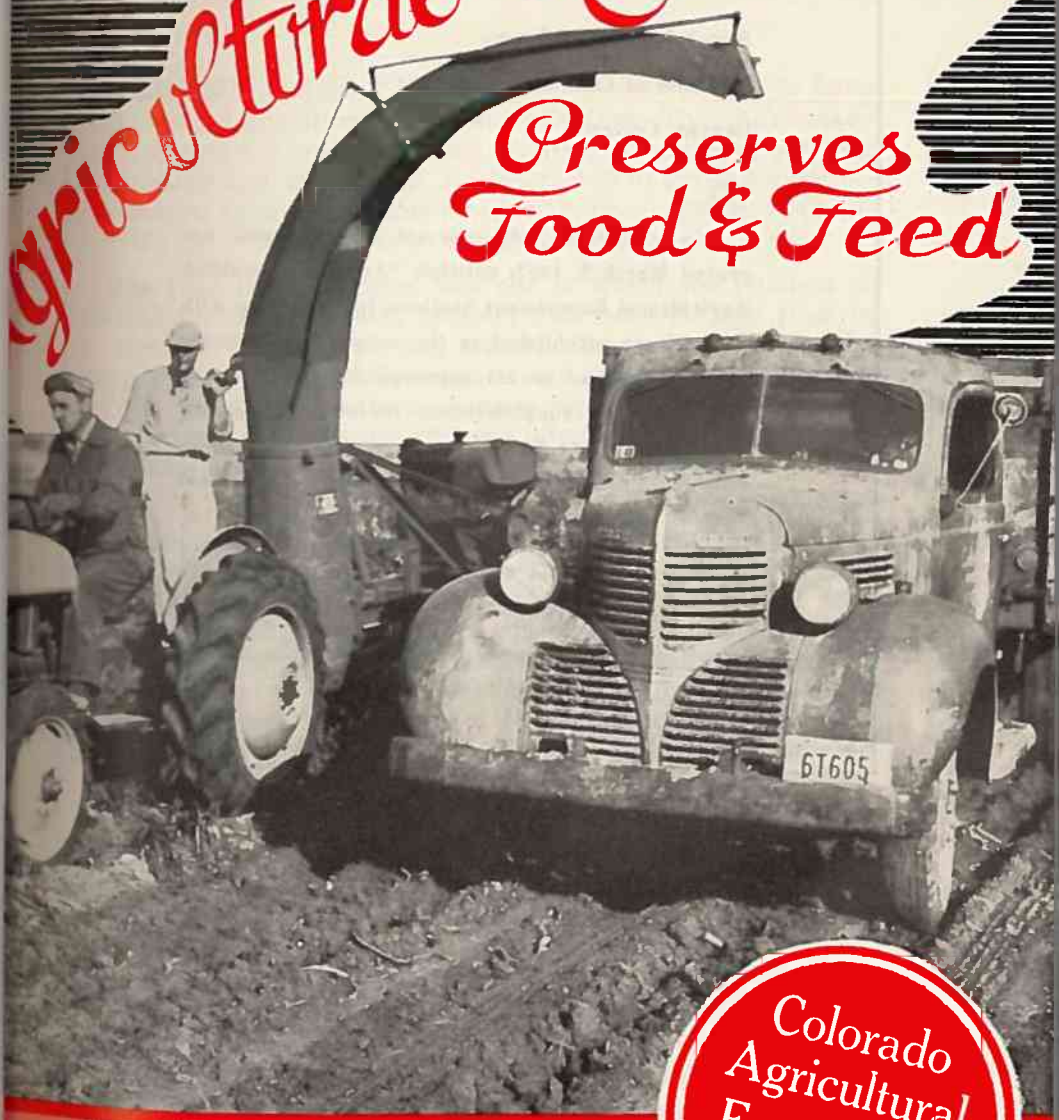
51ST ANNUAL REPORT

1947 - 48

Agricultural Research Preserves Food & Feed



Colorado Agricultural Experiment Station

Colorado A. & M. College

FORT COLLINS

Letter of Transmittal

Sixty-First Annual Report

Colorado Agricultural Experiment Station

Honorable W. Lee Knous

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 the several states under the provisions of an act approved July 2, 1862, and under the acts supplementary thereto," I herewith present the Sixty-First Annual Report of the Colorado Agricultural Experiment Station for the fiscal year of July 1, 1947 to June 30, 1948, inclusive.

Homer J. Henney

Homer J Henney, Director

Fort Collins, Colorado
July 1, 1948

The Defoliator shown on the cover is being studied by the Colorado Agricultural Experiment Station to determine its practicability in harvesting beet leaves. A single propeller-type blade cuts and blows at the same time, forcing the harvested tops into the truck. Other possible uses for the Defoliator are harvesting grass seed for rehabilitating grazing land and removing potato vines prior to harvesting.

Director's Annual Report

Sixty-First Fiscal Year 1947-1948

Colorado Agricultural Experiment Station

RANCHERS AND FARMERS continue to seek help from the Colorado Agricultural Experiment Station. They have made many requests for answers to new questions concerning farming and ranching and, in addition, are interested in getting more information on agricultural problems which have come up in previous years but which have not yet been solved.

The year just completed was one in which the problem of obtaining funds to complete projects was more difficult than in any previous year. Labor and material costs increased to the point where it was necessary to inactivate several projects during the year. In addition to the assistance requested by farmers and ranchers many other groups who are interested in Colorado agriculture also have increased their requests for assistance during the year.

Examples of such requests are those made by dairy farmers and others interested in dairying for the study of irrigated pastures, of the bee growers for control of foul brood, and of residents of mountain meadow areas who are interested in finding out more about soils analyses, conservation, reseeding and irrigation practices in their sections. We have found that there is more and more interest in the work of the Experiment Station and that more and more people are turning to us for information. We find also as more people become interested in the Experiment Station and learn of additional facts through more effective publicity of our work, that the problems connected with agriculture in the state on which we are requested to give service appear to be increasing in scope and number.

In the face of this increased request for service, which certainly is justified in view of the fact that agriculture is the state's largest single industry, we have found that the problem of holding and replacing personnel during the year has been as difficult as the year before. Many men who have remained on the staff of the Experiment Station for the past year or two feel that the increases in salary granted by the last Colorado General Assembly make it possible for them to remain with us and to continue working on the projects in which they are interested. However, toward the end of the fiscal year there was again some

unrest due to the fact that salaries, although increased due to the action of the last General Assembly, still were not up to comparable salaries in comparable positions with other stations, in private business and with other agencies.

On July 1, 1947, there were 99 professional employees and 43 non-professional employees in the Experiment Station. Most of the professional people were half-time. During the year there were 26 resignations of all types. There were 46 additions up to April 15, 1948. The Director expects less turnover during the next fiscal year.

Looking ahead to 1948-49, the program of the Colorado Agricultural Experiment Station will center first on the administration of funds available in order to do the greatest good to agriculture. That is, to work on the problems which are particularly important and pressing at this time. Secondly to administer funds in such a way that the various sections of the Experiment Station will be able to handle projects so that there will be no duplication but rather complementing and correlating between the sections which will react to the benefit of Colorado agriculture.

Any new funds earmarked for special projects which will be allotted will be used to start research work on a cooperative basis with several sections taking part, such as was done with the new funds allotted for the study of bean diseases.

The new federal Research and Marketing fund of $50,000 will be handled as a separate project, and will be directed by Dr. H. S. Wilgus cooperating with a committee from four sections of the Experiment Station.

Third, we plan to work closely with other states in the region. Information on work these nearby Stations are doing which apply to conditions in Colorado will be made available to the Colorado Agricultural Experiment Station so that this information can be given to Colorado farmers and ranchers and others interested in the state's agriculture. This will mean that the funds which are available to the Colorado Agricultural Experiment Station can then be used to work on problems on which there is little or no information. It is expected that information from other states will be adapted on projects concerning dairy cow diseases, most of the bee diseases, the human nutrition program, and several others. On the other hand, of course, the Colorado Agricultural Experiment Station will expect to reciprocate and make available to other state Agricultural Experiment Stations applicable information learned at the Colorado Station.

As we look into the future at the projects which will be worked on by the staff of the Colorado Agricultural Experiment Station, it appears that we must be specific in answering problems of immediate importance. As a result of this, we may need to place some of the basic research which is very necessary and very important on a secondary basis and work primarily on problems of immediate importance.

Following are some of the projects on which emphasis will be stressed during the next year: (1) How can wool be sheared and marketed to bring more money? (2) How can the health of Colorado farm people be improved? (3) Why are so few potatoes sold as No. 1's in Colorado? (4) How can peaches be marketed with more flavor? (5) Can dairy cow manure be used to provide hormones industrially? (6) How can leak in potatoes be controlled? (7) Can inbred lines of Herefords be developed to show increased gains per 100 pounds of feed or acres of grass, similar to increased yields obtained with hybrid corn? (8) Can a soils analysis machine be developed for use at county or farm levels? (9) What is the most effective and economical way to control weeds in beets, corn and cereals? (10) How can radio-active elements be used to determine the kinds of fertilizers that give the greatest response in crop yields on a particular soil? (11) How can beet tops be utilized to avoid the present 50 percent to 70 percent loss in value before they are consumed by the animals?

Food and Feed Preservation

Alfalfa preserved as silage with the addition of phosphoric acid has a higher feeding value for steers than alfalfa silage preserved without acid, and is approximately equal to corn silage. Nutrient conservation is enhanced by this method of preservation.

Windrow-baled alfalfa had a high nutrient yield. Dehydrated alfalfa was fed for the first time and compared favorably with alfalfa harvested and processed in other ways.

Beet leaves, dehydrated alfalfa, and alfalfa-acid silage were tested in various ways with small lots of lambs. The results indicate that dehydrated beet leaves are more palatable and seem to be more valuable as feed for lambs than the beet top silages or field-cured tops. Dehydrated alfalfa fed at various levels pro-

duced larger gains and more desirable killing lambs than any of the other feeds. Alfalfa-acid silage was inferior in quality and did not produce as good results as in the past.

Alfalfa was harvested and processed for livestock feed in various ways in a study to determine labor requirements, equipment problems and feeding values of the finished product. Alfalfa was chopped green for silage, field cured and field stacked, field baled and field chopped. The various products were used in feeding trials by the Animal Husbandry Department and results have been published on their findings.

Soils and Water

Where best to place fertilizers especially in growing beets was demonstrated with last year's results. Apparently the analyses of the soils and the need for certain types of fertilizer on that basis is not the final answer. These studies must be continued to find just what fertilizers are needed on certain types of soils. Research on irrigation by sprinkling is being demanded; two small projects were started to determine costs of sprinkling. Danger of spreading disease with this type of irrigation is indicated. Preliminary studies indicate that a few years from now practically all commercial fertilizers may be applied in liquid form with irrigation water or by airplane sprays. Funds are not available for the Colorado Station to carry on much of this type of irrigation research.

Rotating nozzles on easily moved aluminum pipes are used on a cooperator's farm for study of irrigation with sprinklers simulating to some degree natural precipitation.

The soil is one of our most valuable natural resources. Much has been said regarding its value and a serious problem is now to be faced in maintaining soil productibility, particularly on irrigated land. The cash value for field crops produced in Colorado in 1947 has been estimated at $330,000,000, exclusive of the crops fed on the farm and pasture and range. A large amount of soil nitrogen, phosphorus and potash is required to produce such an income. Colorado soils are fast approaching the state where added fertilizers will be necessary to maintain present production levels. A close relationship exists between soil fertility, adapted disease resistant varieties, and crop yield. Maintenance of soil productivity is the basis of our permanent agriculture. The problem presented requires research on methods of application, rates of application, kinds of materials, combinations of material, and times of fertilizer application to produce and maintain present crop responses.

Laboratory studies were made of the physical and chemical properties of 736 saline and alkali soil samples collected in the Grand Junction area in 1946. A report of the laboratory studies was prepared and the soil samples classified with respect to the properties studied in the soil survey report of the Grand Junction area. Detailed soil surveys were made on the Colorado Potato Station at Greeley, the United States Dry Land Station at Akron, and the Arkansas Valley Branch Station. Soil information and data were assembled for the State Tax Commission to be used in the reappraisal of Colorado land for taxation purposes.

A field plot experiment comparing the effects of 14 different fertilizer placements on the availability of nutrients to sugar beets indicated that band application was better than fertilizer plowed under. This work is being continued in 1948.

The rotation experiment shows a progressive trend toward phosphate depletion on unphosphated plots of both rotations and of nitrogen depletion on the rotation where alfalfa is not included. All crops except sugar beets still give good yields on both rotations. The sugar beet yields range from about 8 tons per acre on the unphosphated plots in the 5-year rotation, to 15 tons on the phosphate plots in the 8-year rotation.

Another study was devoted to restoring the productive capacity of land after the surface soil has been removed by land leveling operations or erosion. The yields of sugar beets and sugar are significantly increased over the no-treatment plots by additions of manure, P, N and P, and N. P. K. Better than a two-fold increase in yield of roots and total sugar per acre was

Sugar beets growing on recently leveled land. The greater stand to the right is the result of added fertilizers.

obtained on all plots that had received N in addition to P. The highest average yield was 19.57 tons of beets and 4,997 pounds of sugar per acre.

The project on the effect of fertilizers on the yield and quality of crops is carried in cooperation with sugar beet companies, Tennessee Valley Authority, farmers, and fertilizer companies. The 1947 tests showed an average increase of about 1 ton of sugar beets an acre due to phosphate treatments and an additional 1½-ton increase when N and P were both added. Heavy applications of nitrogen reduced the sugar content about 1 percent.

Commercial fertilizer trials were conducted in cooperation with a large canning company which financed the work. Studies on canning peas conducted in detail plots and in 12 grower fields indicate that the application of straight phosphorus at the rate of 125 pounds per acre of 43-percent available phosphorus is promising in northern Colorado.

Two detail plots at Longmont and Brighton and trials on 18 growers' farms in Brighton and Fort Lupton areas indicate that

300 pounds of a 10-18-5 commercial fertilizer per acre applied before planting significantly increased the yield of tomatoes when planted after sugar beets. The yield increase was 4,295 pounds per acre and netted the growers about $39.70 per acre over costs of the fertilizer treatment. Where tomatoes were grown after alfalfa, the most promising fertilizer was 125 pounds per acre of 43-percent phosphorus applied before planting.

Crop Improvement

Corn

In the state project on corn improvement, 3 growers produced 11 acres of foundation single-cross seed under contract to be distributed to hybrid corn growers for the production of double crosses of hybrid corn.

In addition to the above, 130 different corn hybrids were grown in 5 regional performance tests. These tests were located at Fort Collins, Rocky Ford, Fort Morgan, Akron, and Haxtun with both commercial and experiment station hybrids. Mimeographed reports of these tests were furnished farmers to aid them in selecting the best adapted hybrid.

Two new Colorado-produced corn hybrids have shown promise under irrigation conditions at Fort Collins. Three additional new Colorado-produced hybrids gave high yields at Rocky Ford in 1947. Since the Rocky Ford hybrids silk from 6 to 7 days earlier than the check varieties they may be too early for the lower Arkansas Valley. They are being tested this year in the intermediate zone at Fort Morgan.

Germination tests were again made in 1947-48 on the old stocks. Some further reduction in viability was shown. However, some of the 20-year old seeds germinated.

Potatoes

In a study of the fundamental action of 2,4-D compounds it has been found that new growth-regulating compounds put on Triumph and Pawnee potatoes improved their cooking qualities. Low concentrations of three of these compounds resulted also in increased specific gravity of potatoes, increased viscosity and greater whiteness on cooking. Hormone treatment of Bliss Triumph variety improved the color.

At the United States Department of Agriculture Colorado Potato Experiment Station, two programs of testing insecticides for the control of potato insects were carried out during the

1947 season. The first consisted of 12 treatments in which 7 of the newer insecticides were contrasted with the standard lime-sulfur basic copper arsenate. Three formulations of DDT with bordeaux mixture, Diathane and Cuprocide were included as combination controls for both insects and diseases. From records taken on insect populations flea beetles, leaf hoppers and grasshoppers were the most abundant. Very few psyllids were taken. The data obtained from worm-track counts on the tubers show highly significant differences for nine of the treatments over the check. These included seven sprays and two dust formulations.

A spray of benzene hexachloride gave the best control on flea beetles but must be ruled out because of the odor and taste which it gives to potato tubers. DDT in combinations with bordeaux mixture or Diathane gave equally good results as sprays. These are being recommended for the 1948 season. A 5-percent DDT and sulfur dust gave good control.

In the second program DDT as a wettable powder, oil emulsion and a 5-percent dust were compared in two, three and four applications for the control of the tuber flea beetle. The results indicate all three formulations of DDT were much better in four applications than in two and three. The wettable suspension of DDT in four applications was superior to the emulsion and the dust.

Twenty-four of the most promising potato seedlings developed by the U. S. Department of Agriculture and Wyoming and Nebraska stations were tested in the Arkansas valley. None were found equal in an isolated test to the cobbler generally grown in this locality. These tests with scab-resistant seedling No. 6317, presented some doubt as to its yield and quality characteristics. It is to be subjected to larger scale commercial tests this year.

Maturity studies conducted for 2 years at Gilcrest, Colorado, on early crop Triumph potatoes indicate, (1) that tuber skin color fades as the tubers mature, (2) that the cooking quality measured by specific gravity remains the same after July 20 and (3) that yields tend to increase until vines begin to die, but increase in yield is large at first and rapidly declines toward the end. Studies are being conducted on means of detecting and identifying mosaic, leafroll, and spindletuber of potatoes by use of ultraviolet light.

San Luis Valley tests on permanent plots showed that 30 pounds of nitrogen, 120 pounds of phosphorus, and 30 pounds of potash per acre gave the most economical yields. This is equiv-

alent to about 48 pounds per acre of a 6-24-6 fertilizer, and agrees with 1946 tests. None of the fertilizer rates or combinations produced a significant effect on color or specific gravity of the tubers, grade or keeping quality in storage.

In the Arkansas Valley, 12 fertilizer treatments on permanent plots were applied and the results indicate that 30 pounds of nitrogen, 120 pounds of phosphorus, and 20 pounds of potash per acre was statistically better than no fertilizer. The grade or number of scabby tubers was not affected. Minor elements added to fertilizers and sulphur when applied to the same plot of ground for 2 years failed to produce a beneficial effect on yield, grade, color, specific gravity or keeping qualities in storage.

A consumer pilot study involving two types of containers, two sizes of potatoes, a bulk bin and a price differential was conducted in Denver during February and March. Preliminary results indicate that Denver consumers like red potatoes larger than 2½ inches in diameter, uniformly sized and packed in containers so that they can see most of the tubers. The survey part of the study has been completed and data is now being compiled.

Some initial design by R. S. Claycomb and construction work by A. J. Krause has been done on a specific gravity separator for potatoes in cooperation with A. D. Edgar, Agricultural Engineer, United States Department of Agriculture, and the Horticulture Department. This work is being done to improve potato grades for shipping and marketing.

Comparative disinfection tests have been made on the rotary knife potato cutter, the stationary knife cutter, and on the tension blade cutter. It has been found that boiling water is most satisfactory for sterilizing the rotary blade, also mercuric chloride 1-500 solution and calcium hypochlorite 5,000 parts per million are effective. Mercuric chloride was most successful with a stationary knife cutter especially when a wetting agent was used. Tests with the tension blade have shown this to be a cheap and economical instrument, with decided mechanical advantages.

Seed piece rots of potatoes materially cut the stand. Three species of fungi of the genus Fusarium and one known as Pythium are associated with this rotting in the field. Studies are being made on the effect of time of planting and of chemical treatments on the occurrence of these rots.

Another field and storage rot known as leak is being studied. Observations to date suggest that there is a close relationship between excess water and incidence of the disease.

Barley

Genetic studies and linkage relationships in barley supported by Adams funds were continued along lines discussed in previous reports.

Progress is being made in obtaining a smut-resistant barley adapted to Colorado irrigated conditions. Crosses are also underway to improve the quality of dryland barleys and to produce disease-resistant sorts. Some attention is being given to malting quality of irrigated barleys under a grant of funds from the trade.

The effect of 2,4-D type of materials has been used on small grains to kill weeds in the grain. This resulted in no injury to the barley, but on the contrary increased the weight of the grain per bushel.

A new form of smut was discovered which attacks Trebi barley. It is from Trebi that disease resistance was obtained for Lico 1 and 2. Consequently, the Licos have broken down under the new attack. Many barley varieties are now planted to test for resistance to the new smut.

Wheat

Additional crosses and selections were made for rust-resistant wheat and the earlier crosses were advanced to later generations. Progress is being made toward disease-resistant adapted varieties of wheat.

Over 6,000 inoculations have been made in genetic studies for the development of resistant winter and spring barleys.

Wheat hybrids are being tested in greenhouse and field for a resistance to leaf and stem rusts. Some 300 lines are planted in a 3-acre plot under sprinkler system.

Beans

Several bean variety tests were conducted in 1947 at Fort Lewis, Rocky Ford, and Akron. Lines of adapted pinto beans were rogued for mosaic and foundation stock of RR1, RR5, RR14, and San Juan selections were obtained at Fort Lewis. These stocks will be furnished foundation seed growers for increase.

Thrips are known to be a serious pest to beans, especially in Idaho and California, often causing the dropping of a large percentage of the blossoms. Southwestern Colorado reported this type of injury during the past season. It was not clear whether

the injury was due to thrips or drouth but probably was due to a combination of the two. If this was true, a week's delay in some very timely showers would have meant the loss of a several-million-dollar crop. We owe it to the growers to determine just how important thrips are in this problem. The species of thrips involved is one on which practically nothing has been published.

Following legislative appropriation last year, a field laboratory was established at Grand Junction for the purpose of studying the diseases of beans common in that region.

Twenty-six experimental plots were put out in Mesa and Montrose Counties, and three diseases were found prevalent, one a virus disease known as red node, causing a 20-percent loss late in the season. Two root rots were found early and midseason caused by a fungus Rhizoctonia and the fungus Fusarium phaseoli together resulting in a loss of approximately 5 percent. The time of planting may be a factor since it was found that with early planting there was less root rot. In rotation tests beans after sugar beets had the most root rot; beans after alfalfa and beans after beans had less. Two varietal plots were established in which 15 out of 50 varieties showed resistance to Fusarium rot, and a few individual plants showed resistance to red node. A side dressing of 10 different fungicides showed no significant effect on root rot. In greenhouse tests in the winter it was found that red node may be seed-borne and goes to several weed hosts.

Peaches

Comparison of minor elements added to the soil under chlorotic peach trees continues to indicate the value of adding iron sulphate in temporarily correcting the condition. However, the use of cover crops and proper cultural practices are basic in maintaining effective orchard fertility levels and reducing chlorosis.

In studying the handling of peaches from orchard to railroad car, it was found that most injury developed from grading, brushing and packing. Peaches pre-packaged in consumer-sized containers showed better keeping qualities when the container was over wrapped with the cellulose acetate film as compared to pliofilm and others. Peaches treated with chemical preservatives in waxes broke down rapidly.

Consumer preference studies in Minneapolis indicates a preference for riper peaches. Studies are needed to determine effective methods of delivering riper peaches on a large volume basis.

Indications are that the Western X-disease which is new to Colorado, occurs on plums as well as peaches. A study of its host range is being made. Likewise, a study of the host range of the ring pox of apricot is being continued.

"Little Cherry," a new virus disease to the United States, which affects both sweet and sour cherry trees has been found in Colorado. The fruits from diseased trees are greatly reduced in size and have an undesirable taste. The disease has spread so rapidly in the Kootenay Lake area of British Columbia where it was first discovered, that after 15 years practically all cherry trees are affected. Indications are that the disease is caused by the same virus causing X-disease in peaches.

Cherries

Seven treatments in two and three applications for control of the cherry fruitworm were made on randomized blocks with six replications. A late freeze reduced the cherries to a very light crop. No significant differences between treatments were obtained and cherries were condemned by pure food officials after being processed. The processing plants refused some fruit at the platforms but in most cases the remaining fruit from the same orchards became acceptable late in the season after the wormy fruit began to shrivel and could be sorted out. However, the problem remains a threat to the industry and could repeat conditions of 1945 when much processed fruit was declared to be unfit for human consumption.

Apples

Codling moth control experiments, consisting of two lines were conducted on pears in Mesa County and on apples in Delta County. In both studies the problem of mites was considered as important as that of codling moth control.

Three cover sprays of DDT, ¾ pound to 100 gallons, gave control equal to four sprays of the same concentration. Also, four sprays of ½ pound of DDT gave control equal to four applications of ¾ pound. This was not true, however, in the apple tests reported later.

For the third season the calyx application was found unnecessary in the DDT program for both apples and pears. The codling moth population was heavy under the conditions of this test as indicated by the fact that from 175 to 200 moths per night were taken in five traps during the peak of flight. The DN 111 used in the first and second cover sprays held the brown

mite quite well in check until near harvest time when it was found necessary to make an application for mite control alone.

The following treatments were tested against the codling moth on apples at Paonia:

1. Four cover sprays, 3 of DDT ¾ pound and 1 of DDT ½ pound to 100 gallons.
2. Five cover sprays, 3 of DDT ¾ pound and 2 of DDT ½ pound to 100 gallons.
3. Five cover sprays, 4 of DDT ¾ pound and 1 of DDT ½ pound to 100 gallons.
4. Five cover sprays, DDT ½ pound to 100 gallons.
5. Five cover sprays, "split" schedule, 2 applications DDT ¾ pound to 100 gallons. One application of Black Leaf 155-DDT blend, 3 pounds to 100 gallons, two applications of Black Leaf 155-DDT blend, 3 pounds to 100 gallons plus 1 quart of summer oil.

There was a highly significant difference in control between treatments. Four cover sprays, as in 1, was not equal to the five cover sprays of either 2, 3 or 5. Reducing the amount of DDT to ½ pound in five cover sprays greatly reduced the efficiency over ¾ pound of this material. Treatment No. 5 with the Black Leaf 155 DDT blend, used in the last three cover sprays, gave results equal to the straight DDT program. However, the presence of the oil appeared to increase the amount of DDT residue on the fruit at harvest time. DDT residue on pears was higher than that on apples. This is to be expected since there was less time between the last application and harvest. The residue on treatment 3 of the pears exceeded the tolerance of 7 parts per million, but the residue on apples did not exceed the tolerance. However, that on the fruit from treatment 5 where oil was used approached the tolerance.

Carnations

Some 40,000 cuttings from nine varieties of carnations have been taken from clean, true-to-type, foundation plants and distributed to growers. The comparison of nitrogen and potash fertilization of carnations to find the proper levels of nutrition so far has not produced any differences in yields but high rates of fertilization have resulted in more third-grade flowers.

The addition of sodium selenate to nutrient solutions to determine its effect on carnations and as a red spider control indicates that there is stunting of growth at four plus parts per million but plants remained free of insects.

Alfalfa

In the alfalfa project carried on Adams funds, the Meeker Baltic maternal lines were advanced another generation. Wilt resistant material was transplanted for yield tests and observation. Hardistan maternal lines were also advanced a generation. The latter lines when bulked gave as high yields as the original Hardistan but produced much heavier seed yields. Inheritance studies on seed setting and flower color were continued.

Irrigation

The project on effect of moisture stress on plant growth was conducted with sugar beets at two levels of fertility. There was no significant difference between yield of roots or sugar at any of the three moisture levels tested. The data indicated that at high fertility levels more moisture is required. It also appears that as long as adequate subsoil moisture is available, the surface 12-18 inches may be reduced to the wilting point for considerable periods without too much effect on yield.

A careful survey of the ground-water resources for irrigation in the Republican River Drainage in Colorado is being made. Additional data are still needed from that area, but within the next year or two it will be possible to produce a ground-water map of the region for the use of farmers in that area. It is important that this work be done since in the last 2 years there has been a considerable increase in the number of pumping installations in the Republican drainage.

Snow surveys and irrigation water forecast reports were regularly issued for the Colorado, Rio Grande, Missouri, and Arkansas Drainage Basins. These reports cover conditions existing as of the first day of February, March, April, and May. Forecasts are made of stream flow from the period of April through August on April 1. An amended forecast is made on May 3.

Work carried on for the past 9 years designed to investigate the possibility of using photographic procedures for making snow surveys indicates that this method of snow surveying compares favorably with standard methods in regard to accuracy. It is planned to extend this study to include other areas and to resort to aerial photography as the only means of obtaining photographic data quickly over large areas. A technical bulletin "Photographic Method of Making Snow Surveys" by Maxwell Parshall, in which is described the limited work to date in this investigation has been prepared for publication.

Construction of about 3,000 linear feet of concrete lined ditches on the Colorado Potato Experiment Station Farm near Greeley was finished during the fiscal year. Design of one section of the lining on this farm was found generally satisfactory, but some correction was found necessary. Several checks were added to help control the outflow through furrow tubes. Some earth had to be pulled away from the ditch in a few places to allow better escape conditions from the tubes. Elevation of the lining and location of the tubes were investigated carefully in connection with the prevention of erosion and the results were satisfactory.

Steel forms for casting concrete linings for farm irrigation ditches, designed by the Civil Engineering Section were originally planned for casting 50 feet of ditch lining. Because of the cost the length was cut down to 12 feet for testing purposes only. The fabricators require approximately 6 months for the preparation of these forms which have only recently been delivered to the Section. It is definitely planned to cast test sections soon and to make an exact cost accounting of the material and labor required for the preparation of concrete lining with these forms.

Weed Control

Experiments on mechanical and chemical methods and techniques of controlling weeds common to sugar beets are being conducted in connection with mechanical thinning and pre-emergence treatments in the beet crop. Mechanical methods in connection with good soil management show the most promise in weed control work. Chemical treatments in some cases show some promise but are expensive and are exacting as to time and conditions of application.

Recent developments in general weed control involve low volume application which, in the extreme, means the application of from 1 to 5 gallons of spray solution per acre as compared to the hundred or so gallons previously used. This was developed in connection with airplane application and later applied to ground equipment. The practice has been quite successful in controlling annuals and winter annuals in small grain and corn. As a result it has been assumed that it would be likewise successful against perennial noxious weeds. Recommendations have been made on this assumption which may be subject to question. In certain grain growing sections, there is a trend toward increasing the volume to 10 or 20 gallons in treating annuals and winter annuals with ground equipment. With perennial noxious

weeds several years of experimentation will be required to determine the facts.

The ester form of 2,4-D has come into prominence and because of its quicker penetration and more rapid kill of the plant's foliage it has been assumed to be generally more effective than the amine and sodium salts of 2,4-D. Results at this Station do not clearly indicate such to be the case, but they do indicate a greater danger of reducing yields in grain when the ester is applied at too high rates or at the wrong time.

Results in general at the Colorado Station indicate that bindweed, the poverty weeds, and many other perennials as well as most annuals and broad-leaved weeds may be satisfactorily and economically controlled with 2,4-D. Grass types, of course, are not affected. Results with Canada thistle and Russian knapweed have been rather discouraging but there are indications that they can be controlled on a practical basis. Leafy spurge remains difficult and tests on this weed are being emphasized.

In laboratory tests, ultraviolet light has been found to increase the activity of several 2,4-D compounds.

Animal Feeding

Laboratory and field investigations have pointed to the discovery that adding small amounts of copper to rations of heavily fed beef cattle prevents symptoms of a rickets-like nature and impairment of breeding ability. The practical significance and value of the discovery is inestimable.

Studies at Akron with heifer calves wintered on common dryland rations have shown that alfalfa is more effective in raising blood vitamin A levels than high potency fish oil. Blood carotene and vitamin A levels of calves wintered on range may drop to a dangerously low point before spring, the depletion occuring at a more rapid rate than is commonly assumed.

In preliminary studies of the digestibility of carotenoids six digestion balance trials with beef heifers have been completed. Results obtained thus far point to the following:

(a) Appreciably low and highly variable carotene digestion on all experimental rations.

(b) High digestibility of xanthophyll in all rations tried.

(c) No apparent effect of wheat germ oil on protection or enhancement of digestibility of carotene.

Summarization of last year's data shows that dehydrated sugar beet leafmeal satisfactorily replaced dehydrated alfalfa leafmeal in a laying and breeding ration.

Yields of leaves and crowns increased with higher levels of nitrogen application. Protein and moisture content of these materials also tended to increase. Protein and carotene levels in dehydrated leafmeal were similar to those of dehydrated alfalfa leafmeal. Dehydrated beet top (leaves and crowns) meal resembled alfalfa meal in these respects. Ash contents were about double those of alfalfa products.

About 1.5 tons each of dehydrated beet leaves and dehydrated beet tops prepared with a commercial alfalfa dehydrator were fed to lambs and chicks and compared to dehydrated alfalfa. The dehydrated beet products gave some better gains in chicks than did dehydrated alfalfa leafmeal.

Angora rabbits and white Leghorn pullets have been fed rations containing different levels of carotene or sources of carotene and vitamin A. Liver, blood, and egg samples from each lot have been furnished the chemistry section for carotene and vitamin A analyses.

A small flock of New Hampshire hens, selected for production of eggs possessing firm albumen of high or low height, have been providing eggs for chemical studies. Histological studies of the endocrine glands, ovaries, and oviducts of these hens will be made this spring in order to ascertain if there is any relationship between these tissues and the quality of eggs produced.

In rearing chicks for use in other projects, it has been possible to compare modifications in starter rations. A high-density low-fiber mash was developed that gave 50 percent greater growth and 25 percent greater gain per unit of feed than the standard starter mash. Further studies showed that niacin, choline, liver meal, fermentation solubles, dried whey, and dried buttermilk were not essential in such a ration when sufficient fish meal was used. Since fish meal is scarce, efforts to reduce or eliminate this ingredient are in progress.

Recently completed analyses of over 500 samples of forage revealed a deficiency of carotene in winter roughage grown in the dryland areas. This may have an important bearing on the economy of beef production on the great plains. With the exception of winter range, low-carotene winter forage appears to be more frequently due to improper harvesting than any other known factor. This has significance in pointing up the practical importance of nutrient conservation and better harvesting and storing methods.

Home and Family Problems

The Foods and Nutrition part of the Station program involves first, investigation on baking problems at the higher altitudes. A steady demand for information in this field continues and extensive research is still needed. Twelve types of cake recipes have been developed for altitudes of 5,000, 7,500, and 10,000 feet, and are being put in a bulletin for distribution. Fundamental work on the optimum water sugar ratio, flour sugar ratio and other proportions necessary for a sucessful cake have been worked out for varying formulas and methods of mixing.

The second phase of the program is concerned with nutrition studies on Colorado foods, including analyses by chemical means of foods in the fresh state and when ready to eat, and biological tests on small animals indicating usefulness to the body. Eventually tests will be extended to the human, using standardized techniques.

Colorado has also participated in two cooperative nutrition projects undertaken by the eleven western states. The first, approved for support under the Congressional Research and Marketing Act of 1946, is a research study planned to investigate by special physical and blood examinations the relationship between the health of selected groups and the composition of the food eaten. The United States Public Health Service and United States Department of Agriculture Bureau of Human Nutrition and Home Economics and other state organizations and agencies are cooperating.

The housing investigation being conducted is part of another regional project on functional requirements of housing for rural farm families.

Antithyroid Drugs

Iodinated thiouracil, first synthesized by the chemistry section, has demonstrated a consistent effectiveness in depressing thyroid activity in rats. Sufficient amount of this new drug has been supplied to the Boston General Hospital to administer to patients clinically on a test basis. The drug displays such excellent remission of thyrotoxicosis without the undesirable toxic effects of other drugs in common use that it has aroused tremendous interest in the human medical profession. (Chemistry Section, University of Colorado, Chemical Foundation, and Boston General Hospital cooperating.)

Herefords grazing on native grass provide data for the cooperative range and livestock studies.

Range Pastures

Cooperative range and livestock studies are being continued on the 1,150 acres of College experimental range west of Fort Collins, comparing year-long grazing of cattle on native range with year-long grazing of cattle on a combination of native range and seeded dryland pastures.

Dry cows averaged 132 pounds gain or 2.69 pounds per day in 49 days (May 5 to June 23) on dryland seeded pastures or better than four times the gain made by cows on native range in the same period. The introduced cool-season grasses of crested wheatgrass, intermediate wheatgrass, Russian wild rye, and smooth bromegrass are proving valuable early pasture grasses because of their early start and rapid growth. In both 1947 and 1948, these grasses were of sufficient height to be grazed by April 15, without injury to the forage plants. However, the good gains on early pasture were offset by little or no gains the remainder of the summer.

Sample areas of native range and abandoned cropland, first studied in 1938 and 1939 in Elbert County and in 1940 in eastern El Paso county were re-examined. Blue grama and other palatable grasses come back slowly on abandoned cropland. For example, blue grama is about 25 percent of the total vegetation after 30 years and in more sandy soils only 15 percent in the same length of time. This is in contrast to better native range where good grasses make up 95 percent of the vegetation.

The productive capacity of these marginal croplands is low because of the high percentage of low value forage. Increased production can be obtained by seeding to good native or introduced grasses.

Sagebrush Eradication

Seasonal burning of sagebrush was not too successful because of above average moisture conditions. However, about 80 acres were burned. Where sagebrush is not destroyed after railing it recovers rapidly while native grasses disturbed by railing do not increase too rapidly. A disturbed soil provides an excellent seedbed for new sagebrush seedlings. Crested wheatgrass sown following railing produced a good stand of forage.

The use of 2,4-D chemical at a rate of 4 pounds per acre was effective in eradicating sagebrush in early summer. Twenty acres of burned sagebrush range were seeded to replicated field plots comparing New Russian and standard grasses.

Closer row spacing and a heavier rate of seeding of grasses on burned range in 1946 showed superior stands but a uniform stand of sage seedlings. Stand ratings on abandoned cropland seeded in 1946 show superior stands of intermediate wheatgrass and smooth bromegrass with better stands following.

Animal Diseases

The value of sulfur as a means of controlling death from overeating (Enterotoxemia) in feedlot lambs has received added proof as a result of the third year of these trials. A daily level of $\frac{1}{3}$ to $\frac{2}{3}$ ounce per lamb appears to be effective in controlling death loss without seriously reducing the consumption of grain and the consequent rate of gain. Immunization with toxoid appears to have some promise. The application of this information in commercial practice should save the lamb-feeding industry thousands of dollars annually.

During the past year three phases of the enterotoxemia project have been studied, including (a) the prophylactic action of sulfur, (b) immunization by means of anaculture, and (c) laboratory studies on the effect of sulfur on the growth and toxin production of Cl. perfringens in artificial culture media.

In the sulfur feeding experiment, three levels of sulfur, namely, $\frac{2}{3}$ ounce, $\frac{1}{3}$ ounce and $\frac{1}{6}$ ounce per lamb per day were fed to respective groups of 100 lambs each by both self-feeding and hand-feeding methods. In general, the results were similar

to those obtained last year in that the evidence presented indicated that a dosage of from 1/3 to 2/3 ounce is the optimum for self-fed lambs, while a dose of from 1/4 to 1/3 ounce is sufficient for hand-fed lambs.

This experiment also demonstrated the importance of thoroughly mixing the sulfur with the grain. A number of lambs on the highest sulfur level died of enterotoxemia before the method of feeding was changed to insure each lamb receiving its quota of sulfur.

One lot of 100 lambs was treated with a commercially prepared Cl. perfringens bacterin, or anaculture. Each lamb received two 5 cc. doses, approximately 3 weeks apart. Following this immunization, there was no death loss from enterotoxemia, while six of a comparable control lot died from this disease. While this information is suggestive, the number of lambs in the experiment was too small for the results to be significant. The experiment should be repeated on a larger scale. If this method of immunization should be effective it has some distinct advantages over other preventive methods.

Sodium Fluoroacetate has come into extensive use for control of noxious mammals on ranges grazed by sheep and cattle. Since cattle and sheep may be exposed to this poison, an experiment was conducted to determine the minimum lethal dose of the drug and symptoms of poisoning in sheep. The animals were arranged into six pairs, with a pair receiving the lowest level. Thus the minimum lethal dose is between 0.25 and 0.50 milligram per kilogram of body weight. Symptoms included motor irritation, excitation, rapid pulse becoming weak, general weakness, convulsions and death.

Prior to the winter of 1946-47, from two to four outbreaks of listerellosis were diagnosed in sheep annually in Colorado. During the winter feeding season of 1946-47, three outbreaks were diagnosed in sheep and 20 in beef cattle. During the winter of 1947-48 the disease was diagnosed in approximately the same number of herds of cattle and sheep. On some farms the disease recurred the second year. The means of transmission were unknown. Herds of cattle having a high incidence of the disease were also heavily infested with spinose ear ticks. Mortality was as high as 14 percent in sheep and 6 percent in cattle. The total mortality constituted a heavy economic loss.

It has been determined that sagebrush is not a factor in the source of infection of Thysanosoma actinioides (fringed tapeworm) in young lambs. Furthermore, young lambs may acquire their infections on flat ranges where grass is very sparse. A preliminary experiment indicates that it is questionable whether

older lambs are capable of becoming infected, and whether this is due to their not coming in contact with the infective material, or whether they are resistant to infection.

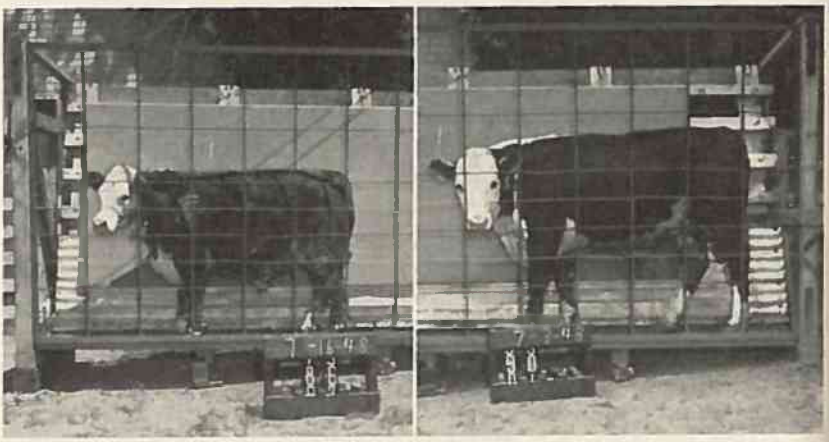
Indirect evidence indicates that the ground lichen, Parmelia molliuscula, should be investigated as a haven for mites that probably carry the fringed tapeworm infection. Lambs free from infection allowed to graze with infected sheep on a limited grazing area failed to pick up infections. When lambs are infected with gravid worms, 29 percent of the stools will show proglottides on the segments. On the basis of counts of fimbriae on proglottides, it is possible that what we have been calling Thysanosoma actinioides is in reality more than one species.

Livestock and Poultry Improvement

Beef

The project on the improvement of beef cattle through breeding involves two distinct phases. The first is a study of variation in sizes and types of Hereford cattle with relation to their reproductive, grazing, fattening and carcass qualities. The successful appearance of new, extremely short-legged Hereford cattle in the feeder and fat steer shows in the past decade has served as an impetus for studying the inheritance and comparative performance on range and in feedlot of the smaller types and the larger more conventional kinds.

The first steer calves of these types were individually fed the same ration until they were slaughtered. Their rates of



A small-type steer is compared on the measuring grid with a large-type steer of the same age.

gain, feed utilization, and carcass cut out tests are being observed. The number of cows in the type experiment has been enlarged to ninety by the addition of thirty small type females to the breeding herd at Fort Lewis.

The second phase of the beef cattle breeding project is set up to explore the possibility of producing hybrid vigor within the Hereford breed by the systematic crossing of unrelated inbred lines. The basis for this research has been the outstanding success of the system of crossing inbred lines in hybrid corn and poultry breeding. The Station is in the process of developing nine inbred lines of Hereford cattle at the present time. Two of these are polled lines. The inbreeding of the 1948 calves in these lines at the present time ranges from approximately 12 to 25 percent. As yet there has been no experimental crossing of lines nor mating of inbred bulls to unrelated outlined cows.

Studies are also being conducted in the herds of cooperating breeders. The amount of inbreeding and the inter-relationships in a Hereford herd closed to outside breeding since 1925 is being determined. In a Shorthorn herd, comparative measurements and weights of the "Compact" and Standard types of Shorthorn cows and calves are being studied.

Dairy

Artificial breeding of dairy cattle was greatly expanded, showing 87 percent increase over 1946 with 3,568 cows being inseminated from the College owned dairy bulls. Four bulls each of Holstein-Friesian, Guernsey, Jersey, and Brown Swiss breeds of high production and type are being used in this service. Shipments of semen are being made regularly to 18 veterinarians throughout the state. Service is made available to all dairymen and becomes most valuable to owners of small herds, where the maintenance of a bull of this high caliber is too expensive. The program when more fully utilized should do much for improvement of dairy cattle in the state.

Thirty acres of irrigated pastures for dairy cattle were seeded in the spring of 1946 to mixtures of grasses and legumes or the start of a long-time irrigated pasture experiment. Two mixtures of grasses and legumes were repeated four times in 3-acre plots. In addition, 32 individual species and 18 mixtures were seeded in 6 replications on 25-foot square plots. Starting in May 1947, data is being collected to determine desirable species and mixtures and methods of management to provide the greatest amount of pasture. Sufficient data have not been collected to reach any conclusions.

Wool

A new project dealing with the behavior of moisture in sacked wool was started in March 1948. Results on this work are not yet available. The fineness and variability studies on wool of Corriedale lambs has been reported and will continue indefinitely. Commercial wool scouring also continues as a project, although this work has been curtailed due to the vogue of government coring and private industrial coring.

Poultry

White Leghorn breeding stock, obtained from a Colorado breeding farm and possessing some broad breastedness, has been reared and mated in two pens. A standard type line of the same strain is being expanded through matings in two other pens. Both types of offspring are being reared to provide adequate stocks for breeding studies next year.

Colorado does not produce a sufficient number of eggs for its own population during the fall and winter and exceeds consumption demands during spring and summer. Approximately 95 percent of the poultry flocks in Colorado are too small to produce quality eggs profitably. Seventy-eight percent of Colorado's eggs are produced in northeastern and eastern Colorado and there are no new specialized areas of production developing in Colorado.

An analysis of the costs of marketing eggs in Colorado has furnished basic information for graphs whereby egg dealers and truckers can compute the effects of various factors on costs of farm pick up, candling and grading, and packing of eggs.

Breeding stock of broad breasted bronze turkeys from two ROP breeding farms and of Beltsville White turkeys from the United States Department of Agriculture were reared, selected, and mated. Poults from six pens of breeders are being hatched and reared to provide pedigreed stock for inbred lines for future work. Hatchability is above expectations this year but still below that attained at lower altitudes.

Oxygen has been introduced into the plant incubator in an effort to improve hatchability. An experimental incubator has been rebuilt to study the effects of pressure and of oxygen and carbon dioxide on hatchability, especially in turkeys.

Insect Control

Chlordane (Velsicol 1068), applied as a spray at the rate of 300 cubic centimeters of 3-percent suspension or emulsion in water per nest, destroyed all mound-building prairie ants within

14 days. Three hundred cubic centimeters of 2-percent material failed to give uniformly good results, as did 200 cubic centimeters of 3-percent material. Good results were secured by spraying directly into the entrance of the nest, by pushing the nozzle back and forth throughout the mound and by spraying half of the material into the entrance and the remainder into a hole made into the top of the mound. Pouring the liquid into the entrance or into holes in the mound failed to give uniform results.

Chlordane dusts blown into nests or placed on mounds failed to give uniformly good kills. Chlordane sprayed or dusted on acre plots at the rate of 1 pound per acre failed to kill this species of ants.

Benzene hexachloride, arylalkyl thionophosphate, chlorinated camphene and water misciable sabadilla killed large numbers of ants but did not destroy any colonies.

Poison baits made with small seed or cracked grain as the carrier show promise. Chlordane as the poisoning agent appears quite effective but the plots should be rechecked to determine if the kill in the nests is complete. Sodium fluoroacetate as the killing agent in baits apparently gave 100 percent kill in all tests. Because of the extreme toxicity of this material to all animal life its use is not permitted for insect control.

Service Laboratories

The seed laboratory testing program after being revamped in 1941, by introducing spot inspections, and courteous letters, even though the fees were increased, has shown a steady growth each year for the last 7 years. The seed testing program shows a need for the College continuing to handle certain service work, such as seed testing, soil analysis, and artificial insemination. When not done by the College, farmers tend to distrust private people who charge for the same type of service work.

Branch Stations

Branch station areas are the Arkansas Valley, San Luis Valley, San Juan Basin, Western Slope, Great Divide, Greeley Potato section, Akron Dry Land area and the Denver Carnation and Vegetable area. Considerable progress has been made in two of the Branch Station areas in providing at least temporary additional finances for experimental work.

In accordance with Section (3) of the agreement made February 21, 1948, between the State Board of Agriculture and

the San Luis Valley Potato Improvement Association, experimental work on the San Luis Valley Branch Experiment Station has been effected and the governing committee has approved seven projects for operation during 1948.

An agreement between the Colorado Growers and Shippers, Inc., and the Colorado Agricultural Research Foundation and the Experiment Station was made, effective April 1, 1948, for the purpose of doing research on onion diseases in field and storage at the Arkansas Valley Branch Station. The Colorado Growers and Shippers, Inc., is a non-profit organization financed by memberships and by a voluntary assessment of 1 cent per 50-pound bag on all onions marketed in and from the Arkansas Valley.

Seventy-two short courses, visiting days, and conferences in which Experiment Station personnel were primarily concerned were held between February and December, 1947. A program of such meetings for 1948 has been prepared in advance and is kept up to date with revisions and additions as conditions require.

Problems of Colorado farmers are as diverse as the state's agricultural phases. Conditions in various parts of the state are widely different from those at the main Station at Fort Collins. The adaptabilities of crops and livestock to different areas, management, and cultural practices require study and research in each particular locality if the correct answers are to be found.

Reasons for branch experiment stations, stated briefly, are:

1. Different soil, climate, altitude and water conditions in various sections of the state.
2. People who never contact the main station learn of experimental work and its results at the branch stations.
3. Larger scope of agricultural research in the state.
4. Test results obtained at the main Station under the various conditions found throughout the state.

The eight branch stations have been located with the view of serving the geographical areas of Colorado and the crops grown in the state to the best advantage possible.

By and large, the accomplishments and the results of the Experiment Station are recorded in detail in the foregoing commodity reports.

Industrial Uses

In the field of feed and food preservation some 200,000 measurements of different amino acids, vitamins and biological assays were made. The industrial use program for agricultural waste and agricultural over-ripe food products is making some headway. Two such patents have been applied for and another on hormones and one on retention of amino acids will be applied for soon.

Beets

The preliminary or pilot study on beet top utilization indicates that beet tops are equal or superior to alfalfa if dehydrated properly. The job is to learn how to dehydrate beet tops as economically as alfalfa. Feeding tests were made with chickens, rabbits, and rats. The addition of $50,000 from the federal government Research and Marketing funds will support this work for 3 years.

Mechanical beet harvesters are being generally accepted and approximately 15 percent of the beets in Colorado were harvested by machines in 1947. New models of machines are entering the field each year but there is room for much improvement in all machines before they can be considered entirely satisfactory.

Increasing numbers of sugar beet growers are using mechanical harvesters. This is one of several being tested by the Colorado Agricultural Experiment Station.

Since beets in normal storage lose an average of approximately 1 pound of sugar per ton per day, a 25 percent decrease would be worth thousands of dollars. The mechanical engineering section has found that by cooling the storage pile by artificial ventilation, it is possible to save as much as 50 percent of the now normal sugar loss. Scientific data is being obtained on 14 tons of beets in controlled storage bins, in October. Weight shrinkage and sugar losses will be determined on this test.

Hormones

In the industrial research field the androgenic substances in animal wastes such as feces from certain types of dairy cows are known to carry beneficial hormones but the identification of the substance is still a problem.

New methods of fattening sheep, cattle, and chickens, with certain chemicals added to the feed or given orally are being partially worked out at this station. Fantastic reports of 20 percent increased gain on thousands of cattle cannot be checked entirely at this station. The effectiveness of iodinated thiouracil in depressing thyroid activity has been demonstrated.

Certain claims that estradiol administered once orally to poultry is effective as a fattening agent have been refuted in extensive experiments with broilers. The effectiveness of diethylstilbestrol implants and of feeding two orally active estrogens in fattening has been confirmed. Diethylstilbestrol, however, consistently lowered the gain per unit of food consumed. A special high-density broiler mash gave superior gains and increased tissue fat to the same extent that diethylstilbestrol did in birds fed the standard mash. Methylbisdehydrodoisynolic acid was not sufficiently active, when implanted, to be economical.

Feces and urine have been collected thus far from 29 cows during different stages of gestation and of the estrous cycle and assays for androgenic potency have been practically completed on the feces. Twenty assay experiments involving about 5,000 chicks have been complete since July 1. The urines from selected cows have been processed to attempt to correlate androgen excretion in urine and feces. This new information will serve as a basis to aid in diagnosis and treatment of breeding disorders of an endocrine nature. Bile has been collected from cows in known periods of pregnancy to ascertain if the androgens in feces are derived in any part from bile. Results thus far appear negative.

Fence Posts

Following the coordinated plan of research adopted by the Six State Utilization Conference, the fence post study was continued during the summer of 1947 on Engelmann Spruce and Douglas Fir. Approximately 250 posts were cut, randomized, tagged and treated by new preservative methods which show promise for farm use. In addition, accelerated tests were carried on with small 1-inch saplings. The study should continue for several years until complete information on the subject is available to Colorado farmers.

Editorial Service

Scientific journals published 20 manuscripts bearing the Station scientific series numbers, and 42 papers were published in semi-technical journals or mimeographed form under the miscellaneous series numbers. There were 149 news stories released to newspapers and the same number sent to radio stations.

Monthly Publications

Twelve issues of the Colorado A & M News made up Volume II and were published monthly during the fiscal year 1947-1948.

Technical Bulletins

No. 37 "Feeding Potatoes to Livestock" by W. E. Connell, R. C. Tom, and S. S. Wheeler

No. 38 "Seepage Losses from Irrigation Channels" by Carl Rohwer and Oscar Van Pelt Stout.

No. 39 "Culture of Barley in Colorado" by D. W. Robertson, Dwight Koonce, Rodney Tucker, J. F. Brandon, and T. E. Haus.

Popular Bulletins

No. 402-A "Summary of Meteorological Data at Colorado Agricultural Experiment Station 1887-1947" by Maxwell Parshall.

Annual Report

Sixtieth Annual Report, Colorado Agricultural Experiment Station, 1946-1947.

Scientific Journal Series

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Patton, A. R. and Foreman, E. M. The pH-Fluorescence Curves of Pyrolyzed Amino Acids. Science 107 pp. 113. 1948. Sci. Series 254

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Binkley, A. M. and (Eakes, Irving L.) The Effect of Commercial Fertilizers on the Yield of Canning Tomatoes—1947. Sta. mimeo. April 1948. Misc. Series 399

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Personnel Changes

Joining the staff during the fiscal year were:

J. L. Mellor	Assistant Agronomist
F. K. Bracken	Assistant Veterinary Pathologist
M. E. Michaelson	Assistant Botanist
H. W. Barrett	Assistant Chemist
Patricia Wilson	Research Assistant in Chemistry
May E. Combs	Research Assistant in Home Economics
A. C. Ferguson	Assistant Horticulturist
C. R. Creek	Associate Rural Economist
H. E. Thomas	Associate Rural Economist

Resignations from the staff during the year were:

Ralph Weihing	Associate Agronomist
W. H. Krull	Parasitologist
Eldon Hill	Research Assistant in Chemistry
M. T. James	Assistant Entomologist

FINANCIAL REPORT, COLORADO AGRICULTURAL EXPERIMENT STATION — For the year ending June 30, 1948

	Hatch	Adams	Purnell	Bankhead Jones	Hope-Flannagan	State Mill Levy	Special	TOTAL
Receipts	$	$	$	$	$	$	$	$
Balance, July 1, 1947						11,312.76	30,390.72	44,703.48
From the treasurer of the United States	15,000.00	15,000.00	60,000.00	24,243.48	20,871.32			135,114.80
Other sources than the United States						129,922.67[1]	151,762.26[3]	281,684.93
Total Receipts	15,000.00	15,000.00	60,000.00	24,243.48	20,871.32	144,235.43	182,152.98	461,503.21
Expenditures								
Personal Services	10,588.48	11,071.21	43,940.50	20,077.42	8,865.71	99,116.19	89,802.28	283,561.79
Travel	908.57	231.69	1,984.52	724.55	696.00	1,253.86	3,692.35	9,491.54
Transportation of Things		59.94	59.68		48.60	383.96	1,115.54	1,667.72
Communication Service	414.54		134.49	61.68	16.30	1,964.10	455.11	2,946.22
Rents and Utility Service	850.90	482.67	1,376.71	627.92	274.34	5,635.76	5,780.21	15,028.51
Printing and Binding	1,248.98		73.45	86.19		1,662.03	274.78	3,345.43
Other Contractual Services	113.02	230.06	1,193.92	486.29	646.03	1,727.20	5,892.02	10,287.54
Supplies and Material	399.58	2,226.60	7,074.64	1,461.43	1,793.17	10,293.97	52,405.03	75,654.42
Equipment	175.75	559.11	3,003.70	255.63	563.31	9,413.19	9,760.49	23,731.18
Lands and Structures							918.75	918.75
Contributions to Retirement	301.18	138.72	1,158.39	462.37	262.26	1,823.27	1,018.39	5,164.58
Total Expenditures	15,000.00	15,000.00	60,000.00	24,243.48	13,165.72	133,273.53[2]	171,114.95[4]	431,797.68
Balance on hand June 30, 1948	0	0	0	0	7,705.60	10,961.90	11,038.03	29,705.53
Grand Total	15,000.00	15,000.00	60,000.00	24,243.48	20,871.32	144,235.43	182,152.98	461,503.21

[1] Includes 32,500.00 HB No. 74.

[2] Includes disbursements 32,500.00 HB No. 74.

[3] Includes receipts 93,012.26 Station Special, 23,750.00 IDR, 10,000.00 Bindweed, 6,000.00 Pure Seed, 19,000.00 Plant Disease.

[4] Includes disbursements 112,364.95 Station Special, 23,750.00 IDR, 10,000.00 Bindweed, 6,000.00 Pure Seed, 19,000.00 Plant Disease.

Under provisions of Section 9 (b) (3) of the Hope-Flannagan Act, $14,900.00 was received. This money is available only for certain projects worked on in cooperation with other State Experiment Stations. Of this amount, $9,754.03 was spent during this fiscal year. In addition the Colorado Station spent $967.93 of Hope-Flannagan 9 (b) (3) regional travel funds and $121.40 of Hope-Flannagan 10 (a) funds.

COLORADO A & M COLLEGE

COLORADO AGRICULTURAL EXPERIMENT STATION

FORT COLLINS, COLORADO

STATE BOARD OF AGRICULTURE

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Elmer Hartner, Vice Pres.	Denver
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James R. Miller, Sec'y	Fort Collins
*A. M. Camp	Durango
Edward H. Divelbiss	Hotchkiss
Duane F. Hartshorn	Fort Collins
T. C. McPherson	San Acacio

EXPERIMENT STATION OFFICERS

I. E. NEWSOM, D.V.S., D.Sc.	Pres.
HOMER J. HENNEY, M.S.	Director
JEAN MAUNIER	Clerk
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JOSEPH M. WHALLEY, M.S.	Treasurer
REX W. BROWN, B.S.	Director of Information
MARCIA GREGG	Assistant Editor

EXPERIMENT STATION STAFF

AGRICULTURAL DIVISION

Agronomy

D. W. Robertson, Ph.D.	Chief Agronomist
Robert Gardner, M.S.	Agronomist (Soils)
W. H. Leonard, Ph.D.	Agronomist
R. E. Carlyle, Ph.D.	Associate Agronomist (Soils)
D. E. Romine, M.S.	Associate Agronomist (Soils)
R. S. Whitney, M.S.	Associate Agronomist (Soils)
Ralph Weihing, Ph.D.	Associate Agronomist
G. J. Gausman, M.S.	Assistant Agronomist
Thilo Haus, M.S.	Assistant Agronomist
J. L. Mellor, B.S.	Assistant Agronomist
Donald R. Wood, B.S.	Assistant Agronomist
Cooperators:	
G. W. Deming, B.S.	Assistant Agronomist, USDA
R. R. Headley, B.S.	Soil Scientist, USDA
O. J. Kelley, Ph.D.	Soil Scientist, USDA
S. R. Olsen, Ph.D.	Soil Scientist, USDA
Harold L. Parkinson, B.S.	Soil Scientist, USDA

Animal Investigations

S. S. Wheeler, Ph.D.	Chief Animal Husbandman
L. E. Washburn, Ph.D.	Animal Husbandman
H. H. Stonaker, Ph.D.	Animal Husbandman
W. E. Connell, M.S.	Animal Husbandman
Melvin H. Hazaleus, M.S.	Associate Animal Husbandman
A. Lamar Esplin, M.S.	Associate Animal Husbandman
Eugene Bertone, M.S.	Associate Animal Husbandman
E. K. McKellar, B.S.	Assistant Animal Husbandman

Animal Pathology and Veterinary Medicine

Floyd Cross, D. V. M.	Chief Veterinary Pathologist
A. W. Deem, D.V.M., M.S.	Associate Veterinary Pathologist
Rue Jensen, D.V.M., M.S.	Associate Veterinary Pathologist
Wendell H. Krull, Ph.D.	Parasitologist
J. W. Tobiska, M.S.	Chemist
R. Scott Jackson, D.V.M., B.A.	Assistant Veterinary Pathologist
Frank K. Bracken, D.V.M.	Assistant Veterinary Pathologist

Botany and Plant Pathology

L. W. Durrell, Ph.D.	Chief Botanist and Plant Pathologist
Bruce J. Thornton, M.S.	Associate Botanist in Charge of Seed Laboratory
A. O. Simonds, Ph.D.	Associate Botanist
Jess L. Fults, Ph.D.	Associate Botanist
H. D. Harrington, Ph.D.	Associate Botanist
George H. Lane, M.S.	Associate Plant Pathologist
Walter D. Thomas, Jr., Ph.D.	Associate Plant Pathologist
R. E. Atkinson, M.S.	Associate Botanist
M. E. Michaelson, B.S.	Assistant Botanist
Cooperators:	
J. O. Gaskill, M.S.	Plant Pathologist, USDA
L. A. Schaal, Ph.D.	Associate Plant Pathologist, USDA
E. A. Lungren, M.S.	Associate Plant Pathologist, USDA

* Appointed October 11, 1947, to serve unexpired term of W. I. Gifford, resigned.

Chemistry

Wesley E. Pyke, Ph.D.	Chief Chemist
Lowell Charkey, Ph.D.	Associate Chemist
Paul R. Frey, Ph.D.	Associate Chemist
A. R. Patton, Ph.D.	Associate Chemist
Harold W. Barrett, Ph.D.	Assistant Chemist
R. E. Carlson, Ph.D.	Assistant Chemist
E. B. Crone, Ph.D.	Assistant Chemist
H. A. Durham, M.A.	Assistant Chemist
Dale M. Griffin, M.S.	Assistant Chemist
Gestur, Johnson, M.S.	Assistant Chemist
Eldon Hill, B.S.	Research Assistant
Elsie Foreman, B.S.	Research Assistant
Patricia Wilson, B.S.	Research Assistant

Entomology

George M. List, Ph.D.	Chief Entomologist
John L. Hoerner, M.S.	Associate Entomologist
Leslie B. Daniels, M.S.	Associate Entomologist
J. H. Newton, B.S.	Associate Entomologist
M. T. James, Ph.D.	Assistant Entomologist

Forestry and Game Management

J. Lee Deen, Ph.D.	Chief Forester
R. J. Preston, Ph.D.	Forester
E. W. Nelson, M.S.	Range Conservationist
Clinton H. Wasser, M.S.	Associate Range Conservationist
D. F. Hervey, M.S.	Assistant Range Conservationist

Home Economics

Elizabeth Dyar, Ph.D.	Chief Home Economist
Flora L. Slocum, Ph.D.	Home Economist
Miriam E. Hummel, M.S.	Assistant Home Economist
May E. Combs, B.S.	Research Assistant

Horticulture

A. M. Binkley, M.S.	Chief Horticulturist
George A. Beach, M.S.	Horticulturist
Robert Kunkel, Ph.D.	Horticulturist
A. C. Ferguson, M.S.	Associate Horticulturist
Carl J. C. Jorgensen, M.S.	Associate Horticulturist
August Mussenbrock	Assistant Horticulturist

Poultry

H. W. Wilgus, Jr., Ph.D.	Chief Poultry Husbandman
F. X. Gassner, D.V.M., M.S.	Associate Endocrinologist
Robert Adolph, B.S.	Assistant Poultry Husbandman

Rural Economics and Sociology

R. T. Burdick, Ph.D.	Chief Rural Economist
J. L. Paschal, Ph.D.	Associate Rural Economist
C. R. Creek, M.S.	Associate Rural Economist
H. E. Thomas, Ph.D.	Associate Rural Economist
Catherine Clark, A.B.	Research Assistant in Sociology

ENGINEERING DIVISION

Civil Engineering

R. L. Lewis, M.C.E.	Chief Civil Engineer
W. E. Code, B.S.	Associate Irrigation Engineer
M. L. Albertson, Ph.D.	Associate Civil Engineer
Maxwell Parshall, B.S., B.S.	Meteorologist
H. H. Schweizer, B.S.	Assistant Civil Engineer

Cooperators:

C. H. Rohwer, B.S.C.E.	Senior Irrigation Engineer, USDA
H. J. Stockwell, B.S.	Irrigation Engineer, USDA

Mechanical Engineering

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

Cooperators:

A. D. Edgar, B.S. ..... Agricultural Engineer, USDA
S. W. McBirney, B.S.A.E. ..... Senior Agricultural Engineer, USDA
George Stafford ..... Engineering Aide, USDA
P. F. Gifford, B.E. ..... Farm Job Analyst, USDA

Branch Stations

W. R. Horlacher, Ph.D. ..... Director
Herman Fauber, M.S. ..... Superintendent, Arkansas Valley
Ferris M. Green, B.S. ..... Superintendent, Western Slope
Dwight Koonce, M.S. ..... Associate Agronomist, Fort Lewis
W. F. McGee, B.S. ..... Superintendent, San Luis Valley

Cooperators:

W. C. Edmundson, M.S. ..... Horticulturist, USDA, Colorado Potato Station
J. F. Brandon, B.S. ..... Associate Agronomist, USDA, Akron

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