3 percent greater than in birds not receiving the feed.

When liquid betaine concentrate (MC-47) was fed to chicks at 1-, 2-, 3- and 4-percent levels it produced a growth stimulus of 2 to 7 percent.

Recommended Levels of Feeding Choline Equivalent

A question of whether today's generally recommended level (700 mg.) per pound of ration of feeding choline equivalent in the poultry ration is adequate was brought to light during feeding experiments.

Substituting betaine for choline poultrymen fed the nutrient at 600, 700, 800, and 1,200 mg. of choline equivalent per pound of ration. Only at the 800 mg. level was growth of the chicks improved. At this level, birds appeared to have increased vigor and some improvement in carcass quality was also noted.

Mechanical Engineering Economics and Sociology



Mechanical Engineering

Mechanization of the Sugar Beet Industry

About one-third of the acreage of sugar beets in Colorado, or 46,000 acres, had some type of mechanical thinning operation performed on them in 1951 using principles and techniques developed by mechanical engineers at the Station.

The saving in hand labor on these acres ranged from 10 percent to 74 percent, depending upon field conditions and the extent to which farmers were willing

Three out of four mechanically thinned plots of sugar beets produced more gross sugar per acre than hand blocked and thinned plots in tests carried on by mechanical engineers at the Station.

Two of the mechanically thinned plots produced higher tonnages of roots. Al-



to carry out the program.

At harvest time 78 percent of the sugar beet acreage in the State was harvested by machines.

Mechanical Thinning

though these differences were not statistically significant, there was a high trend in favor of the mechanical treatments.

Two of the mechanically thinned plots were significantly higher in percentage of sugar content.

Dehydration of Sugar Beet Tops

Two commercial alfalfa dehydrating plants have become interested in the past year in dehydration of sugar beet tops to supplement their alfalfa processing. The interest has been a direct result of the work of mechanical engineers in cooperation with the USDA on the dehydration of sugar beet tops as livestock feed.

Interest is increasing in dehydration of sugar beet tops. Left, dehydrated sugar beet leaves; right, dehydrated and pelleted beet leaves.

Economics and Sociology

Work in the Economics and Sociology section consisted of participation in completion of four regional bulletins:

"Analysis of Auction Livestock Marketing" "Trade in Western Livestock at Auctions" "Western Feeder Cattle Marketing"

"Consumer Demand for Ripeness of Peaches," Colorado Technical Bulletin 48.

Reports and publications completed included:

Twenty-five Years of Crop Costs on Northern Colorado Irrigated Farms

Alfalfa: Harvesting and Feeding Costs

Old Age Pension in Definition of Role of Farmers and Non-Farmers in Northern Colorado

Work under way:

Analysis of 40 years of feeder cattle and

lamb fattening in northern Colorado

Analysis of 10 years of cattle and sheep ranch operations in western Colorado

Analysis of 1951 irrigated pasture costs and returns in northern Colorado

Analysis of the function of weekly newspapers in northern Colorado to discover what type of information is read by rural population

Compilation and analysis of cattle shrinkage data and costs of marketing as part of regional livestock marketing research

Analysis of 14-year northeast Colorado dryland farm business records

-38-



Improved bread formulae have been developed by home economics personnel for use by homemakers living at three altitudes: 5,000, 7,500 and 10,000 feet. The high-altitude chamber at the Station was used to simulate the latter two altitudes.

At the same time, recipes and procedures were also standardized for making rolls and specialty breads at the same altitudes.

Home economists found that high nu-

tritive value was obtained through use of both enriched white and 100 percent wholewheat flour, along with 6 to 14 percent non-fat dry milk, and in some formulae by using supplements of wheat germ and soy flour.

Nutritional Status Among Groups in Colorado

Home economists in cooperation with the USDA determined in a study of nutrition and physical condition among various population groups in Colorado that the most prevalent signs of nutritional deficiencies in adolescent children were defective teeth and faulty eyesight along with an underweight condition in boys.

In adults over 50 years of age, the symptoms appeared in the forms of dental deterioration, high blood pressure and ocular manifestations. Nearly two-thirds of the women included in the tests were overweight.

Housing Needs of Rural Families

Home economists have studied space needs for storing clothing of the family in cooperation with the USDA.

Information and Publications

To keep Colorado citizens informed of research progress and activities of the Colorado Agricultural Experiment Station, more than 715 news releases were disseminated by the College News and Radio Service. The stories were written for publication in the State's weekly and daily newspapers and farm magazines.

Semi-Monthly Publications

Colorado Farm and Home Research. Six issues containing 64 articles on Station research progress.

Monthly Publications

Colorado A and M News. Twelve issues. Volume 6.

Technical Bulletins

- No. 45—"Land-Use Ordinances of Soil Conservation Districts in Colorado." By Stanley W. Voelker. 2,000 copies. March 1952; 56 pages and cover.
- No. 46—"Results With Potato Vine Killers in Colorado."
 By R. Kunkel, W. C. Edmundson, and A. M. Binkley.
 5,000 copies.
 March 1952; 36 pages and cover.

Popular or General Series Bulletins

- Bul. 393-A (reprint) "Handbook of Commercial Fertilizers and Soil Amendments." By Robert S. Whitney and R. H. Tucker 5,000 copies, 40 pages, July 1951.
 Bul. 403-A (revised) "Pasture and Forage Crops for Irrigated Areas in Colo-
 - By D. W. Robertson, K. Brown, R. H. Tucker, and E. K. McKellar 7,000 copies, 52 pages, May 1952.
- Bul. 404-A (revised) "Mile-High Cakes." By Elizabeth Dyar, Ferne Bowman, et al 8,000 copies, 28 pages plus cover, July 1951

Regular editorial service for the Experiment Station included tape recording and distribution of more than 400 radio programs dealing with research activities which were used by Colorado radio stations.

Commodity letters were published periodically dealing with honey, bees, and carnations and distributed to growers and other interested parties.

Yearly Publications

Sixty-fourth Annual Report, Colorado A and M College Experiment Station, 1950-51. 28 pages, 1,500 copies.

No. 47—"Conservation of Sugar Beet Tops by Dehydration." By R. D. Barmington, P. N. Davis, and H. S. Wilgus. 5,000 copies. May 1952; 88 pages and cover.

- No. 48—"Consumer Demand for Ripeness of Peaches." By Sub-Committee on Consumer Demand Phases of Regional Project WM-2 (C. Richard Creek) 3,000 copies June 1952; 24 pages and cover.
- Bul. 409-A (reprint) "Freezing Fruits and Vegetables." By May Stanek and Gestur Johnson 5,000 copies, 12 pages, May 1952.
- Bul. 410-A (reprint) "Canning Vegetables and Meats." By May Stanek, Elizabeth Dyar, et al 8,000 copies, 24 pages, August 1951.
- Bul. 412-A (revised) "Poisonous and Injurious Plants in Colorado" By L. W. Durrell, Rue Jensen and Bruno Klinger 8,000 copies, 88 pages and cover, January 1952.

41-

- Bul. 415-A (reprint) "Quick Mixes for High-Altitude Baking." By Ferne Bowman and Elizabeth Dyar 10,000 copies, 36 pages, Aug. 1951.
- Bul. 416-A "Fruit Pests and Their Control in Colorado." By Gordon T. Mickle and J. H. Newton 5,000 copies, 40 pages, Aug. 1951.
- Bul. 417-A "Alfalfa-Harvesting and Feeding." By Harry Sitler, W. E. Connell, R. T. Burdick and S. S. Wheeler 5,000 copies, 24 pages, October 1951.
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- Bul. 420-A "Mechanizing the Production of Sugar Beets." By R. D. Barmington, S. W. Me-Birney 5,000 copies, 40 pages, April 1952
- Bul. 422-A "The Mechanical Separation of Potatoes into Specific Gravity Groups." By R. Kunkel, P. F. Gifford, A. D. Edgar, and A. M. Binkley 5,000 copies, 40 pages, May 1952

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		COLO	ORADO	AGRICU	JLTURA	L EXI	Fine	<i>incia</i> ENT	l Rep Stati	ort ON	For y	ear enc	ling J	une 30	, 1952			
	Receip	ts 1951 -	. 1952		Ι	Disburs	ement	of Fun	tds by	Classif	ication	for the	: Fisca	l Year	Endea	I June 3	30, 1952	
	Balance July 1, 1951	Receipts from U.S. Treasurer	Receipts other Sources	Total Receipts	Personal Services	Travel	Trans- por- tation of things S	Com- muni- cation Service	Rents and F Utility Service	rinting and Binding	Other Con- tractural Services	Supplies and Material	Equip- ment	Land Co and t Struc- R tures	ontribu- ion to tetire- I ment	Total Expendi- tures	Balance June 30, 1952	Grand Total
Hatch		15000.00		15000.00	11877.82	1400.66	1.20	26.40		109.75	51.20	360.79	737.12		435.06	15000.00		15000.0
Adams		15000.00		15000.00	13051.04	42.05	100.00	12.50	284.51		226.87	632.23	166.07		484.73	15000.00		15000.0
Purnell		60000.00		60000.00	46406.80	2334.83	8.90	140.74	366.22	100.38	787.55	5770.59	2124.79		1959.20	60000.00		60000.0
Bankhead- Jones		25460.16		25460.16	18159.88	663.65	7.94	50.75	663.48	323.62	76.46	3489.50	1285.05		739.83	25460.16		25460.1
Hope- Flanagan (9B1 & 2)	5796.66	41466.00		47262.66	35621.19	1057.73	147.64	63.88	43.41	700.77	2270.94	4131.24	1697.94		1527.92	47262.66		47262.6
Hope- Flanagan (9B - 3)	12720.76	28100.00		40820.76	27057.03	2277.97	50.66	73.43	748.43	1362.39	1786.39	4474.52	2299.82		689.62	40820.76		40820.7
Hope- Flanagan (10A)	854.91	10000.00		10854.91	5989.77	80.30	2.20		104.86	171.66	29.25	284.50	181.19		266.60	7110.33	*3744.58	10854.9
Hope- Flanngan (9B3) (Trust)	5835.13	2750.00		8585.13	91.90	2479.12			5.00	5888.36	120.75					8585.13		8585.1

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Husbar	idman ((Dairy	Husb.)
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		Husb	andmar
C. W. Fox, M.SAssistant	Animal	Husb	andmar
E. T. Hedrick, B.SAssistant	Animal	Husb	andmar
	(Arti	ficial	Insem.)

*H. H. Stonaker, Ph.D	Animal Husbandman
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A Lamar Esplin, M.S	Associate Animal
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L E. Washburn, Ph.D Chief Animal Husbandman

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' Temporary

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Walter D. Thomas, Jr., Ph.D. Plant Pathologist
A. O. Simonds, Ph.D. Associate Botanist
H. D. Harrington, Ph.D. Associate Botanist
George H. Lane, M.SAssociate Plant Pathologist
Norman R. Gerhold, M.S. Asst. Plant Pathologist

Car	1 E	. Selisk	ar, P	h.D.	Asst.	Plant	Pa	thologing
*R.	L.	Skiles,	M.S.			Assista	nt	Botanim
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	(USDA)
E. A. Lungren, M.S. Associate Plant	Pathologist
	(USDA)
Ross Davidson, B.S., M.S.	Pathologist
	(USDA)

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J. J. Lehman, Jr., Ph.D.	Assistant Chemist	Lois Lucas, B.S.	Research Assistant

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	Range Management	Conservationist
*Donald F. Hervey,	M.S. Chief Range Convervationist	H. E. Troxell, Jr., M.F. Assistant Forester

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Ferne Bowman,	Ph.D	Home	Economist	May E.	Combs,	M.S. Asst.	Home	Economist
Miriam E. Humi	mel, M.SAsst.	Home	Economist					

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Robert Kunkel, Ph.D. Horticulturist	J. S. Gregory, B.S. Assistant Horticulturist
A. C. Ferguson, Ph.D. Associate Horticulturist	R. F. Farmer, B.S. Assistant Horticulturist

POULTRY

E. G. Buss, M.S., Acting Chief Poultry Husbandman I. L. Madsen, B.S., Assistant Poultry Husbandman *T. E. Hartung, B.S. Assistant Poultry Husbandman

* On Leave

† Temporary

RURAL ECONOMICS AND SOCIOLOGY

Catherine R. Clark, A.B. Research Assistant

Cooperators:

J. C. Crecink, M.S. Agricultural Economist (USDA) H. G. Sitler, M.S....Agricultural Economist (USDA)

CIVIL ENGINEERING

n. 1	F	Peterson, D.C.EChief Civil	Engineer	Ralph L	. Rollins	, M.S.	Assistant	Civil	Engineer
TV.	E.	Code, B.SAssociate Irrigation	Engineer	C. S. Yil	1, Ph.D		Assistant	Civil	Engineer
M. I	L.	Albertson, Ph.D. Associate Civil	Engineer	†E. F. S	chutz, B.	S	Assistant	Civil	Engineer
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J. al	, 1	E Cermak, M.S. Assistant Civil	Engineer						_

MECHANICAL ENGINEERING

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

W. C. Edmundson, M.S. Senior Horticulturist,

USDA, Colorado Potato Station

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

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H. O. Mann, B.S....Asst. Agronomist, San Juan Basin

PERSONNEL CHANGES

Joining the staff during the fiscal year wer

H. O. Mann......Asst. Agronomist, San Juan Basin Kenneth Goodrich...... Assistant Editor

W. Hamilton Administrative Assistant Gail

Resignations from the staff during the fiscal year were:

Peyto	n DavisResearch Asst., Mechanical Engineer	Arthur KatonaAssociate Sociologist
R. L.	SkilesAssistant Botanist	D. M. Stevens Associate Rural Economist
Ruth	Hay Research Assistant in Chemistry	H. Prentiss GazawayAssistant Rural Economist
R. P.	Martin Research Assistant	Ralph L. RollinsAssistant Civil Engineer

Temporary

J. F. Brandon, B.S.....Associate Agronomist, USDA, Dry Land Field Station

n.F.	Peterson,	D.C.E	Chief	Civil	Engineer	
W.E.	Code, B.S.	As	sociate Irrig	ation	Engineer	
M. L.	Albertson	, Ph.D	Associate	Civil	Engineer	
S D.	Resnick,	M.S.	Assistant	Civil	Engineer	
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