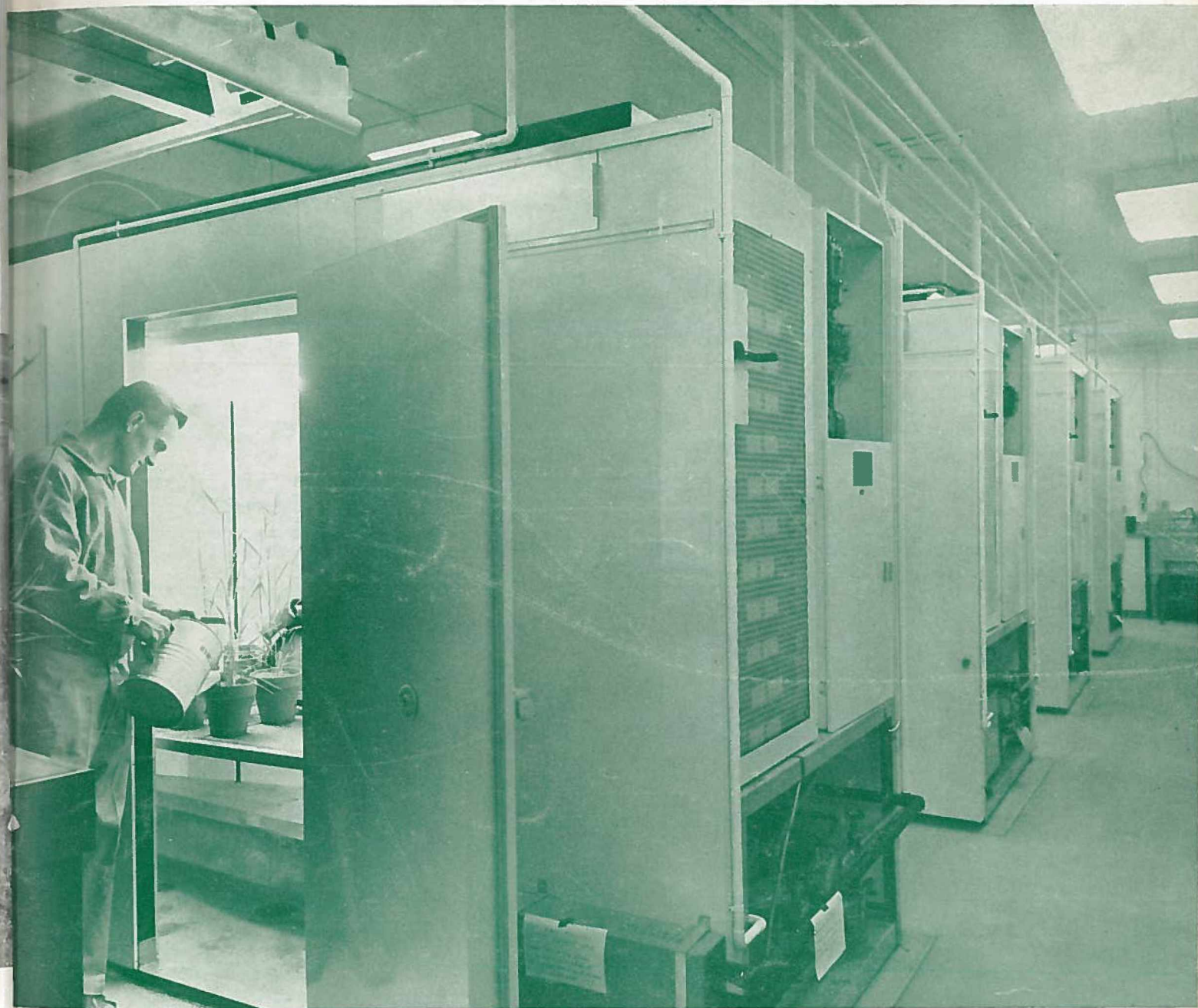


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# Agricultural Research in Colorado

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76th Annual Report  
1962-1963



Colorado Agricultural Experiment Station  
Colorado State University  
Fort Collins, Colorado

**Letter of Transmittal  
Seventy-Sixth Annual Report  
Colorado Agricultural Experiment Station**

Honorable John A. Love  
Governor of Colorado  
Denver, Colorado

Sir:

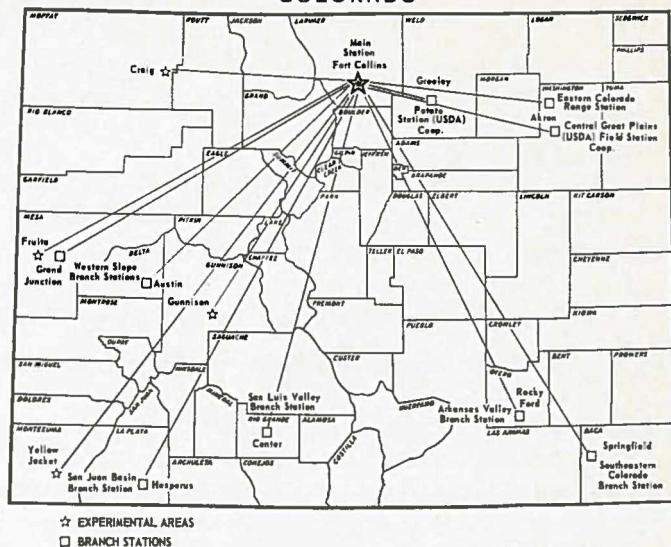
In compliance with the act of Congress, approved March 2, 1887, entitled, "An act to establish Agricultural Experiment Stations, in connection with the colleges established in several states under the provisions of an act approved July 2, 1862, and under the acts supplementary thereto," I herewith present the Seventy-sixth Annual Report of the Colorado Agricultural Experiment Station for the fiscal year of July 1, 1962 to June 30, 1963.

Fort Collins, Colorado  
July 1, 1963

  
S. S. Wheeler  
Director

# Colorado Agricultural Experiment Station

## Branch Stations and Experimental Areas COLORADO



## 76th Annual Report

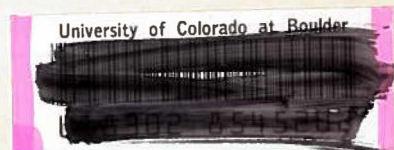
Agriculture is the largest industry in Colorado, and in the United States as well. Research helps the agricultural industry maintain and enlarge its contributions to the total economy, and it has helped provide the American people with an abundance and variety of wholesome, delicious foods at reasonable prices.

Agricultural research is an investment that pays dividends to everyone—urban as well as rural people. The major purpose of the Colorado Agricultural Experiment Station is to carry on research in agriculture and related fields, and to make the results of this research available to people who can use them.

CSU scientists conduct both basic and applied research at the main experiment station at Fort Collins, at seven branch experiment stations around the State, at two stations in Colorado operated by the U. S. Department of Agriculture, and at several experimental areas.

New crop varieties, farm and ranch management techniques, livestock production, new approaches to marketing, better management of water resources—these are but a few of the many areas under investigation by experiment station personnel.

The various branch stations and experimental areas enable CSU scientists to study agricultural problems under the same conditions encountered by farmers and ranchers in Colorado's diverse production areas.



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# Agricultural Engineering

Agricultural engineers developed criteria for the design of gravel filters for use with tile drains. Their studies showed that low cost "pit run" gravel could be used with only minor modification.

They also found that alternate row irrigation saves water and produces fewer clods in potato fields, while sprinkler irrigation does not reduce the number of clods.

Projects for the year included:

- Preparation and Analysis of Climatological Data of Importance to Agriculture
- Design Criteria for Drain Tile Filters and Envelopes
- Influence of Inorganic Watershed Covers on Moisture Exchange in Vertical Direction Across the Soil-Air Interface
- Hydraulics of Sub-Critical Flow in Small, Rough Channels
- Streamflow Forecasts
- Potato Harvest Mechanization
- Mountain Meadow Hay Harvesting
- Investigation of Potato Storage Methods
- Weed Control in Sugar Beets
- Canning Crop Mechanization
- Fluid Flow in Porous Media

# Agronomy

Agronomists reported development of a hybrid sugar beet. The hybrid is both high yielding and high in sugar content when grown in soils medium to high in nitrogen fertility. With this hybrid, the level of available soil nitrogen is less critical and will permit farmers to improve their efficiency in management. Genetic material in the hybrid was made available for use by the sugar beet industry.

Research projects under study were:

- Genetic Studies and Linkage Relationships in Barley
- The Effect of Alfalfa, Plant Nutrients, and Moisture Level on Crop Production Under Irrigation in Colorado
- Sorghum Improvement
- The Influence of Irrigation Practices on Soil Structure and Plant Growth
- The Effect of Fertilizers on the Yield and Quality of Crops Under Dry Land Conditions of Colorado
- Study of Host-Pathogen Relationships in the Evaluation of the Resistance of Bean Varieties to *Fusarium Solani* F. Phaseoli
- The Behavior of Natural and Artificial Phosphates in Calcareous and Alkali Soils, Including: Solubility, Chemical Activity and Availability to Plants
- Fundamental Research on Trace Elements in Calcareous Soils and Application of the Results to the Efficient Production of Crops in Colorado
- Improvement of High Altitude Irrigated Meadows
- Reclamation and Management of Salted Soils
- Forage Crops
- Corn Genetics and Breeding
- Factors Influencing the Availability of Nitrogen in Soils
- The Effect of Different Temperature Levels During Anthesis on the Reproductive Processes of Selected Clones of Russian Wildrye Grass
- The Basis of Heterosis in Seed Germination and Seedling Vigor in Alfalfa and Russian Wild-Rye Grass under High Osmotic Pressure
- Factors and Mechanisms Affecting the Role of Organic Matter in Stabilizing Soil Aggregates in a Hydrated Environment

- Effects of Soil Moisture Availability and Related Variables on Seed Germination and Seedling Development
- Movement of Water in Small Capillaries and Thin Files in Response to Pressure and Temperature Gradients
- Small Grain Improvement
- Hybrid Corn Testing
- Cooperative Soils Lab
- The Effect of Management, Genetic, and Environmental Factors on Yield and Quality of Sugar Beets
- State Soil Survey and Land Classification
- The Effect of Machinery, Herbicides and Soils on the Control of Weeds in Sugar Beet Fields
- Seed Maintenance and Viability
- The Effect of Various Commercial Fertilizer Treatments on the Yield, Quality and Nutrient Uptake of Potatoes
- Dry Bean Improvement
- Special Crops
- Wheat Quality Improvement
- Commercial Sorghum Hybrid Performance Tests
- Organic and Microbiological Properties of Arid, Semi-Arid and Montana Soils

## Animal Disease

Scientists discovered a second strain of *Vibrio fetus* that causes abortion in sheep. A polyvalent vaccine against both pathogenic strains has been developed and tested.

The section also determined the biochemical and biophysical characteristics of ruminant urine that lead to calculosis, and found methods of producing and preventing the disease.

Projects under investigation included:

- Shipping Fever of Beef Cattle
- Urinary Calculi (Urolithiasis) of Beef Cattle
- Enterotoxemia of Cattle
- The Mechanism of Vibriosis in Sheep
- The Effect of Parasitism Upon the Absorption of Essential Amino Acids
- Polyarthrititis of Lambs
- Diagnostic Laboratory
- Vibriosis in Range Cattle
- Bovine Foot Rot
- Semino-vesiculitis of Bulls
- Control of Vibriosis in Bull Studs
- Comparative Placental Pathology and Bacteriology
- High Mountain Disease
- Elbow Dysplasia—A Genetic and Pathological Study
- The Effect of Chronic Heart Failure on Renal Function in Swine
- Physiological Interrelationships of the Thyroid and Adrenal Glands
- A Study of Pituitary, Thyroid and Adrenal Gland Inter-relationships in Ground Squirrels (*Citellus richardsoni*) as Influenced by Diet and Atmospheric Pressure
- Effects of Ionizing Radiation on the Functional and Structural Status of the Bull Testicle
- Further Studies of *Haemobartonella Canis* and *Felis*
- Genetic and Biochemical Studies on Diploid Strains of *Escherichia coli*

- Effect of Altered Pulmonary Hemodynamics in Swine
- Morphological Study of the Brain of *Citellus Richardsoni*
- Cinephotographic Techniques in Morphology for Visualization of Anatomical Structures in Depth, Using the Central Nervous System as a Pilot Study
- Effects of Colostrum on Immunological Maturation
- The Role of Animal Fecal Flora in Stream Pollution
- A Study of the Food Chain Pattern of Strontium-90, Cesium-137 and Iodine-131 in a Wild Deer Population
- Hepatoma in Rainbow Trout
- Bone Growth in Deer
- Susceptibility of Deer to Viral Bovine Rhinotracheitis
- Effects of Ionizing Irradiation on the Canine Ovary
- Testicular Degeneration from Isosperm Antibodies
- Physiology of Hypothermia Hibernation
- Electrical Anesthesia in the Dog
- Microbiology of Ice

## Animal Science

Animal scientists completed the development of a specific pathogen free (SPF) swine herd at CSU. Staff members helped organize a Colorado Specific Pathogen Free Accrediting Association.

Active projects included:

- A Study of Selection, Inbreeding and the Crossing of Inbred Lines Within the Hereford Breed
- To Examine the Consequences of Selecting for Rapid Gains in Mammals
- Mineral Nutrition and Biological Efficiency of Livestock Production  
Phase I—The Progressive Variation of the Calcium: Phosphorous Ratio in Growth, Maturation and Fattening  
Phase II—The Effect of Certain Trace Elements. (1) The Nature and Effect of Vanadium Toxicity Stress on the Mammal
- The Effect of Hormones, Male and Female on the Rate of Gain and Reproductive Performance of Beef Heifers
- A Study of Milk Marketing and Milk Distribution Practices in Colorado
- Intermediary Metabolism of the Ruminant as Influenced by Various Feeds
- An Investigation of Inhibitory Substances in Milk
- Identification and Characterization of Biochemical and Biophysical Factors Related to Feed Quality and Marketability
- Evaluation and Application of Criteria for Selection of Sheep to Produce Carcasses of Superior Eating Quality
- The Effect of Seasonal Feed Levels on Cow-Calf Production, Rumen Fermentation, and Nutritional Losses of Range Forage on Sandhill Ranges
- The Effect of Altitude on Growth and Production of Livestock
- The Effects of Environmental Stresses on Range Cattle and Sheep Production
- The Effect of Exogenous and Endogenous Hormones and Feed Additives on Growth Rate, Feed Conversion and Carcass Characteristics of Growing Finishing Cattle

- Methods of Fattening Heavy, Medium and Light Weight Lambs at Desired Market Weights
- The Improvement in Efficiency of Lamb and Wool Production in Colorado
- Feeding Methods and Feed Preparation for Stocker Steer Calves During Winter and the Effect on Subsequent Summer Gains
- Use of a High Feeding Level as a Means of Reducing the Rearing Time for Dairy Replacements
- Mastitis as a Problem in Dairy Production in Colorado
- A Study of Cesium-137 Passage from Precipitation to Milk
- Assortative Mating and Selection
- Studies in Plant Nutrition
- The Relationship of Growth to the Fatty Acid Composition of Ovine Fat

## Botany and Plant Pathology

Staff scientists, in cooperation with industry personnel, developed a new, highly effective pre-emergence herbicide (Bandane) for crabgrass control.

They developed a technique for the detection of barley stripe mosaic, using common millet plants, and developed a reasonably cheap chemical control for tall larkspur on certain western range lands.

Projects under study were:

- Peach Tree Gummosis and Other Diseases of Fruit Trees
- Weeds Detrimental to the Agricultural and Livestock Industries and Other Interests in the State
- Factors Affecting the Toxicity and Selectivity of Pre-Emergence Soil Herbicides
- Peach Fruit Decay in Transit and Marketing
- The Nature of the Influence of Various Sources of Carbon in Soil on Fungus Induced Root Diseases
- The Effect of Light Duration, Intensity and Quality on the Response of Plants to Herbicides
- Horticultural Studies of Ornamental Plants—Pathology Phase
- Diseases of Sugar Beets
- Diseases of Potatoes
- Improvement of Laboratory Techniques in the Germination of the Seeds of Economically Important Grass Species
- Diseases of Onions
- The Effect of Machinery, Herbicides and Soils on the Control of Weeds in Sugar Beet Fields (Botany and Plant Pathology Phase)
- Investigations on Pathogenic Organisms of Cereals and Grasses in Colorado
- Miscellaneous Truck Crop Diseases
- Incidence and Control of Diseases of Kentucky Bluegrass Turf



## Chemistry

A new gas chromatograph, a thin layer chromatography apparatus, and a 200 tube counter current distribution apparatus, were added to the equipment of the chemistry section this year.

Studies were made of the disease resistant substance in sugar beet leaves, the sugars occurring in fruits and vegetables, and amino acids in chickens.

Research projects under investigation included:

- Antianemic and Growth Factors as Related to Amino Acid Utilization in Chickens
- Quality Determination and Improvement of Food Products by Chemical and Physical Means
- Isolation and Identification of the Polyphenols of Crop Plants and a Study of Their Properties and Biochemical Function
- Cultural Factors Affecting Yield and Quality of Colorado Fruit
- Chemical Identification and Mechanism of Action of Substances Responsible for Resistance to Diseases in Plants
- Chemical Genetics Studies on Sugar Beets

## Civil Engineering

The civil engineering section moved to new facilities, with the completion of the new Engineering Research Center at the Foothills Campus west of Fort Collins.

Research work included development and improvement of water measuring devices, including a new trapezoidal measuring flume and a suspension wire probe that measures flow by measuring the drag on a wire suspended across the flow field.

Projects under study by the civil engineering section were:

- Meteorological Observations
- Effect of Cloud Seeding on Rocky Mountain Snowfall
- Ground Water Fluctuations and Their Relation to Pumping
- Development and Improvement of Water Measuring Devices
- Hydraulics Laboratory
- Sealing of Canals and Reservoirs with Colorado Clays
- Genesis Areas for Hailstorms in the High Plains
- Ground Water Reservoir Management
- Hydrometeorology
- Watershed Hydrology

## Economics

Agricultural economists followed some 4,500 head of cattle from Colorado feedlots through Denver packing plants, collecting data on shrink, marketing costs, and other factors. They made cost comparisons for cattle marketed through the Denver stockyard and those sold direct from the feedlot.

Economics research projects for the year included:

- Inter-Area Competition Marketing Colorado Cattle
- Relation of Integration to Growth and Development of Field Food Crops Production, Processing and Distributing Industries in Colorado

- Irrigation Benefits and Optimal Farm Enterprises—Platte River Valley, Northern Colorado
- An Economics Analysis of Farm Labor Adjustments in Colorado
- Improving the Marketing of Colorado Wool
- Dryland Farm Resources Requirements for Various Income Levels Under Three Farm Policy Situations in Eastern Colorado
- Appraisal of Opportunities for Adjusting Farming to Prospective Markets
- Economic Analysis of Integrated Ground Water-Surface Water Resource Management
- Interrelationship of Structure and Practice in Dairy Marketing in Colorado
- An Economic Comparison of Alternative Marketing Channels for Colorado Cattle and Calves
- Effects of Buying Practices of Corporate and Cooperative Food Retailers Upon Suppliers of Selected Agricultural Products
- Economic Analysis of Crop Insurance in Eastern Colorado
- Resources for the Future—A Study of the Social Mechanism of Rural-Urban Water Transfers with Special Reference to External Effects

## Endocrine

The endocrine staff conducted research to determine effects of irradiation on the quantity and quality of bull semen. Fifteen Hereford bulls were irradiated with single doses, ranging from 50 to 800 roentgens, and their semen was collected weekly for from 36 to 54 weeks. Semen quality was affected by the irradiation, but recovery was apparent after a prolonged period, except at the highest level of irradiation. Effects and recovery times required depended on the dose level.

Endocrine projects included:

- Causes and Treatment of Testis Failure in Sub-Fertile Bulls
- Metabolism of Diethylstilbestrol in Chickens
- The Effect of Polystilbestrol Phosphate (PSP) on the Meat Producing Capacity of Feedlot Cattle
- Evaluation of Estradiol Monopalmitate (EMP) as a Potential Caponizing Agent in Chickens
- Metabolism of Steroids in the Bovine Male and Female
- The Effects of Ionizing Irradiation on the Functional and Structural Status of the Bull Testicle
- Relationship of Seminal Constituents to Testis-Accessory Sex Organ Function
- Pulmonary Hemodynamics in Swine

## Entomology

Entomologists discovered considerable numbers of a parasitic wasp that preys on the peach twig borer, in the Palisade area. Investigations were launched into the possibilities of biological control of the peach twig borer. The wasp has been considered rare, and the collection in Colorado contained more specimens than the entire collection of this group of wasps in the U. S. National Museum in Washington, D. C.

Projects underway during the year included:

- Insect and Mite Populations and Their Relationship to Virus Transmission in Stone Fruits
- Biology of Insects Transmitting Viruses to Potatoes and Their Control

- The Influence of Orchard Management Practices upon Insect and Mite Populations of Pome Fruit
- Investigation for the Control on Rangeland Grasshoppers
- The Effect of Plant Growth on the Dilution of Pesticide Residues
- Insect Investigations on Onions and Other Truck Crops
- General Insect Investigations—Colorado Insect Survey Program
- European Foulbrood of Honeybees

## Forestry and Range Management

Staff members studied the food habits of the plains pocket gopher and, during 1962, over one-half million acres of land was treated with the burrow builder developed by the Colorado Cooperative Pocket Gopher Project. This machine is considered to be one of the most significant contributions to rodent control in recent times.

An experimental solar heated dry kiln was placed in operation on the CSU campus. It is one of very few in operation.

Projects for the year included:

- The Relationship of Lamb Weight-Gains to Fertilizer Applications on Crested Wheatgrass Pastures
- Induced Revegetation of Range and Croplands to Increase Meat and Wool Production
- Investigations in Wood Utilization, Preservation, Seasoning, and Technology to Induce More Efficient Use of Colorado's Native Woods
- Marketing of Forest Products in Colorado
- The Use and Management of Seeded Range Units
- Field Studies on Growth and Survival of Natural and Planted Seedlings of Ponderosa and Lodgepole Pine as Affected by Climate and Soil
- Forage Production and Species Composition of Sand Sagebrush Range as Affected by Climate, Soil Moisture, and Intensity of Grazing
- Forest Products Marketing Practices and Problems at the Initial Processor Level in Colorado
- Improvement and Management of Oakbrush Ranges
- Use of Asphalt Emulsion Films in Range Seeding
- Shelterbelt
- Colorado Cooperative Pocket Gopher Study
- Changes in Rodent Population in Response to Habitat (Changes caused by using 2, 4-D on Rangelands)
- Aspects of Interspecific Competition in Two Closely Related Species of Pocket Gophers, *Thomomys talpoides* & *T. bottae*
- A Monographic Study of *Ophio stomatacase*
- Study of the Permeability of Engelmann Spruce Wood
- Evaluating Pol-Nu and TIMPREG as Effective Groundline Maintenance Treatment for Wood Utility Poles
- Wood Density Study of Lodgepole Pine
- Practices for Better Establishment of Seeded Grass Stands
- Forest Taxation in Colorado

## Home Economics

Home economists published a bulletin on cookie recipes and completed other laboratory work on phases of high altitude baking. A manuscript was prepared on the retention of nutrients in vegetables cooked in an electronic range.

Home economics research projects were:

- The Baking of Flour Mixtures at High Altitudes
- Effects of Microwave Energy on the Quality of Fruits and Vegetables Cooked at High Altitudes
- The Effect of Selected Vitamins on the Biochemical Utilization of Amino Acids and Proteins
- Effect of Sunshine on Dwelling Design for Semi-Arid Climates
- Factors Which Affect Consumer Purchase and Home Utilization of Selected Fruits and Vegetables in Colorado
- The Effect of ACTH and Ascorbic Acid on Lipid Metabolism in the Guinea Pig
- The Effect of Atmospheric Conditions on Cotton Fabrics and Their Resistance to Abrasion
- Nutritional Status of Population Groups in Selected Areas of Colorado

## Horticulture

Horticulturists developed a new method for speeding up potato breeding work, with field planting of seedlings. As many as 10,000 seedlings can now be handled, compared to 4,000 by the older method.

Researchers also found irrigation of potatoes twice a week instead of once a week increased yields in 1962 as much as 144.7 100-pound bags at the Greeley USDA station.

Horticultural projects included:

- The Improvement of Canning Tomatoes
- The Effect of Timing, Method of Application and Source of Nitrogen on Delicious Apples
- The Development of Onion Varieties and Hybrids Adapted to the Major Onion Growing Areas of Colorado
- Potato Tuberization and Root Growth Factors
- Method of Application and Source of Nitrogen on Delicious Apples
- Cultural Factors Affecting Yield and Quality of Colorado Fruit
- Floriculture Investigations
- Improvement of Potatoes (*Solanum tuberosum*) Through Clonal Selection, Intra-specific Hybridization and Haploidization
- The Development and Adaptation of New Cultural Practices to Mechanical Harvesting of Canning Tomatoes
- Orchard Transit and Storage Factors Affecting Fruit Quality of Apples and Peaches
- Processing Quality of Colorado Potatoes
- Turf
- The Interaction Effects of Nutrient Elements on the Yield and Processing Quality of Potatoes

## Poultry

Poultry scientists studied new ways of packaging eggs for maintaining egg quality and consumer convenience. New methods tested included packing broken out eggs in milk cartons, individual eggs broken into boil-in-bags and frozen, and development of pre-cooked egg "sausage." The new techniques showed promise, and studies were continued to evaluate consumer acceptance, shelf life, and further refinements of techniques.

Poultry projects included:

- A Study of Intestinal Transit and Absorption of Radioactive Minerals and the Role of Vitamin D in Intestinal Absorption in the Domestic Fowl
- The Influence of the Color and the Amount of Carcass Fat on the Market Grades of Dressed Turkeys
- Determination, Evaluation and Improvement of Methods of Controlling Deterioration of Shell Eggs in Market Channels
- Optimum Management and Housing Practices for the Efficient Production of Turkeys
- The Nutritive Requirements of Laying Hens as Affected by Individual and Breed Differences, Energy Level of the Ration, and Management
- Nutrient Requirements as Influenced by the Dietary Energy Level in Growing Chickens
- Genetic Adaptability to Temperature Stress and the Development of the Turkey Embryo
- Reproductive Performance of Layers in a High Altitude Environment Under Controlled and Natural Temperature Conditions
- An Investigation of Storage Conditions and Their Influence upon the Shelf Life of Raw and Precooked Turkey
- Investigation for Preparing Shell-less Eggs for Market
- Environmental Effects on Pullet Rearing Conditions on the Production Performance of Laying Hens
- The Investigation of Processing and Storage Conditions and Their Influence Upon the Shelf Life of Raw and Precooked, Unfabricated and Fabricated Turkey
- X-Ray Irradiation of the Developing Avian Embryo as a Factor of Aging

## Information Service and Publications

About 700 news releases, including feature stories, were prepared and released to newspapers and magazines by information service specialists. Most of the releases were also made available to radio stations. About 500 taped radio programs were produced and sent to radio stations, and numerous experiment station personnel appeared on television programs.

Publications issued or processed included:

### General Series Papers

<i>GSP Number</i>	<i>Title</i>
779	Weed Research in Colorado
780, 781, 782, 783	Water Supply Outlook for Colorado and New Mexico, February, March, April, and May, 1963, respectively
784	Insect Control Recommendations
785	Animal Science Research Highlights
786	Insect Control Recommendations
787	Sorghum Hybrid Performance Tests
788	Marketing Information Available from Colorado Brand Inspection Records
789	Beef Cattle Improvement Day and Auction
790	Corn Performance Tests

# Progress Reports

<i>PR Number</i>	<i>Title</i>
11	Onion Thrip Investigations
12	Tomato Insecticide Tests
13	Field Experiments in Onion Pink Root Control
14	Corn Research
15	Effects of Nitrogen on Delicious Apples
16	Sevin Insecticide Proves Effective as Chemical Thinner on Apples
17	Diseases of Fruit Trees
18	Dormant and Delayed Dormant Sprays on Peaches
19	Interaction of Mite Populations with Minor Elements
20	Factors Affecting Fruit Quality of Apples and Peaches after Harvest, Storage, Transit
21	Semi-Dwarf Rootstocks for Apple Trees in Western Colorado
22	Peach Rootstalks
23	Fruit Variety Trials
24	Pruning
25	Effect of Nitrogen and Iron Fertilization on Yield and Quality of Elberta Peaches in Mesa County
26	Causes and Control of Blemishes in Red McClure Potatoes
27	Development and Testing of Potato Seedlings and New Varieties
28	Potato Fertilizer Trials
29	Small Grain Trials
30	Sprout Inhibitor Tests on Potatoes
31	Soil-Borne Potato Disease Studies
32	Insect Control with Systemic Insecticides on Potatoes
33	Seed and Forage Production of Three Grasses
34	Forage and Grain Sorghum Yield Tests
35	Storing and Utilizing Excess Runoff by Spreading Over Leveled Fields in Dryland Areas
36	Yield and Chemical Constituents of Sorghum-Sudangrass
37	Yield and Chemical Constituents of Intermediate Wheat and Russian Wildrye Grasses
38	Water Utilization by Foxtail Millet and Sudangrass
39	Extra Wide Row Spacing of Grain Sorghum
40	Growing Barrier Crops for Snow Trapping
41	Summer Planted Legumes and a Sudangrass-Millet Comparison
42	Sudangrass Production on Eroded Soil (Weld Silt Loam)
43	More Efficient Use of Rainfall
44	Effect of Nitrogen Fertilization on Yield and Quality of Sugar Beets
45	Corn Research
46	Soil Tilth and Plant Growth
47	Pinto Bean Improvement Investigations
48	Effect of Nitrogen Fertilizer Levels on Five Orchard Grass Varieties
49	Alfalfa Variety Test
50	Influence of Source, Rate and Placement of Fertilizer on Yield of Barley
51	Inheritance Studies in Barley
52	Gravel Mulch Conserves Soil Moisture
53	Weed Control Studies in Sugar Beets
54	Special Crops
55	Red and Alsike Clover Trials in the High-Altitude Irrigated Meadows of Colorado
56	Small Grain Trials
57	Grain Sorghum Variety Tests
58	Dryland Forage Sorghum Variety Tests
59	Grain Sorghum Cultural Experiment
60	Forage Testing
61	Small Grain Variety Tests
62	Effects of Different Planting Dates on Winter Wheat
63	Rotation Experiment
64	Moisture-Fertility Relationships in Winter Wheat Production in 1961
65	Broom Corn Research
66	Testing of Miscellaneous Crops
67	Water Conveyance and Measurement
68	Clod Problems in Potato Production

69	Studies of Hailstorms at Colorado State University
70	Phreatophyte Growth in the Arkansas Valley
71	Floods from Small Watersheds
72	Water on the High Plains of Eastern Colorado
73	Study of Grazing Intensities on Native Sandhill Ranges
74	Grass vs. Grass-Legume Mixtures
75	The Effect of Seasonal Feed Levels on Cow-Calf Production, Rumen Fermentation and Nutritional Losses of Range Forage on Sandhill Ranges
76	The Effect of Male and Female Hormones on the Rate of Gain and Reproductive Performance of Beef Heifers
77	Feeding Methods and Feed Preparation for Stocker Steer Calves During Winter and the Effect on Subsequent Gains
78	Winter Roughage Rations for Steer Calves and Their Effect on Subsequent Gains
79	Alfalfa Variety Tests
80	Grass Variety Tests
81	Bean Improvement
82	Dryland Soil Management
83	Special Crops and Crop Uses — Safflower Variety Tests
84	Oat Variety Tests
85	Barley Variety Tests
86	Corn Testing
87	Wheat Tests
88	Natural Ground-Water Recharge from Kiowa Creek
89	Artificial Ground-Water Recharge Operations in Prospect Valley
90	Ground-Water Table Fluctuations in Colorado
91	Methods of Using Colorado Clays for Sealing Canals and Ponds
92	Specifications for Colorado Clays for Sealing Canals and Ponds
93	Sampling and Testing of Colorado Clays for Sealing Purposes
94	Corn Performance Tests on the Western Slope
95	Forage Testing
97	Rhizopus Decay — Problem for Peach Growers

## Scientific Series Papers

- Aanes, W. A. "Surgical Repair of Third Degree Perineal Laceration and Rectovaginal Fistula in the Mare." *Jour. Am. Vet. Med. Assoc.* (Sci. Series 851).
- Adams, O. R. "Hepatic Changes Resulting From Partial Ligation of the Posterior Vena Cava in Cattle." *Amer. Jour. Vet. Research.* (Sci. Series 811).
- Alexander, A. F., and Jensen, Rue. "Pulmonary Vascular Pathology of Bovine High Mountain Disease. IV. Pulmonary Vascular Pathology of High Altitude Induced Pulmonary Hypertension." *Amer. Jour. Vet. Res.* (Sci. Series 837).
- Alexander, A. F., and Jensen, Rue. "Pulmonary Vascular Pathology of Bovine High Mountain Disease. I. Normal Structure of Bovine Pulmonary Vasculature." *Amer. Jour. Vet. Res.* (Sci. Series 838).
- Alexander, A. F., and Jensen, Rue. "Pulmonary Vascular Pathology of Bovine High Mountain Disease. III. Qualitative Evaluation of Pulmonary Vascular Lesions in Animals with High Mountain Disease." *Amer. Jour. Vet. Res.* (Sci. Series 839).
- Alexander, A. F., and Jensen, Rue. "Pulmonary Vascular Pathology of Bovine High Mountain Disease. II. Pulmonary Arteriographic Studies." *Amer. Jour. Vet. Res.* (Sci. Series 840).
- Anderson, W. B., and Kemper, W. D. "Corn Growth as Affected by Aggregate Stability, Soil Temperature, and Soil Moisture." *Agronomy Journal.* (Sci. Series 815).
- Baker, Ralph. "The Dynamics of Inoculum." *International Symposium on Soil-borne Pathogens.* (Sci. Series 875).
- Ball, Leslie. "Artificial Uterus for Teaching Obstetrics." *Jour. of Amer. Vet. Med. Assoc.* (Sci. Series 810).
- Ball, Leslie, and Carroll, E. J. "Induction of Fetal Death in Cattle by Manual Rupture of the Amniotic Vesicle." *Jour. of Amer. Vet. Med. Assoc.* (Sci. Series 801).
- Ball, Leslie, Griner, L. A., and Carroll, E. J. "The Bovine Seminal Vesiculitis Syndrome." *Amer. Jour. of Vet. Res.* (Sci. Series 868).
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Rubin, Robert, M.S.	Associate Veterinary Pathologist	Weis, Adelia E., Ph.D.	Associate Nutrition Scientist
Salisbury, F. B., Ph.D.	Assistant Botanist	Whitney, R. S., Ph.D.	Chief, Agronomy Section, and Agronomist (Soils)
Sardo, Joseph, M.A.	Assistant Sociologist	Willhite, Forrest M., M.S.	Associate Agronomist (Soils)
Schleusener, Richard A., Ph.D.	Assistant Civil Engineer	Wilson, W. T., M.S.	Assistant Entomologist
Schmehl, W. R., Ph.D.	Agronomist (Soils)	Wood, D. R., Ph.D.	Associate Agronomist (Crops)
Schulz, Edmund, M.S.	Associate Civil Engineer	Wood, Mrs. Marcile, M.S.	Home Economics Editor
Schweissing, F. C., M.S.	Assistant Entomologist	Yevdjevich, V. N., Ph.D.	Civil Engineer
Seastone, D. A., Ph.D.	Associate Economist		
Simpson, R. G., Ph.D.	Assistant Entomologist		

## Federal Employees Cooperating

Federal employees cooperating. Employees are USDA except \*USGS and \*\*USDI.

Alexander, R. R., B.S.	Forester	McCambridge, W. F., B.S.	Entomologist
Alfieri, Salvatore, Ph.D.	Superintendent, U.S. Potato Station (Greeley)	McKnight, M. E., M.S.	Entomologist
Anderson, R. L., Ph.D.	Agricultural Economist	Miller, Robert L., B.S.	Research Forester
Bement, R. E., M.S.	Forester	Mueller, Lincoln A., B.S.	Technologist
Capener, W. N., Ph.D.	Agricultural Economist	Nagel, Roy H., M.S.	Entomologist
Cline, A. J., B.S.	Soil Scientist	Olsen, S. R., Ph.D.	Senior Soil Scientist
Cole, C. V., Ph.D.	Soil Scientist	Paulson, H. A., M.F.	Range Conservationist
Davan, C. F., Ph.D.	Economist	Peterson, Geraldine P., B.S.	Statistician
Fly, C. L., Ph.D.	Soil Scientist	Peterson, Roger, M.A.	Plant Pathologist
Follett, R. H., M.S.	Soil Scientist	Powers, LeRoy, Ph.D.	Principal Geneticist
Goodell, B. C., M.F.	Forester	Price, Raymond, M.S.	Director, Rocky Mountain Forest and Range Experiment Station
Grable, A. R., Ph.D.	Soil Scientist	Reid, Elbert H., B.S.	Range Conservationist
Gaskill, J. O., M.S.	Plant Pathologist	Reid, Vincent H., B.S.	Biologist
Greb, B. W., M.S.	Soil Scientist	Richardson, E. V., B.S.	Hydraulic Engineer
Haise, H. R., Ph.D.	Technical Staff Specialist	Roebecker, Melvin, B.S.	Soil Scientist
Hawksworth, F. G., Ph.D.	Plant Pathologist	Robinson, A. R., M.S.	Agricultural Engineer
Hayes, G. Lloyd, B.S.	Forester	Ronco, Frank, Jr., B.S.	Forester
Heede, B. H., M.F.	Forester	Schaal, Lawrence, Ph.D.	Associate Plant Pathologist
Hinds, Thomas E., B.S.	Plant Pathologist	Shawcroft, R. W., B.S.	Soil Scientist
Hoover, Marvin D., B.S.F.	Forester	Simons, Daryl B., Ph.D.	Hydraulic Engineer*
Hunter, E. C., Ph.D.	Agricultural Economist	Sitler, Harry, M.S.	Agricultural Economist
Hughes, Jay M., M.S.	Research Forester	Smith, D. R., B.S.	Range Conservationist
Hays, Orville E., M.S.	Superintendent, U.S. Central Great Plains Field Station, Akron	Tanner, H. A., Ph.D.	Fisheries
James, Edwin, Ph.D.	Head, National Seed Storage Laboratory	Townsend, Charles, Ph.D.	Research Geneticist
Knight, Fred B., Ph.D.	Entomologist	Viets, F. G., Ph.D.	Technical Staff Specialist
Kovner, Jacob L., Ph.D.	Statistician	Washichek, J. N., B.S.	Hydraulic Engineer
Love, L. D., Ph.D.	Forester	Watanabe, F. S., M.S.	Soil Scientist
Marinelli, Mario, Jr., Ph.D.	Forester	Whitfield, C. J., Ph.D.	USDA Liaison Representative
		Wilford, B. H., Ph.D.	Entomologist
		Willhite, F. M., M.S.	Soil Scientist, Grand Junction
		Wygant, Noel D., Ph.D.	Entomologist
		Yeager, Lee E., Ph.D.	Game Management**

## Financial Report for Year Ending June 30, 1963

RECEIPTS 1962-63					DISTRIBUTION OF FUNDS BY CLASSIFICATION FOR FISCAL YEAR ENDING JUNE 30, 1963								
Funds	Balance 7/1/62	Receipts from U. S. Treasurer	Receipts other sources	Total income	Personal services	Contribu- tions to retirement	Labor	Travel	Equipment	Misc.	Total disbursements	Balance 6/30/63	GRAND TOTAL
Hatch		362,607.00		362,607.00	242,543.81		50,583.56	9,744.41	12,904.33	46,830.89	362,607.00		362,607.00
RRF		186,237.00		186,237.00	109,714.60		19,655.30	4,860.82	14,266.43	37,739.85	186,237.00		186,237.00
Title II	416.94	2,600.00		3,016.94	1,312.50			33.78	245.00	297.80	1,889.08	1,127.86	3,016.94
RRF Trust		11,820.00		11,820.00	400.00		160.00	7,100.20	1,031.70	3,128.10	11,820.00		11,820.00
Mill Levy Tax	257.29		106.34	363.63				35.35		323.39	358.74	4.89	363.63
State Appropriation			1,350,000.00	1,350,000.00	672,043.21	53,909.07	69,140.78	27,287.25	67,687.23	459,932.46	1,350,000.00		1,350,000.00
Vibrio Tax	4,837.93		13,608.40	18,446.33	14,419.98	865.20					15,285.18	3,161.15	18,446.33
Service Projects	6,944.79		70,887.62	77,832.41	6,262.24	375.74	31,414.81	1,308.57	3,277.32	37,174.65	79,813.33	(1,980.92)	77,832.41
Research Projects	1,115.35		233,065.64	234,180.99	884.49		33,004.28	9,477.97	14,045.89	179,315.85	236,728.48	(2,547.49)	234,180.99
Trust & Agency	2.69		84,991.45	84,994.14	28,805.55	1,344.00	7,339.41	2,853.36	1,595.88	21,125.33	63,063.53	21,930.61	84,994.14
Corn Foundation	3,260.85		2,989.82	6,250.67	830.68	49.09	1,011.93	842.99	149.44	868.82	3,752.95	2,497.72	6,250.67
Sorghum Foundation	4,975.95		2,840.00	7,815.95			581.09	659.05	645.00	616.41	2,501.55	5,314.40	7,815.95
ARS Contracts	(15,928.94)		50,767.56	34,838.62	13,240.45	794.43	18,853.01	1,127.72	39.00	12,386.62	46,441.23	(11,602.61)	34,838.62
<b>TOTALS</b>	5,882.82	563,264.00	1,809,256.83	2,378,403.68	1,090,457.51	57,337.53	231,744.17	65,331.47	115,887.22	799,740.17	2,360,498.07	17,905.61	2,378,403.68

