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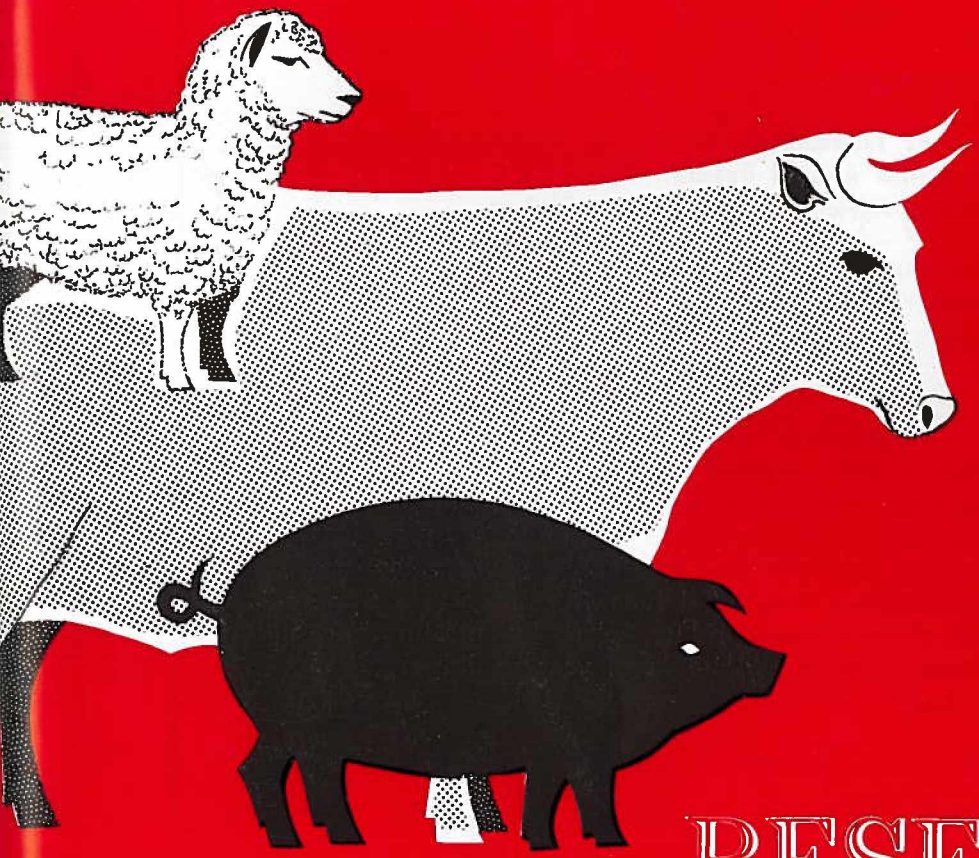

RESEARCH

SERVES COLORADO AGRICULTURE

AGRICULTURAL EXPERIMENT STATION • FORT COLLINS

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

Honorable Edwin C. Johnson
Governor of Colorado
Denver, Colorado

Sir:

In compliance with the act of Congress, approved March 2, 1887, entitled, "An act to establish Agricultural Experiment Stations, in connection with the colleges established in several states under the provisions of an act approved July 2, 1862, and under the acts supplementary thereto," I herewith present the Sixty-ninth Annual Report of the Colorado Agricultural Experiment Station for the fiscal year of July 1, 1955 to June 30, 1956.

Fort Collins, Colorado
July 1, 1956

S. S. Wheeler
Director

sixty-ninth annual report—colorado agricultural experiment station

Research Serves Colorado Agriculture

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Crops and Soils

Alfalfa is an important crop in Colorado. Continuous attacks by the spotted alfalfa aphid will bring pressure to solve this problem by use of a resistant variety. Three cuttings of Lahontan, resistant to nematodes and attacks of the spotted alfalfa aphid, were grown in the greenhouse and the cuttings were increased for planting in the field. The project needs additional greenhouse space since most breeding procedures demand the use of clones and the transplanting of seedlings from the greenhouse.

Previous work in restoring land after surface soil has been removed by leveling or erosion shows the main factors limiting growth on subsoils exposed by land leveling are deficiences of available nitrogen and phosphorus. Sugar beets were grown on such land in 1955. The non-fertilized beets yielded 7.3 tons per acre, while the fertilized acreage produced from 17 to 20 tons.

Improved seed variety tests were conducted at Fort Collins, Rocky Ford, Fort Lewis and Akron with winter wheat, winter barley, spring wheat, spring barley and oats. Results indicate that Overland, a short-strawed midseason oat, yields well and is suitable for the San Luis Valley where a short-strawed variety with good yield is desired as a nurse crop. Hiland, a smooth-awned 6-rowed barley produced by the Wyoming station, is recommended as an irrigated barley.

In dryland sorghum experiments eleven grain sorghums, six sorgos and six sudangrass strains were used in a variety test at the Akron Field Station in 1955. Grain sorghum varieties with highest production on fallow land were Early Kalo, Gurno, Coes, Midland, Double Dwarf Sooner and Double Dwarf Hegari. High grain varieties on stubble land were Coes, Early Hegari and Double Dwarf Hegari. Sorgo varieties with high fodder yields on fallow land were Leoti and Black Amber. The high sorgo yielders on stubble land were Leoti, Idaho Amber and Black Amber. High hay yielders in the sudangrass strains were Sweet Sudan on fallow, while Piper produced the most on stubble land. Twenty-four grain sorghum variety tests on irrigated land were conducted at Rocky Ford. High grain producers were Martin, Combine Hegari and Darset.

The Soils Testing Laboratory is operated jointly by the Colorado Agricultural Experiment Station, the Soil Conservation Service and the Colorado Agricultural Extension Service. From January 1, 1955 through December 31, 1955 the laboratory processed 3,506 samples involving 23,546 separate tests. This is a 13 percent increase over 1954. Farmers submitted 2,023 samples in 1955, or 58 percent of all samples. The laboratory is a direct service to many farmers and city people. It is also a good means of spreading general information and results of experimental work.

The foundation seed project is established to provide genetically pure seed for seed growers and farmers of the state. Head rows of Lico III, Colorado 37 oats, Meimi barley and Cheyenne winter wheat were grown for purification.

This year's major work in soil survey and land classification has been in connection with the accelerated soil survey program in the wind erosion areas in eastern Colorado. Standard soil surveys are now in progress in

Hybrid corn is rapidly becoming an important crop in Colorado's irrigated areas.

Agronomists look over a stand of corn growing on reclaimed land near Grand Junction.

Prowers, Crowley, Adams, Morgan and Sedgwick counties. Survey work plans and soil survey legends were prepared in cooperation with the state soil scientist of the Soil Conservation Service. Work has continued on the preparation of county soil maps for County Agents.

Researchers explored production of mountain meadows under three management systems in the project on improvement of high altitude meadows. They are: (1) present rancher practices which result in wire grass-sedge meadows; (2) rancher practices including irrigation control which result in grass-legume meadows, and (3) introduced research findings including water control, fertilization with nitrogen, and proper cutting which results in grass meadows of high protein content. Results show that (1) without water control ranchers obtain an average of one ton of hay, 160 pounds of crude protein and 90 pounds of beef per acre; (2) with water control and grass-legume nitrogen, ranchers obtain an average of two and one-half tons of hay, 450 pounds of crude protein and 225 pounds of beef per acre; (3) with water control and grass fertilized with commercial nitrogen, results showed five and one-half tons of hay, 1,000 pounds of crude protein and 480 pounds of beef per acre.

In soil reclamation studies unproductive saline-alkali soil was successfully reclaimed by leaching. Analysis indicated the degree of reclamation was determined by the amount of water used in leaching. Alfalfa yields increased as more water was used to leach the soil.

Livestock and Poultry

The 1955-56 wintering period was the third year of winter range feeding of Vitamin A supplements to cattle in winter range feeding tests. Two-year results of this phase have shown that feeding supplemental amounts of alfalfa hay and dehydrated alfalfa results in greater daily gain in calves. Dehydrated alfalfa has shown some advantage over alfalfa hay as a supplement under winter range feeding conditions.

Purpose of the study of fat measurement in cattle is to develop a method of measuring subcutaneous fat in live cattle. This method should be useful in refinements in marketing, performance testing and other experimentation with cattle. An ultrasonic device called the "Somascope" was used on Herefords in three positions over the last rib. Results so far indicate the Somascope will measure fat accurately in live cattle.

Random samples of grease wool were obtained at shearing from one clip of 55,000 pounds in a study on shrinkage of commercial wool clips. The shrinkage estimate from samples for the whole clip was 60.8 percent. Actual mill shrinkage of the entire lot was 61.5 percent. It indicates the closeness of prediction of shrinkage values from the samples.

Self-fed pelleted rations of various kinds were compared with hand-feeding a standard ration to heavy weight lambs. Results showed considerable advantage in self-feeding pelleted rations. There was a saving of feed, the lambs gained faster, finished in less time and there was a saving in labor due to self-feeding. One disadvantage to self-feeding pelleted rations was increased cost of pelleting. In four of the six pellet lots, however, this extra cost was more than offset by savings in feed and labor.

The objective in a test on feeding corn silage to light weight lambs was to feed corn silage with different supplements during the first 60 to 70 days for slow, economical gains. This was followed by a period of self-fed pelleted rations for rapid gains in an attempt to get the lambs on a more favorable late spring market. Most economical practice was to feed light lambs a daily ration of five pounds of corn silage, two-tenths of a pound of soybean meal and a half pound of dehydrated alfalfa pellets for the first 70 days. During the last 44 days a self-fed pelleted ration of half alfalfa hay and half corn is recommended.

In tests of the effect of hormones, drugs and similar substances on livestock nutrition experiments were designed to determine the effect of various hormonal substances when fed as part of the ration and administered parenterally upon feedlot performance and carcass grade of steers. Results of the first year's test show that steers fed 10 mg. of stilbestrol per day produced the highest gain at the lowest feed costs. Generally, steers receiving various hormone injections gained faster than the check lot of cattle, but not as much as those on stilbestrol. Little variation in carcass value was noted.

A study was set up to investigate practices which have been suggested as causing off flavors in milk. Feeding molasses or milo grain had no effect. Ointments for treatments by infusion of mastitis seemed to have no effect on flavor. A preliminary trial indicated that cows on grass pasture produced better milk than those on alfalfa. No relationship appears between the age, breed, stage or lactation or heat cycles and the flavor of milk.

Two hundred and forty New Hampshire and Delaware chicks were hatched February 2, 1956. They were placed on 12 different feeding levels of vitamins, protein and calories in a test on chick nutrition. There were ten males and ten females in each group. The chicks were weighed bi-weekly to measure growth and feed efficiency. Results to date indicate there is a sex difference in males and females as to requirements of energy, calories and perhaps protein. Indications are that males require or can tolerate a higher caloric and protein level while females appear to have a higher vitamin requirement. Purpose of the study is to determine effects of different energy levels on nutrient requirements of the ration.

Twelve bulls up to seven years of age with a history of breeding failure have been under study and treatment in a study of testes failure in sub-fertile bulls. Attempts were made to classify the type of testis failure. Then hormone treatment was started. Three bulls were restored to fertility and the remainder showed only minor improvement or did not respond. This demonstrates that causes of spontaneous infertility need more study.

An automatic processing machine for frozen semen plus an automatic storage cabinet to handle 25,000 vials of frozen bull semen are now in operation. A number of chemical agents is being added to semen diluents to prolong livability of sperm after freezing. While the results have been encouraging, it is too early to state which of these agents will be suitable for commercial processing.

Through the use of light traps, station entomolgists can determine insect infestations throughout the state.

Control of Insect Pests

Studies on the control of psyllid, tuber flea beetle, aphids and leaf hoppers on potatoes were undertaken at the USDA potato station at Greeley. Emphasis was placed upon soil treatments using two forms of Heptachlor, two of Aldrin and one of Dieldrin for control of tuber flea beetle. This was followed by foliage treatments with DDT, Systox, Dieldrin, Toxaphene and Lethane during the growing season for control of leaf feeding insects carrying virus diseases such as psyllid, aphid and leaf hoppers.

The importance of knowing what economic insect pests are devoloping in agricultural areas has been demonstrated in the past three seasons through a series of regular reports and surveys by the Colorado Insect Detection Committee headquarting at the Station. Light traps throughout Colorado permit accurate reports of insect population and movement. Reports go to USDA personnel and others in Washington, D.C., and county agents, farm leaders, chemical industries and aerial applicators in Colorado. Through CSU's Information Service, releases are sent to the state's newspapers, and radio and television stations, farm magazines and press associations.

The Miller amendment to previous laws regulating the use of pesticides has made deliberations of a special Insecticide Subcommittee important. A committee composed of representatives from the U.S. Department of Agriculture, U.S. Public Health Service,

U.S. Pure Food and Drug Administration and extension and research staffs has been meeting with chemical manufacturers to arrange a procedure approving the use of various insecticides for the control of insects. The setting of tolerances on all agricultural chemicals and sampling of agricultural products for toxic residues place considerable responsibility on any agency making new recommendations.

A "Community Fly and Mosquito Control" publication is near completion. The Entomology section has been working on the problem for several years. A considerable backlog of information is available that can be used in community programs.

Surveys made to determine the presence of insects in stored wheat in Colorado showed these findings: minor grain insects found include sawtoothed grain beetle, confused flour beetle, flat grain beetle, yellow meal worm, cadelle, Indian meal moth, black carpet bettle, lesser cabinet beetle and procids. Tests in Adams county on the effectiveness of fumigation with 80-20 mixture of carbon tetrachloride and carbon bisulfide showed that the material is effective when applied at the recommended concentration of one and one-half gallons per 1,000 bushels. If the material is evenly distributed over the surface as a splattering spray, 90 to 100 percent mortality is obtained. If the material is applied in a spotty pattern, there will be areas in which insects may survive fumigation. There was an indication that insects near the surface of the grain have a better chance of survival than those at greater depth.

Horticultural and Floricultural Crops

This year 136 potato varieties and seedlings were planted at Fort Collins in special tests. Fifty-two of the varieties were harvested. Forty-one will be replanted for further testing. Records were taken on vine type, growth, disease resistance, tuber type and quality, specific gravity, yield and chipping quality. Out of the tests, seven seedlings have looked exceptionally good. From these lots, seed has been distributed to foundation and certified seed growers for increase and field trials.

Purpose of the project on improvement of canning tomatoes is to develop a new type tomato which is adapted to northern Colo-

Onion research is valuable to growers on Colorado's Western Slope.

rado. During the past season three acres of hybrid tomatoes from outcrosses and selections were grown and seed saved for planting this spring. Several lines look promising and are being tested by canning companies.

Considerable progress was made in carnation breeding research. One fine yellow-flowered variety is being released for commercial production. It has been named "Brigadoon." An outstanding white with superior keeping quality is being sent out for commercial tests this spring.

Dehydrated potatoes were removed from accelerated storage and their degree of browning measured in an experiment on processing of fruits and vegetables. Storage tests were run at 100 degrees F. and 120 degrees F. Rates of color development at higher temperatures were also studied. Comprehensive tests were conducted to determine canning and freezing characteristics of peaches and apples. Pears were tested for canning qualities. Excellent pies with intense flavor were made with these apple varieties: Standard, Foster, Markham, Jonathan, Jonared, Black Jon and Secor.

Engineering Research

There are 130 active snow courses and 18 soil moisture stations in Colorado used in the project on snow measurement. Stream flow forecasts were prepared for about 55 streams serving more than two million acres of irrigated land in Colorado. Information concerning snowpack and streamflow forecasts is sent out regularly by the Information Service. In addition, 850 copies of the snow report are sent out to people requesting this material.

Two soil columns have been installed in the wind tunnel to study evaporation from soil surfaces. Evaporation data will be collected with the water table at different elevations with different types of soil. The study will also consider different conditions of surface soil and varying wind velocities.

In an experiment on open channel constrictions, figures have been worked out from 200 separate tests which make possible the prediction of backwater curves due to channel constrictions resulting from bridge piers. These results are applicable to the more standard types of bridge pier construction.

Engineers are working on means to make a sugar beet planter meter processed and monogerm seed more accurately and plant seed with less damage. Three foreign planters and the most popular domestic planters are being tested. The average field germination from the three foreign planters was 63 percent higher than the American planters. Seed damage from the foreign planters was negligible and distribution was good on two of the three machines. The tests were with monogerm seed. A search for new ideas is being made for a machine to plant accurately monogerm seed without damage. With these new ideas as a guide engineers plan to build and test a model of their own design.

Range Management and Forestry

Tests were made to improve sagebrush lands to obtain maximum livestock production in a study of reclamation of such areas. Sage land was cleared in several ways. One method was to burn the sage and allow natural recovery of vegetation. Other land was burned and reseeded and other sage was sprayed with 2,4-D and 2,4,5-T. In grazing tests conducted, those during the 1955 grazing season show possibilities of more than doubling beef gains by burning and reseeding. Chemical control of sagebrush resulted in only slightly greater beef gains per acre than the untreated pasture during 1955.

Efforts to stabilize a 30-acre blowout area were started by smoothing the roughest spots. This was followed by one of these methods: (1) applying manure; (2) applying straw and N, NP, P or no fertilizer; (3) seeding sorghum and then planting grass and sweet clover in the stubble. About one-half of the blowout area was seeded to sorghum in 1955.

Pasture studies are important to livestock operators. The cattle seem to take an interest, too.

Strips of sand lovegrass, crested wheatgrass and Madison vetch were planted in the sorghum stubble in October, 1955 and April, 1956. Observations indicate that scattering either straw or manure and rolling it into the sand prior to seeding is effective in preventing the seeded area from blowing. Sorghum stubble was effective in all but the most critical areas. Under extremely severe conditions of the blowout, the outstanding species were sand lovegrass and sweet clover.

A survival count at the Akron field shelterbelt indicated around 70 percent for the Russian Olive and Siberian peashrub, 45 to 60 percent for Chinese Elm and 33 percent for Ponderosa pine in shelterbelt plantings. Preliminary counts indicated that hand planting was not superior to machine planting except with Siberian elm.

Investigations into making charcoal in a small kiln have received major effort in a study of more efficient use of Colorado timber. The quality and yield of charcoal manufacturing trials meet acceptable standards. Fence post studies have been continued. Of posts which had been in the ground since 1943, those treated with cresote were in best condition. Those treated with pentachlorophenol were next best.

Control of Plant Diseases

A 15-acre Jonathan apple orchard was used to evaluate three fungicides applied three times in the bloom period for control of fire blight. Results indicated that streptomycin produced a 95 percent reduction in blighted spurs. Findings relative to fire blight control are of particular significance to apple and pear growers who have been fighting a losing battle with this disease. Results of the test have been conclusive enough to warrant their incorporation in fruit disease control recommendations for the state.

Dalapon was tested as a post-emergence application for control of volunteer oats in sugar beets. Rates used were seven and nine pounds per acre. Results indicate good oat control without a significant depression in sucrose yield at the seven-pound rate applied in the cotyledonary stage.

Tests were conducted to compare the

effectiveness of seed and soil treatments in controlling seed rot and seedling blight of sugar beets. Application of a fungicide in the form of a seed treatment was more effective than the application of a fungicide into the soil at planting. A new experimental seed treatment compound was shown to be more effective than Maneb, Captan or Arasan. Any information that contributes to the effective control of soil-borne organisms by seed treatment, soil treatment, resistant varieties or other agronomic practices is of significant value to the sugar industry.

Potato tubers infected with aster yellows were found to have accumulated a high concentration of chlorogenic acid in an investigation of polyphenols of crop plants. This is similar to such accumulation in areas of mechanical injury. Treatments which lowered the rate of respiration (both environmental and chemical) lowered the rate of accumulation of chlorogenic acid. Researchers found that polyphenol accumulation in potato tubers is related to resistance of the potato variety to scab. As a result, it was decided to determine whether similar relationships might exist in the wheat plant for resistance to black stem rust. Four resistant and three susceptible varieties were tested, but no significant difference in the total phenols in these varieties was found.

A field plot was established to evaluate 13 materials in the control of seed rot and seedling blight on crops susceptible to these diseases. Captan, Arasan, SFx and Delsan A-D produced notable increases in stand.

Scientists found that through use of seed treatments of small grain, it is possible to control the majority of seed-borne organisms. Without effective control, losses from 25 to 50 percent would result from covered smut, loose smut, stinking smut and Setrete smut.

The number of seed samples received by the Seed Laboratory as of April 1 was 400 more than received at the same time last year —or an increase of 16 percent. Just completed is the 36th series of germination tests on samples of crop seed that have been in storage under a cooperative seed longevity project inaugurated in 1921. Altogether, 120 lots of seed have been included in the tests. Many of them show sufficient viability to maintain the lines after 30 years in storage. The germination of some samples of barley and oats runs as high as 70 percent and better than 90 percent in black amber cane.

Much effort was again directed toward the control of creeping perennial weeds, mostly of the primary noxious group. Foliage and soil applications are being tested. The cooperation of county agents in locating and staking out infested areas has proved to be of benefit to the counties and the Experiment Station.

Home Economics

Recipes for quick breads and cookies are being prepared for use at high altitudes. Forty standard recipes have been checked at 5,000 feet and are being adjusted for 7,500 and 10,000 feet. The laboratory work is nearing completion and the recipes are being prepared for publication.

Follow-up studies are in progress to check further the baking qualities of Russet Burbank and Red McClure potatoes. Tests were conducted at time of harvest, and again after six months in storage. The potatoes were analyzed for total solids and ascorbic acid content. Researchers also studied the effect of tuber size and of baking temperature on the baking quality.

The 10-11-12 rib section from the right side of each of the 60 animals used in the somascope study conducted by the Animal Investigations section was placed in frozen storage in a meat quality test. The rib eye muscle from this 3-rib cut was studied this year. Moisture, pH, and chemical fat determinations were made on uncooked meat. Specific gravity was investigated as a procedure for measuring marbling fat. Quality of the cooked meat was studied by broiling the thawed rib eye muscle steaks under controlled conditions. They were scored by a panel of five judges for appearance, odor, flavor, juiciness and tenderness.

Separate findings on diet, physical condition and blood nutrients of persons in selected age groups have been gathered in a project on nutritional status of poulation groups. Current work includes an analysis of dietary data

in relation to physical condition. Personnel have been active in making preparations for a regional dietary bulletin.

Graphic interpretations of unit space for storage of all types of garments have been prepared in experimental work on clothes and storage space. Recent work includes a recheck of the computed lateral or side-to-side dimensions of storage compartments or facilities. The report will be ready for publication soon.

Agricultural Marketing

Data on location, volume, source of supply and outlets for milk plants in Colorado were secured in a study of needed adjustments in fluid milk marketing. This information was combined with similar information from 11 other western states. Detailed cost and sales figures for a selected milk firm in Colorado were secured in order to judge the feasibility of automatic milk dispensers as a means of milk distribution.

Questionnaires were sent to all radio stations, newspapers and livestock auction firms in Colorado to determine the extent and nature of marketing information published by these agencies.

Several conferences were held with representatives of the carnation industry to determine the most critical problems facing the industry in the marketing of carnations. The shipping container was selected for critical analysis. Representatives of major container companies and the U. S. Department of Agriculture have been consulted. Improvement has been made over the previous method of shipping, but to date a modified container design has not been agreed upon.

Animal Diseases

In one experiment on liver abscess in cattle and sheep, 150 cattle were fattened on a ration with a low level of aureomycin; 242 cattle were fattened on a high level of the antibiotic; and 180 cattle were fattened without aureomycin. At slaughter no significant differences in number of abscessed livers were observed. Studies on the nature of the irritant which is responsible for rumenitis are being continued.

Scientists studied the influence of various rations on the development of urinary calculi

Veterinarians inspect a steer's heart as they try to get a better understanding of high altitude disease in cattle

in sheep and cattle. There was no definite correlation between mineral ration and calculi development in the tests. Future experiments will be designed to determine more accurately the predisposing causes of calculi which operated in this year's studies. Possible control procedures will also be studied.

Field trials in the use of perfringens type C toxoid and antitoxin for the control of hemorrhagic enterotoxemia in calves and lambs indicate that both of these products are effective. Toxoids used in attempting to prevent "cow asthma" have been only partially successful.

Studies of sick or dead animals or poultry are conducted in the fields of pathology, bacteriology, virology and parasitology. In addition, chemical tests are made for toxicology and to determine the potability of water. Many field trips are taken by staff members to investigate unusual or severe livestock disease problems.

The research effort on mechanism of vibriosis in sheep was concentrated on transmission of vibriosis in sheep. One lot of ewes was bred to clean rams, another lot was bred to rams which contained vibrio fetus in sheath, and a third lot was bred to clean rams and during the fifth month of gestation was fed infected fetal tissues. No abortions occurred in the first two lots, while three-fourths of the ewes in the third lot aborted. In further research, scientists will study ways to determine immunity produced by infection and by vaccination.

A number of developments in the study of rhinotracheitis in cattle were brought out this year. They are: (1) geographical distribution and epizootology were studied, (2) pathology and clinical pictures were determined, (3) experimental reproduction of the disease was accomplished, (4) laboratory cultivation of the virus was initiated, and (5) a diagnostic service for the benefit of other states was established.

Information and Publications

Citizens of Colorado were kept informed of developments in agricultural research through news releases prepared by the Information Service and sent to press associations, newspapers, magazines and radio and television stations.

The Experiment Station bi-monthly publication, "Colorado Farm and Home Research," contained articles of general interest describing various research projects. Circulation of this magazine is approximately 3,000.

Other duties included editing and preparing for publication the technical papers, progress reports and bulletins listed below.

General Series Papers

Amemiya, M. "Reclamation of Saline and Alkali Soils-Progress Report." Gen. Series 619.

Binkley, A. M;. Rogers, E.; Green, F. M. "Potash Application on Elberta Peach Trees." 1955 Progress Report on Western Colorado Research. Gen. Series 632.

Cooper, V. "San Luis Valley Progress Report, 1955." Gen. Series 637.

Daniels, L. B. "Insect Control Recommendations, 1956." Gen. Series 634.

Denham, A. H. "Eastern Colorado Range Station, 1955 Report." Gen. Series 638.

Fauber, Herman. "1955 Arkansas Valley Progress Report." Gen. Series 629.

Ferguson, A. C. and Binkley, A. M. "Hybrid Onion Trials, Western Colorado." Gen. Series 632.

Ferguson, A. C. and Binkley, A. M. "Onion Breeding." 1955 Progress Report on Arkansas Valley Research. Gen. Series 629.

Ferguson, A. C.; Bakes, Donald; Fauber, Herman. "Chemical Weed Control." Gen. Series 629.

Green, Ferris, "Western Slope Progress Report." Gen. Series 632.

Hervey, D. F.; Everson, A. C.; Barmington, R. D.; Daugherty, F. C. "1954 Eastern Colorado Range Station Progress Report." Gen. Series 620.

Jenkins, L. E. and Daniels, L. B. "Sugar Beet Root Maggot in Colorado." Gen. Series 626.

Kunkel, Robert. "Preliminary Report of Potato Research, 1954." Gen. Series 618.

Kunkel, Robert. "Who Produces Our Surplus Potatoes?" Gen. Series 623.

Kunkel, Robert. "Specific Gravity of San Luis Valley Potatoes." Gen. Series 624.

Kunkel, Robert. "Fertilization of Potatoes in the San Luis Valley." 1955 Progress Report for San Luis Valley. Gen. Series 637.

Kunkel, Robert and Fauber, Herman. "Rotation Experiment." 1955 Progress Report on Arkansas Valley Research. Gen. Series 629.

Leonard, W. H. "U. S. Akron Field Station Progress Report." Gen. Series 625.

Leonard, W. H.; Brandon, Joe; Koonce, D. "Hybrid Corn Performance Tests." Gen. Series 628.

Mann, Herbert. "1954 San Juan Basin Branch Station Progress Report." Gen. Series 616.

Olsen, S.; Watanabe, F.; Romsdal, Dale. "Correlation of Soil Test Results with Yield Response and Phosphate Uptake." Gen. Series 614.

Patton, A. R. "Teaching Dynamic Biochemistry." Gen. Series 641.

Rogers, Ewell. "Sweet Cherry Fertilizer Test." 1955 Progress Report on Western Colorado Research. Gen. Series 632.

Stockwell, H. J. "Snow Survey," February 1, 1956. Gen. Series 630.

Stockwell, H. J. "Snow Survey," March 1, 1956. Gen. Series 633.

Stockwell, H. J. "Snow Survey," April 1, 1956. Gen. Series 636.

Stockwell, H. J. "Snow Survey," May 1, 1956. Gen. Series 640.

Stonaker, H. H. "Improvement of Beef Cattle Through Breeding." Gen. Series 642.

Story, C. D. "1956 Feeders Day Report." Gen. Series 635.

Troxell, H. E. and Barney, C. W. "Forestry Research Notes." Gen. Series 631.

Troxell, H. E. and Campbell, Don. "Time-Temperature Study in Small Charcoal Kiln," March, 1956. Gen. Series 639.

Ward, Gerald M. "Calcium Balances and Blood and Urinary Levels of Some Organic and Inorganic Constituents as Related to Parturient Paresis in Dairy Cows." Gen. Series 627.

Willhite, Forrest. "Soil Fertility Research on Colorado Mountain Meadows." Gen. Series 621.

Willhite, Forrest. "1955 Mountain Meadows Progress Report." Gen. Series 615.

Willhite, Forrest and Rouse, Hayden. "Production of a Grass Hay for Use as a Protein Supplement Through Nitrogen Fertilization." Gen. Series 617.

Willhite, F.; Rouse, H.; Miller, D. E. "The Effect of Nitrogen and Phosphate Fertilizers on Mountain Meadow Forage as Measured by Beef Production and Weaner Calf Production." Gen. Series 622.

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Amemiya, M.; Robinson, C. E.; Cowley, E. W. "Reclamation of Saline-Alkali in the Upper Colorado River Basin." Proc. Soil Science Society. Sci. Series 463.

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Chow, T. L.; Palotay, J. L.; Deem, A. W. "Infectious Rhinotracheitis in Feedlot Cattle (III); An Epizootiological Study in a Feedlot." AVMA Journal. Sci. Series 472.

Evans, N. A. "Stratum Survey Techniques for Drainage Investigation on Irrigated Lands." Journal of Agricultural Engineering. Sci. Series 497.

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Griner, L. A.; Jensen, Rue; Brown, W. W. "Infectious Enbolic Menigno-Encephalitis in Cattle." Jour. of AVMA. Sci. Series 483.

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Kunkel, Robert and Edmundson, W. C. "Factors Affecting the Toughness of Potato Skins." Amer. Soc. of Hort. Science. Sci. Series 480.

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Financial Report for Year Ending June 30, 1956

	RECEIPTS 1955-1956				DISBURSEMENT OF FUNDS BY CLASSIFICATION FOR THE FISCAL YEAR ENDED JUNE 30, 1956												
	Balance July 1, 1955	Receipts from U. S. Treasurer	Receipts Other Sources	Total Income	Personal Services	Travel	Transportation of Things	Communication Service	Rents and Utility Service	Printing and Binding	Other Contractual Services	Supplies and Materials	Equipment, Land Structures	Contributions to Retirement	Total Expenditures	Balance June 30, 1956	Grand Total
Hatch		255,587.56		255,587.56	183,757.05	11,963.12	781.59	869.07	2,137.74	204.27	3,906.73	29,347.46	16,699.57	5,920.96	255,587.56		255,587.56
R. R. F.		108,000.00		108,000.00	72,169.49	4,529.46	193.98	454.78	829.25	234.92	1,218.33	13,486.26	12,940.28	1,943.25	108,000.00		108,000.00
R. R. F. Trust		15,880.00		15,880.00	7,043.52	5,903.01	56.97	906.26	225.00	25.25	477.66	1,106.43	135.90		15,880.00		15,880.00
Title II, Sec. 204 (b)	3.66	4,900.00		4,903.66	4,103.50	269.34		3.00			2.50	33.75	491.57		4,903.66		4,903.66
ARS Contracts	(1,001.75)	22,250.00		21,248.25	13,417.38	689.34	139.44	98.73	116.87	1.71	1,358.61	15,866.12	1,292.23	168.34	33,148.77	(11,900.52)	21,248.25
General Appropriation			275,000.00	275,000.00	185,978.38	5,200.54	422.41	2,461.32	7,672.65	2,772.62	13,317.59	35,399.44	14,040.27	7,734.78	275,000.00		275,000.00
Plant Disease			25,000.00	25,000.00	16,431.87	655.47	118.36	242.40	834.29	150.50	618.32	3,950.25	1,540.26	458.28	25,000.00		25,000.00
Pure Seed			8,000.00	8,000.00	7,625.87		63.68	42.83	16.25	6.58	22.85	132.77		89.17	8,000.00		8,000.00
Mountain Meadow			7,500.00	7,500.00	5,442.35	99.60	9.36	215.55	122.85		368.43	723.24	481.18	37.44	7,500.00		7,500.00
S.E. Colo. Branch Station			32,000.00	32,000.00	3,859.28	249.96	36.49	14.35	1,024.81			3,301.24	10,770.12	154.56	19,410.81	12,589.19	32,000.00
Colorado Gopher Fund			30,000.00	30,000.00	12,517.39	2,376.78	29.41	72.11	829.25	28.00	143.18	7,225.14	6,406.30	60.00	29,687.56	312.44	30,000.00
Mill Levy Tax	9,905.12		150,674.71	160,579.83	75,347.13	2,569.39	478.85	2,634.66	5,542.14	2,463.18	5,375.64	34,019.24	7,418.49	2,495.34	138,344.06	22,235.77	160,579.83
Vibrio Tax Fund	3,857.31		11,901.45	15,758.76	7,310.71	102.30	26.58	.75			420.00	7,051.54		153.74	15,065.62	693.14	15,758.76
Station Special	5,228.72		215,137.41	220,366.13	28,750.11	2,623.08	2,674.89	1,081.64	15,047.13	645.78	10,345.77	82,003.67	61,226.43		204,398.50	15,967.63	220,366.13
Hybrid Corn	6,855.84		3,488.37	10,344.21	1,355.58	368.49	77.94	60.37	14.40	156.00	430.46	1,177.53			3,640.77	6,703.44	10,344.21
CAMRF	137,496.48		420,406.64	557,903.12	247,130.20	12,043.40	1,096.81	1,282.27	2,968.08	1,750.52	40,262.30	42,579.09	44,632.78	2,633.60	396,379.05	161,524.07	557,903.12
TOTALS	162,345.38	406,617.56	1,179,108.58	1,748,071.52	872,239.81	49,643.28	6,206.76	10,440.09	37,380.71	8,439.33	78,268.37	277,403.17	178,075.38	21,849.46	1,539,946.36	208,125.16	1,748,071.52

Administrative Officers and Staff

State Board of Agriculture

Warren H. Monfort, President	Greeley
Raman A. Miller, Vice President	Strasburg
George McClave	McClave
Jesse McCabe	Cortez
L. S. McCandless	Craig
Walter G. Lehrer	Denver
John H. Brownell	Hooper
Walter B. Cooper	Fort Collins

Experiment Station Officers

W. E. Morgan, LL.D.	President
S. S. Wheeler, Ph.D.	Director
G. W. Hamilton, B.S.	Adminstrative Assistant
Joseph M. Whalley, M.S.	Treasurer
Lowell H. Watts, B.S.	Director, Information Service
Kenneth Goodrich, B.S.	Editor

Experiment Station Staff

Agronomy

D. W. Robertson, Ph.D.	Chief Agronomist
W. H. Leonard, Ph.D.	Agronomoist
R. S. Whitney, Ph.D.	Associate Agronomist (Soils)
W. R. Schmehl, Ph.D.	Associate Agronomist (Soils)
D. S. Romine, M.S.	Associate Agronomist (Soils)
Dwight Koonce, M.S.	Associate Agronomist
T. E. Haus, M.S.	Assistant Agronomist
D. D. Johnson, Ph.D.	Assistant Agronomist (Soils)
R. E. Danielson, M.S.	Assistant Agronomist
D. R. Wood, M.S.	Assistant Agronomist
K. G. Brengle, M.S.	Assistant Agronomist
S. D. Romsdal, M.S.	Assistant Agronomist (Soils)
A. D. Dotzenko, Ph.D.	Assistant Agronomist
E. G. Seimer, B.S.	Assistant Agronomist
W. T. Franklin, M.S.	Assistant Agronomist (Soils)

Cooperators:

Minoru Amemiya, Ph.D.	Associate Agronomist
C. V. Cole, Ph.D.	Soil Scientist
J. G. Dean, M.S.	Agronomist
W. D. Kemper, Ph.D.	Assistant Agronomist (Soils)
S. R. Olsen, Ph.D.	Senior Soil Scientist
J. L. Paschal, Ph.D.	Agricultural Economist
E. M. Payne, B.S.	Soil Scientist
Melvin Robecker, B.S.	Soil Scientist
F. M. Willhite, M.S.	Associate Agronomist (Soils)
C. W. Robinson, B.S.	Assistant Agronomist
F. S. Watanabe, M.S.	Soil Scientist

Animal Disease

A. W. Deem, DVM, M.S.	Chief Veterinary Pathologist
Floyd Cross, DVM	Veterinary Pathologist
Rue Jensen, DVM, M.S.	Veterinary Pathologist
Lee Seghetti, DVM, M.S.	Pathologist and Bacteriologist
Maxine M. Benjamin, DVM, M.S.	Associate Pathologist and Bacteriologist
Tsu-Ling Chow, DVM, Ph.D.	Associate Pathologist and Bacteriologist
L. A. Griner, DVM, M.S.	Associate Pathologist
V. A. Miller, DVM	Assistant Pathologist and Bacteriologist
H. J. Hill, DVM	Assistant Veterinary Surgeon (Artificial Insemination)
M. A. Hammarlund, DVM	Assistant Pathologist
Robert Udall, DVM, Ph.D.	Assistant Veterinary Physiologist
Dale D. Maag, M.S.	Assistant Chemical Pathologist
J. W. Tobiska, M.S.	Chemical Pathologist
E. T. Hedrick, B.S.	Assistant Chemist (Artificial Insemination)

Animal Investigations

L. E. Washburn, Ph.D.	Chief Animal Husbandman
H. H. Stonaker, Ph.D.	Animal Husbandman
Charles D. Story, Ph.D.	Assistant Animal Husbandman
M. H. Hazaleus, M.S.	Associate Animal Husbandman
A. L. Esplin, M.S.	Associate Animal Husbandman
F. C. Daugherty, M.S.	Associate Animal Husbandman
T. R. Blackburn, M.S.	Assistant Animal Husbandman
V. B. Swanson, M.S.	Assistant Animal Husbandman
Kent Riddle, B.S.	Assistant Animal Husbandman

Botany and Plant Pathology

J. L. Fults, Ph.D.	Chief Botanist and Plant Pathologist
R. H. Porter, Ph.D.	Plant Pathologist
L. W. Durrell, Ph.D.	Botanist and Plant Pathologist
H. D. Harrington, Ph.D.	Associate Botanist
Bruno Klinger, M.A.	Associate Botanist
G. H. Lane, M.S.	Associate Plant Pathologist
C. E. Seliskar, Ph.D.	Associate Plant Pathologist
Bruce J. Thornton, M.S.	Associate Botanist
R. R. Baker, Ph.D.	Assistant Botanist
N. R. Gerhold, M.S.	Assistant Plant Pathologist
F. B. Salisbury, Ph.D.	Assistant Botanist

Cooperators:

J. O. Gaskill, M.S.	Plant Pathologist
Lawrence Schaal, Ph.D.	Associate Plant Pathologist
E. A. Lungren, M.S.	Associate Plant Pathologist
R. W. Davidson, M.S.	Senior Plant Pathologist

Chemistry

W. E. Pyke, Ph.D.	Chief Chemist
F. X. Gassner, DVM, M.S.	Endocrinologist
Paul R. Frey, Ph.D.	Chemist
A. R. Patton, Ph.D.	Chemist
L. W. Charkey, Ph.D.	Associate Chemist
R. E. Carlson, Ph.D.	Associate Chemist
Joe L. Lehman, Jr., Ph.D.	Associate Chemist
Merle G. Payne, M.S.	Associate Chemist
H. A. Durham, M.S.	Assistant Chemist
Gestur Johnson, M.S.	Assistant Chemist
Duane K. Johnson, B.S.	Junior Chemist
Adaline K. Kano, B.S.	Assistant Chemist
M. L. Hopwood, B.S.	Assistant Chemist
H. L. Bredrick, Ph.D.	Assistant Chemist

Dairy Industry

E. K. McKellar, M.S.	Chief of Section and Associate Dairy Husbandman
B. J. Demott, Ph.D.	Assistant Animal Husbandman
G. M. Ward, Ph.D.	Assistant Animal Husbandman

Economics and Sociology

Rex D. Rehnberg, Ph.D.	Acting Chief and Associate Economist
C. R. Creek, M.S.	Associate Economist
Henry Hudek, Ph.D.	Assistant Economist
Dwight Blood, M.S.	Assistant Economist
Irving F. Davis, Ph.D.	Assistant Economist

Cooperators:

H. G. Sitler, M.S.	Agricultural Economist
J. L. Paschal, Ph.D.	Agricultural Economist

Entomology

Leslie B. Daniels, Ph.D.	Chief Entomologist
J. L. Hoerner, M.S.	Associate Entomologist
T. O. Thatcher, Ph.D.	Associate Entomologist
J. H. Newton, B.S.	Associate Entomologist
George M. List, Ph.D.	Entomologist (Emeritus)

Cooperators:

F. B. Knight, M.F.	Entomologist
Calvin Massey, Ph.D.	Entomologist
R. H. Nagel, M.S.	Entomologist
B. H. Wilford, Ph.D.	Entomologist
N. D. Wygant, Ph.D.	Entomologist

Forestry and Range Management

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

Cooperator:

L. E. Yeager, Ph.D.	Game Management

Home Economics

Elizabeth Dyar, Ph.D.	Chief Home Economist
Ferne Bowman, Ph.D.	Home Economist
May Combs, M.S.	Assistant Home Economist
Inez Harrill, Ph.D.	Assistant Home Economist
Edna Page, Ph.D.	Associate Home Economist
Adelia E. Weis, Ph.D.	Associate Home Economist

Horticulture

A. M. Binkley, M.S. — Chief Horticulturist
George A. Beach, M.S. — Horticulturist
Robert Kunkel, Ph.D. — Horticulturist
W. D. Holley, M.S. — Associate Horticulturist
Walter F. Larson, B.S. — Assistant Horticulturist

Cooperator:

W. E. Edmundson, M.S. — Horticulturist

Poultry

R. E. Moreng, Ph.D. — Acting Chief Poultry Husbandman
Paul A. Thornton, Ph.D. — Associate Poultry Husbandman

Civil Engineering

D. F. Peterson, Ph.D. — Chief of Civil and Irrigation Engineering
W. E. Code, B.S. — Associate Irrigation Engineer
N. A. Evans, M.S. — Assistant Engineer
J. E. Cermak, M.S. — Assistant Engineer
M. L. Albertson, Ph.D. — Engineer
H. K. Liu, Ph.D. — Assistant Engineer
Maxwell Parshall, B.S. — Assistant Engineer
August R. Robinson, M.S. — Assistant Engineer
Edmund F. Schulz, M.S. — Assistant Civil Engineer
Aristokles Spengos, M.S. — Assistant Civil Engineer
R. D. Dirmeyer, B.S. — Assistant Geological Engineer
A. T. Corey, Ph.D. — Assistant Civil Engineer

Cooperators:

H. J. Stockwell, B.S. — Irrigation Engineer
J. N. Washicheck, B.S. — Engineering Aide

Mechanical Engineering

R. D. Barmington, B.S., M.E. — Acting Chief and Associate Mechanical Engineer
Edwin N. Davis, B.S. — Assistant Mechanical Engineer

Branch Stations

Herman Fauber, M.S. — Superintendent, Arkansas Valley Branch Experiment Station
Alfred Denham, B.S. — Superintendent, Eastern Colorado Range Station
Ferris M. Green, B.S. — Superintendent, Western Slope Branch Experiment Station
Verne Cooper, Jr., B.S. — Superintendent, San Luis Valley Branch Experiment Station
H. O. Mann, B.S. — Superintendent, Southeastern Colorado Branch Experiment Station

Cooperators:

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

Personnel Changes

Joining the staff during the fiscal year were the following:

Henry E. Bredick — Assistant Chemist
Arthur T. Corey — Civil Engineer
J. R. Davidson — Junior Economist
Irving F. Davis — Assistant Economist
Richard D. Dirmeyer — Assistant Geological Engineer
Ali Dad Farmanfarma — Assistant Civil Engineer
Richard L. Foskett — Associate Horticulturist
William T. Franklin — Assistant Agronomist
Richard M. Hansen — Assistant Biologist
Inez K. Harrill — Assistant Home Economist
Howard B. Lindholm — Animal Husbandman
Hsin-Kuan Liu — Assistant Civil Engineer
Clark H. Livingston — Assistant Plant Pathologist
Richard S. Miller — Assistant Biologist
Robert E. Moreng — Chief of Section and Poultry Husbandman
Kenneth E. Mueller — Junior Plant Pathologist
William H. Paulson — Assistant Agronomist
John A. Quist — Assistant Entomolgist
Elmer E. Remmenga — Assistant Research Analyst and Statistical Consultant
August R. Robinson — Assistant Civil Engineer
S. Dale Romsdal — Assistant Agronomist
Frank B. Salisbury — Assistant Plant Pathologist
Lee Seghetti — Parasitologist
Eugene G. Seimer — Assistant Agronomist
Aristokles Spengos — Assistant Animal Husbandman
Charles D. Story — Assistant Animal Husbandman
Vern B. Swanson — Assistant Animal Husbandman
Paul A. Thornton — Assistant Poultry Husbandman
Robert H. Udall — Assistant Physiologist
Patricia Wood — Junior Home Economist

Resignations from staff during fiscal year:

Lynn S. Blaylock — Assistant Chemist
E. G. Buss — Assistant Poultry Husbandman and Acting Chief of Section
Albert C. Ferguson — Associate Horticulturist
Carroll W. Fox — Assistant Animal Husbandman
Charles W. McAnelly — Assistant Horticulturist
Harry S. Puleston — Assistant Chemist
Frederick O. Sargent — Assistant Economist

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