THE
SEVENTH
ANNUAL
REPORT

OF

The Agricultural Experiment Station,

OF

THE STATE AGRICULTURAL COLLEGE.

FORT COLLINS, COLORADO.

FOR THE
YEAR
1894.

The State Agricultural College

OF THE STATE OF COLORADO.

SEVENTH ANNUAL REPORT

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The Agricultural Experiment Station,

FORT COLLINS, COLORADO,

For the Year 1894.

FORT COLLINS, COLORADO.
THE EXPRESS PUBLISHING COMPANY.
1895.

OFFICERS AND MEMBERS

OF

The State Board of Agriculture.

1894.

HON. A. L. EMIGH, ... PRESIDENT.

HON. DANIEL W. WORKING, . . . SECRETARY.

HON. CHARLES H. SHELDON, . . . TREASURER.

		TERM EXPIRES.
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HON. FRANK J. ANNIS,	Fort Collins,	1895
HON. JOHN J. RYAN,	Fort Collins,	1897
HON. A. L. EMIGH,	Fort Collins,	1897
HON. J. E. DuBOIS,	Fort Collins,	1899
HON. JOSEPH S. McCLELLAND,	Fort Collins,	1899
HON. JAMES L. CHATFIELD,	Gypsum,	1901
HON. A. LINDSLEY KELLOGG,	Rocky Ford,	1901
GOVERNOR DAVIS H. WAITE, } *ex-officio.*		
PRESIDENT ALSTON ELLIS, }		

THE STATE EXPERIMENT STATION.

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HON. A. L. KELLOGG, HON. A. L. EMIGH,
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C. S. CRANDALL, M. S., - HORTICULTURIST AND BOTANIST
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L. G. CARPENTER, M. S., METEOROLOGIST AND IRRIGATION ENG.
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CHARLES J. RYAN, - - - - - - - CHEMISTRY
R. E. TRIMBLE, B. S., - METEOROLOGY AND IRRIGATION ENG.

SUB-STATIONS.

F. A. HUNTLEY, B. S. A., - - - - - SUPERINTENDENT
Arkansas Valley Station, Rocky Ford, Colorado.
J. H. McCLELLAND, - - - - - - SUPERINTENDENT
Divide Station, Table Rock, Colorado.
CHAS. A. DUNCAN, B. S., - - - - - SUPERINTENDENT
San Luis Valley Station, Monte Vista, Colorado.
J. B. ROBERTSON, - - - - - - - SUPERINTENDENT
Rain-Belt Station, Cheyenne Wells, Colorado.

The State Agricultural College.

TREASURER'S FINANCIAL STATEMENT

FOR THE FISCAL YEAR ENDING JUNE 30, 1894.

EXPERIMENT STATION FUND.

RECEIPTS.

United States Treasurer	$15,000.00	
Sales at Arkansas Valley Station	720.83	
Sales at San Luis Valley Station	117.12	
Sales at Divide Station	137.31	
State appropriation for the establishment of an Experiment Station at Cheyenne Wells	2,500.00	
Donation from Cheyenne County for the benefit of the Experiment Station at Cheyenne Wells	1,200.00*	
		$19,675.26

EXPENDITURES.

Salaries, Station Staff, Officers, and Assistants	$ 8,723.89	
Agricultural Section, labor and supplies	226.23	
Stationery and postage	53.40	
Horticultural Section, labor and supplies	160.88	
Divide Experiment Station	551.69	
Chemical Section, chemicals	32.76	
Printing Bulletins	837.20	
Meteorological and Irrigation Eng. Section	149.34	
San Luis Valley Experiment Station	1,362.70	
Arkansas Valley Experiment Station	2,713.25	
Entomological Section	192.29	
Buildings at Stations	371.00	
Printing Annual Reports	285.40	
Buildings at Rain-Belt Station, Cheyenne Wells, State appropriation	1,326.25	
Rain-Belt Station, for equipment and support, State and Local appropriations	1,480.33	
Over-draft from 1893	736.62	
Binding Annual Reports	9.25	
		$19,212.48
Balance in Treasury, State appropriation		$ 462.78

Fort Collins, Colorado, November 30, 1894.

* Of this sum the Union Pacific System contributed $500.

Experiment Station Inventory.

1894.

SUMMARY.

Agricultural Section, Fort Collins	$ 645.00
Horticultural Section, Fort Collins	546.56
Section of Irrigation and Meteorology, Fort Collins	1,124.75
Entomological Section, Fort Collins	727.50
Total Home Station	3,043.81
Arkansas Valley Station, Rocky Ford	$15,722.50
San Luis Valley Station, Monte Vista	5,551.87
Divide Station, Table Rock	2,137.00
Rain-Belt Station, Cheyenne Wells	3,342.00
Total of Experiment Station Property	$29,797.18
Total of Experiment Station Property in 1893	$25,037.12

Letter of Transmittal.

HON. DAVIS H. WAITE,

Governor of Colorado:

SIR—As required by law, I herewith present the Seventh Annual Report of the Colorado Experiment Station, connected with The State Agricultural College and controlled by the Executive Committee of The State Board of Agriculture, for the year 1894. Much valuable information will be found in the comprehensive reports from the Executive Committee, the Members of the Station Council, and the Superintendents of the Sub-Stations at Rocky Ford, Table Rock, Monte Vista, and Cheyenne Wells. It is believed that the experimental work now in progress in Colorado is destined to prove of lasting value to the agricultural and horticultural interests of the State—interests that are yearly growing in importance.

Respectfully submitted,

Alston Ellis.

Director of the Agricultural Experiment Stations of Colorado.

FORT COLLINS, COLORADO, December 31, 1894.

GROVE OF WALNUT TREES, COLLEGE FARM, FORT COLLINS, COLORADO.

REPORT OF THE DIRECTOR.

To the Executive Committee of The State Board of Agriculture:

GENTLEMEN—Agreeably to the requirements of law, and in conformity with the regulations of The State Board of Agriculture, whose representative you are, I herewith present some statements relating to the work of the Agricultural Experiment Stations, under your direction, for the year ending November 30, 1894.

The Act of Congress, passed March 2, 1887, and known as the "Hatch Act," providing for the maintenance of the agricultural experiment stations in the several states, requires that each station, established under its provisions, shall annually, on or before the first day of February, make to the Governor of the State in which it is located a full and detailed report of its operations, including a statement of receipts and expenditures.

WORK OF THE STATIONS.

The work to be done by the experiment stations, established under Government authority, is clearly outlined and described in Section 2 of the act just referred to:

"That it shall be the object and duty of said experimental stations to conduct original researches or verify experiments on the physiology of plants and animals; the diseases to which they are severally subject, with the remedies for the same; the chemical composition of useful plants at their different stages of growth; the comparative advantages of rotative cropping as pursued under a va-

rying series of crops; the capacity of new plants or trees for acclimation; the analysis of soils and waters; the chemical composition of manures, natural or artificial, with experiments designed to test their comparative effects on crops of different kinds; the adaptation and value of grasses and forage plants; the composition and digestibility of the different kinds of food for domestic animals; the scientific and economic questions involved in the production of butter and cheese; and such other researches or experiments bearing directly on the agricultural industry of the United States as may in each case be deemed advisable, having due regard to the varying conditions and needs of the respective States or Territories."

AGRICULTURAL EXPERIMENTS PRIOR TO 1887

Prior to the passage of the "Hatch Act," valuable experimental work had been done on a portion of the 240-acre farm connected with The State Agricultural College, at Fort Collins, Colorado. Before the organization of The Agricultural Experiment Station of Colorado, the annual reports of the Secretary of The State Board of Agriculture, in control of the College, contained valuable matter relating to the number, character, and success of the agricultural experiments conducted on the College Farm. The acceptance of the "Hatch Act" by the General Assembly of Colorado bears date, March 25, 1889.

COLORADO EXPERIMENT STATIONS.

Under State authority six experiment stations have been established in Colorado. The locations of these stations and their acreage of land and its value are shown as follows:

Station.	County.	Acres Cultivated.	Acres Uncultivated.	Value of Land.
College	Larimer	200	40	$26,750.00
San Luis Valley	Rio Grande	125	35	2,400.00
Arkansas Valley	Otero	188	0	9,400.00
Divide	El Paso	40	0	400.00
Rain-Belt	Cheyenne	80	80	480.00
*Fruit	Delta	10	30	1,000.00

* Not in full operation.

The stations are named in the order of their establishment. Upon each, save the last-named, are to be found a comfortable dwelling-house and a substantial barn. The annual inventories show that the stations are fairly well-equipped for the carrying on of the work for which they were put in operation.

PERMANENT IMPROVEMENTS MADE IN 1894.

At the time of my last report, the Rain-Belt Station, at Cheyenne Wells, had been located but no improvements had been put upon the land. Within the past year a comfortable dwelling-house and model barn have been erected at a total cost of $1,326.25. The sum of $1,480.33 was spent in laying a water-main, fencing the land, securing a team of draught horses, and providing the farm implements necessary for carrying on the station work.

The other improvements worthy of mention are as follows: Root-cellars at the San Luis Valley and the Divide Stations and repairs on the dwelling-house at the Arkansas Valley Station. All these improvements were made at a cost not exceeding $250.

All improvements put upon the College Station grounds are paid for out of College funds. The cost of all equipments is met in the same manner. This station makes no draft upon the experiment-station fund save that required to pay salaries of station employes.

STATION EMPLOYES.

Those directly connected with the experimental work are the members of the Station Council, five assistants, the superintendents of the sub-stations,

and a necessary number of farm laborers. The President of the Station Council receives no compensation for his services, as such. Other members of the Station Council, five in number, receive annually $500 each from the Station Fund. The assistants engaged in station work are five in number:

Names.	Subjects.	Annual Salary.
Frank L. Watrous	Agriculture	$1,000.00
M. J. Huffington	Horticulture	1,000.00
Charles F. Baker	Entomology	800.00
Charles J. Ryan	Chemistry	800.00
Robert E. Trimble	Meteorology	800.00

The names and annual salaries of the superintendents of the sub-stations are herewith given:

Sub-Station.	Name of Superintendent.	Annual Salary
Arkansas Valley	Fred A. Huntley	$1,000.00
San Luis Valley	Charles A. Duncan	800.00
Divide	J. H. McClelland	800.00
Rain-Belt	J. B. Robertson	600.00

No superintendent has yet been appointed for the station in Delta county. The superintendents of the sub-stations, in addition to their annual salaries as herein given, have free use of the station dwelling-houses. They are not required to pay for garden vegetables taken for their own use.

STATION PUBLICATIONS.

Within the year covered by this report, four bulletins were issued from the Director's office. The annual reports for the years 1892 and 1893 were also printed and distributed. Our station publications are creditable to their authors and represent a great amount of careful, scholarly investigation. Herewith is given the bulletin literature of the Station from the time of its establishment up to the present date:

No.	Subjects.	Authors.
1.	Reports of Experiments in Irrigation and Meteorology	Elwood Mead.

2.	Report of Experiments with Grains, Grasses, and Vegetables on the College Farm	A. E. Blount.
3.	Concerning the Duties of the Secretary of The State Board of Agriculture, and Distribution of Seeds	Frank J. Annis.
4.	Report of Experiments with Potatoes and Tobacco	James Cassidy.
5.	Experiments in Apiary	C. M. Brose
6.	Notes on Insects and Insecticides	James Cassidy.
7.	Potatoes and Sugar Beets	James Cassidy, and David O'Brine.
8.	Alfalfa: Its Growth, Composition, and Digestibility	James Cassidy, David O'Brine.
9.	Soils and Alkali	David O'Brine.
10.	Tobacco	C. L. Ingersoll, James Cassidy.
11.	Sugar Beets	David O'Brine.
12.	Some Colorado Grasses and their Chemical Analysis	James Cassidy. David O'Brine.
13.	On the Measurement and Division of Water	L. G. Carpenter.
14.	Progress Bulletin on Sugar Beets	David O'Brine.
15.	The Codling Moth and the Grape-vine Leaf-hopper	C. P. Gillette.
16.	The Artesian Wells of Colorado and their Relation to Irrigation	L. G. Carpenter.
17.	A Preliminary Report on the Fruit Interests of the State	C. S. Crandall.
18.	Index Bulletin	W. J. Quick.
	Special Bulletin "A." Concerning Subjects Investigated by the Experiment Station	
19.	Observations upon Injurious Insects, Season of 1891	C. P. Gillette.
20.	I. The Best Milk Tester for the Practical Use of the Farmer and Dairyman.	
	II. The Influence of Food upon the Pure Fat Present in Milk	W. J. Quick.
21.	I. Sugar Beets II. Irish Potatoes. III. Fruit Raising	F. L. Watrous.
22.	A Preliminary Report on the Duty of Water.	L. G. Carpenter.
23.	Colorado Weeds	C. S. Crandall.
24.	A Few Common Insect Pests	C. P. Gillette.
25.	Progress Bulletin on the Loco and Larkspur.	David O'Brine.
26.	Farm Notes for 1893	W. W. Cooke, Frank L. Watrous.
	Garden Notes for 1893	Charles S. Crandall, Marion J. Huffington
	Seeding, Tillage, and Irrigation	Fred A. Huntley.

27. The Measurement and Division of Water. (Third Edition, Revised, of Bulletin No. 13)..... L. G. Carpenter.
28. The Russian Thistle..... Charles S. Crandall.
29. Strawberries and Grapes: Notes on Varieties.....Marion J. Huffington.

An edition of 7,000 copies of each of the last four bulletins was printed. The number of copies of these now on hand is limited. Bulletin 26 contains 32 pages. Its cost was $150. Bulletin 27 contains 42 pages. It was printed at a cost of $175. Bulletin 28 contains 12 pages of printed matter and 6 half-tone illustrations, each covering a page. The printing of this bulletin cost $95. The half-tones, from which impressions were taken, cost $44.85. Thus the total cost of the bulletin was $139.85. Payment has not yet been made for Bulletin 29. Its cost, however, will not exceed $100.

Five hundred copies of the report for 1892—72 pages, paper cover—cost $100. One thousand copies of the report for 1893—84 pages, paper cover—cost $175. Our bulletins are printed on a cheap-grade book paper; the reports are printed upon paper of a better quality. None of the paper used is of a higher grade than medium.

The printers' charges under present management are not inordinate. The total cost for printing bulletins, Nos. 22, 23, 24, and 25, for the year ending November 30, 1893, was $896.54. From the figures given, it will be seen that the cost of printing our bulletin matter has been materially reduced within the last year and a half.

In general, there is much costly duplication of station literature. Each station acts independently of all others, and of the Department of Agriculture at Washington, in the preparation and dis-

tribution of this matter. A bulletin on the Russian Thistle has been issued by the Division of Botany, Department of Agriculture, at Washington, D. C. At least four state stations, including our own, have issued bulletins on the same subject. Any one of these publications would have answered reasonably well the purpose that called all of them into existence. Their illustrations are practically the same. Had the Government bulletin been methodically distributed to all most needing its information, there would have been no necessity for the appearance of any of the others. Look at the waste of time and money involved in this duplication of station work! Five men gave time and thought to a work that either alone could have done. Five sets of compositors and pressmen were engaged where one set would have sufficed. One office, or one station, could have undertaken the whole work of printing and distributing the matter deemed necessary for the information and warning of the people, and the aggregate saving thereby would have been great. Some way should be devised to prevent this waste.

Bulletin information of particular interest to the people of more than one state, no matter by whom prepared, should be printed and distributed by the Department of Agriculture at Washington. A method of distribution could easily be planned by which the printed matter would reach its proper destination. Evidently, any plan to be effective of good result must involve some control over the preparation of all bulletin matter by a central authority. This authority could decide whether the information contained in any manuscript bulletin was of general or local value. If the former, it

could be handled as before suggested; if the latter its publication and distribution could be left to the authorities of the station where it originated.

The bulletins that will be issued from my office at no distant day are the following-named:

1. Farm and Garden Notes for 1894.
2. Colorado Hemiptera.
3. Alfalfa: Its Composition and Soil Requirements.
4. Duty of Water.
5. On Return Waters from Irrigation.
6. Relation of Forests to Water Supply for Irrigation.

The promise of last year of a forthcoming bulletin entitled "Meteorological Observations in 1893" has not been redeemed. The reason assigned for the failure of its appearance is the lack of time on the part of the force of the "Meteorological Section" to tabulate the data on hand and work out, in popular form, legitimate deductions therefrom. There is a mass of meteorological data derived from daily observations carefully made, on file in the Department of Irrigation Engineering that is almost useless in its present state. The information wrapped up in these data, while not of general interest, has a special value that is daily growing less. If these observations are worth making, their results worth recording, some means ought to be found to make public the information they give at the earliest possible time. My own opinion is that observations covering a narrower field would subserve every desirable purpose. It seems to me desirable that our meteorological work should be connected in some way with the Weather Bureau of the U. S. Department of Agriculture at Washington

SHORT COURSE IN AGRICULTURE.

A short course in agriculture was opened in January last, beginning on the 8th and continuing four weeks. The course was a decided success. Many farmers, both old and young, availed themselves of the privileges and showed by their words and actions that they appreciated the opportunities offered them.

The course will be repeated this winter with some enlargements and additions. It will continue four weeks, from Monday, January 7, 1895, to Friday, February 1, 1895.

Instruction will be given by lectures and by work in the shops and laboratories. The regular daily programme will consist of three lectures, and two hours in the laboratory, shop, or greenhouse.

STOCK FEEDING—Eight Lectures.

The relative value of stock foods; feeding standards; feeding for beef, mutton, pork, milk, butter, etc.; ensilage and the silo; winter shelter for stock; preparation of food—cutting, steaming, grinding, etc.....PROF. W. W. COOKE.

DAIRYING—Eight Lectures.

Selection and care of dairy stock; dairy breeds; composition and secretion of milk; care and handling of milk; butter and cheese making; milk testing; paying by test at creameries and cheese factories; profitable use of skim milk and buttermilk.....PROF. W. W. COOKE.

IRRIGATION HYDRAULICS—Twelve Lectures.

Water supply; measurement of water; duty of water; storage of water; reservoirs; methods of irrigation; irrigation in other countries .....PROF. LOUIS G. CARPENTER.

HORTICULTURE—Eight Lectures.

Grasses and forage crops; orchard crops and small fruits; grafting; other methods of propagation; improvement through seed selection; cross fertilization; variation.....PROF. CHARLES S. CRANDALL.

ENTOMOLOGY—Six Lectures.

Insects injurious to farm and garden crops; insect enemies of orchards and small fruits; parasites of domestic animals; methods of preparing and using insecticides; beneficial insects.....PROF. CLARENCE P. GILLETTE.

AGRICULTURAL CHEMISTRY—Five Lectures.

Soils and their formation; the nutrition of plants; manures, natural and artificial; fertilizing value of feed stuffs; green manuring.....PROF. WILLIAM P. HEADDEN.

FARM MACHINERY AND TOOLS—Three Lectures.

Care and use of wood-working tools; care of farm machinery; repairing farm machinery.....PROF. JAMES W. LAWRENCE.

THE SCIENCE OF GOVERNMENT—Two Lectures.

.....PRESIDENT ALSTON ELLIS.

DOMESTIC ECONOMY—Eight Lectures.

The cooking of meats and vegetables, soups, eggs, salads, croquettes, puddings, and dainty deserts; various ways of using "left'overs;" the preparation of food for the sick-room.....MRS. W. W. COOKE.

VETERINARY SCIENCE—Four Lectures.

Sanitary science and prevention of diseases; common diseases of cattle, sheep, and hogs; general remedies useful on the farm.....DR. CHARLES CRESSWELL, State Veterinarian.

In addition to these courses of lectures there will be single lectures by specialists on the following subjects:

The Agricultural Future of Colorado—LUTE WILCOX, Editor *Field and Farm*, Denver, Colo.

The Relation of Oleomargarine to Colorado Dairying—J. T. FLOWER, State Dairy Commissioner, Denver, Colo.

The Creamery Industry of Colorado—D. E. NEWCOMB, President State Dairyman's Association, La Jara, Colo.

The Winter Feeding of Hogs—BENJAMIN B. HARRIS, Fort Collins, Colo.

Cheese Factories—JOHN SEVERNS, Longmont, Colo.

Poultry Raising—FRANK S. SMITH, Fort Collins, Colo.

The Farmer in Politics—W. R. THOMAS, Editor *Rocky Mountain News*, Denver, Colo.

FARMERS' INSTITUTES.

Within the year an effort has been made to awaken farmers to a more lively interest in improved methods of farming. This effort has not been crowned with any flattering success. A few institutes were held. These gatherings when once arranged for are usually well regarded by those who attend. The difficulty is in getting a few ca-

pable persons in a locality to make the necessary preparations for the institute their business. Recently, the Secretary of The State Board of Agriculture, prepared a short bulletin, for distribution within the State, in which practical and serviceable hints are given as to the best manner of organizing a farmers' institute. To show local committees the kind of talent and information at their command, he writes:

"The persons named below are prepared to deliver addresses or read papers on the subjects indicated. The members of the College Faculty will be sent to Institutes in response to applications made through the Secretary. Those persons not connected with the College, whose names appear below, will attend Institutes upon invitation when time and circumstances permit. Invitations may be sent to them or to the Secretary of the Board of Agriculture and College:

PRESIDENT ALSTON ELLIS:
- The Agricultural College: Its Work and Mission.
- Debt: A Lecture for the Times.
- Higher Education for the Farmer.
- Our Schools and Our Country; or, Education and Citizenship.

PROFESSOR LOUIS G. CARPENTER:
- Reservoirs and Their Construction.
- The Measurement of Water.
- Irrigation in Many Lands—with Magic Lantern Views.
- The Importance of Forests to Irrigation.

PROFESSOR CHARLES S. CRANDALL:
- Propagation of Plants.
- Diseases of Plants.
- Botany of Farm Crops.
- Botany of Orchard Crops.

PROFESSOR CLARENCE P. GILLETTE:
- Insecticides: Their Preparation and Use.
- Insects Injurious to Farm Crops.
- Insects Injurious to Garden Crops.
- Insects Injurious to Fruit.
- Health in the Home.

PROFESSOR W. W. COOKE:
Dairying.
Handling Milk and Making Butter.
Stock Feeding.
Ensilage.
Effect of Food on Fat of Milk.

PROFESSOR WILLIAM P. HEADDEN:
Plant Food Furnished by Soils.
Artificial Fertilizers.

SECRETARY DANIEL W. WORKING:
The Work of the Board of Agriculture.
Science on the Farm: An Inquiry.

HON. A. L. EMIGH, Fort Collins, Colo.:
Some Causes of Low Prices with Which Politics Has Nothing to Do.

HON. J. S. MCCLELLAND, Fort Collins. Colo.:
Fruit for the Farm.
The Evolution of Weeds and Parasites: A Realistic View.

HON. A. L. KELLOGG, Rocky Ford. Colo.:
Good Roads.
Beet Sugar.

LUTE WILCOX, Editor *Field and Farm*, Denver, Colo.:
The Agricultural Future of Colorado.
The History or Any Other Matter Pertaining to Irrigation.
Cattle Feeding and Beef Making.
"The Boy on the Farm."

W. R. THOMAS, Editor *Rocky Mountain News*, Denver, Colo.:
The Farmer in Politics.

It is expected that in the early part of 1895, a vigorous institute campaign will be in progress in Colorado. Already arrangements have been made for holding a number of farmers' institutes before active farm operations begin next spring.

OUTLINE OF STATION WORK.

At my suggestion, the superintendents of the sub-stations were requested to attend the lectures and work of the "Short Course" held at the College Station. The members of your Committee and the members of the Station Council were also present. The time was favorable for a discussion

of outlines and plans of experimental work for 1894. At a meeting of the Station Council, at which all the persons before-named were present, a committee, composed of W. W. Cooke, C. S. Crandall, and J. S. McClelland, was appointed to prepare an outline of work to be taken up and discussed at a subsequent meeting. The report was in due time submitted for consideration and final action. It is herewith presented as a part of my report:

REPORT OF COMMITTEE.

To the Station Council:

Your Committee to whom was referred the subject of the experimental work at the College Station and the sub-stations, for the season of 1894, would respectfully report as follows:

RAIN-BELT STATION,

CHEYENNE WELLS, COLORADO.

1. Wheat, four varieties, one-fourth acre each.
2. Polish Wheat one acre.
3. Oats, two varieties, one acre each.
4. California barley, one-half acre.
5. Corn, White Australian, six acres; Pride of the North, six acres; Colorado White, six acres.
6. Sorghum, non-saccharine varieties, ten acres.
7. Broom corn, eight acres.
8. Field peas, one-fourth acre.
9. Potatoes, one-half acre.
10. Beets, sugar and stock, one-fourth acre.
11. Alfalfa, one-half acre.
12. *Bromus inermis*, ten pounds of seed.
13. *Garden crops:*
    A plat of general assortment.
14. *Apple trees:*
    Twelve trees.
15. *Plum trees:*
    Twelve trees, Weaver and Miner.

16. *Cherry trees:*
    Twelve, Early Richmond; twelve, Rocky Mountain.
17. *Grapes:*
    Twelve, Concord.
18. *Gooseberries.*
    Six, Downing.
19. *Currants:*
    Twelve, Red Dutch.
20. *Raspberries:*
    Twelve, Cuthbert; twelve, Gregg.
21. *White Ash trees:*
    Twelve trees.

DIVIDE EXPERIMENT STATION,

TABLE ROCK, COLORADO.

1. *Wheat:*
   A few drills for samples, about one-eighth acre.
2. *Oats:*
   Six acres, to be devoted to tests of new varieties, light and heavy seeding, deep and shallow plowing, and for the treatment of smut.
3. *Peas and Oats:*
   Two acres for station hay.
4. *Oats and Bromus inermis:*
   A few drills. Use seed now on hand.
5. *Flax:*
   A few drills of several varieties.
6. *Buckwheat:*
   One acre *Silverhull;* one acre *Japanese.*
7. *Corn:*
   Two acres. Testing large growing varieties for fodder and early varieties for corn.
8. *Forage Crops and Grasses:*
   (*a*) Rye sown in 1893 to be cut for hay in 1894.
   (*b*) Alfalfa seed on hand to be sown on thin spots of seeding for 1893.

(*c*) One acre to be devoted to grass garden.
(*d*) Previous grass plots to be plowed up.

9. *Barley:*
A few drills for exhibition.

10. *Potatoes:*
(*a*) One-half acre on fall plowing, early planting, 6 inches deep; ½ acre on fall plowing, early planting, 3 inches deep; ½ acre on fall plowing, late planting, 6 inches deep; ½ acre on fall plowing, late planting, 3 inches deep; 2 acres on deep plowing, early planting, 6 inches deep; 2 acres on deep plowing, early planting, 3 inches deep; 2 acres on deep plowing, late planting, 6 inches deep; 2 acres on deep plowing, late planting, 3 inches deep; 2 acres on shallow plowing, early planting, 6 inches deep; 2 acres on shallow plowing, early planting, 3 inches deep; 2 acres on shallow plowing, late planting, 6 inches deep; 2 acres on shallow plowing, late planting, 3 inches deep.
(*b*) Ten new varieties, one pound each, for testing.
(*c*) Second trial of thirty to forty of last year's varieties that did the best.

11. *Apple trees:*
Twenty trees

12. *Cherry trees:*
Six trees.

13. *Plums:*
Six trees.

14. *Forest trees:*
Twelve trees.

SAN LUIS VALLEY STATION,

MONTE VISTA, COLORADO.

1. *Wheat:*
Testing of varieties,
1. As to early maturity.

2. As to yield per acre on twenty-nine acres of new breaking.

2. *Oats:*
   Variety tests,
   1. As to early maturity.
   2. As to yield per acre, 15 acres new breaking, 5 acres stubble.

3. *Barley:*
   Variety tests,
   Notes as to yield, length of straw, and date of maturity. One acre new breaking, and four acres stubble.

4. *Polish Wheat:*
   Notes on manner of growth, yield, and value as a forage crop; one acre.

5. *Buckwheat:*
   Variety tests,
   1. Testing two varieties in half-acre plats.
   2. Different seasons of sowing. One acre stubble.

6. *Peas:*
   (*a*) Peas with oats.
   (*b*) Yield per acre as a fodder. Ten acres.
   (*c*) Variety test of field peas in one-half acre plats, and peas as a crop. Ten acres.

7. *Forage Crops and Grasses:*
   (*a*) Alfalfa,
   1. Alone and with Orchard grass.
   2. Different seasons of sowing; the 1st of May, June, July, August, and September.
   3. With or without nurse crop.
   4. Different quantities of seed per acre —15 to 20 pounds—in all ten acres.
   (*b*) Many varieties of grasses in plats.
   (*c*) Small plats of cane and corn for fodder.

8. *Potatoes:*
   (*a*) Variety tests.
   1. Date of maturity.

2. Marketable yield.

(*b*) Unfertilized versus fertilized with barnyard manure, 15 acres in all, on stubble.

9. *Sugar Beets:*

Several varieties, one-eighth acre.

10. *Garden Vegetables:*

Notes on maturity and general observations.

11. *Orchard:*

Strawberries.

12. *Trees:*

Twelve Ash.

13. *Duty of Water:*

Measurement of amount of water used on crops to be reported to the Irrigation Engineering Section.

ARKANSAS VALLEY EXPERIMENT STATION,

ROCKY FORD, COLORADO.

1. *Wheat:*

(*a*)

1. Winter varieties; in the aggregate twenty-two acres already planted.
2. Test; deep culture and general observations.
3. Varieties; *Turkish, Red Russian, Canadian, Velvet Chaff, and Polish.*

(*b*)

1. Spring varieties sown in the fall.
2. Test; adaptability of spring grains to fall sowing.
3. Varieties; *Clawson, Australian Club, Amethyst, Improved Fife, and Sonora.* One and one-half acres.

(*c*)

1. Samples of several varieties sufficient for exhibition purposes to be sown in the spring.
2. Also six acres near oat ground.

2. *Oats:*

Twenty acres of corn ground to be

sown on deep plowing and to be seeded to alfalfa

3. *Barley:*
   1. An acre or more of some hulless variety to test the reqirements of culture; yield and general observations.
   2. Samples of several varieties for exhibition purposes.
4. *Rye:*
   1. One acre or more of a spring variety, if it can be obtained.
   2. Two-acre pasture plat of winter rye to be seeded partly to *Bromus inermis* in spring for permanent pasture tests. Now in rye.
5. *Buchwheat:*
   One acre or more. Observation test.
6. *Corn:*
   1. *Colorado White* variety.
   2. Field culture on deep plowing; 34 acres.
   3. High culture on manured ground. Five acres.
   4. Variety plantings for exhibition purposes, including sweet varieties.
   5. Five acres of some large variety for fodder.
7. *Alfalfa:*
   1. Continued observations.
   2. Twenty acres to be seeded with oats.
8. *Sugar Beets:*
   One acre.
   1. Test of varieties and culture.
   2. Crop for feeding station animals.
9. *Peas and Oats:*
   Two acres for dry fodder.
10. *Potatoes:*
   1. One and one-half acres on contin-

uous potato land, testing early and late planting.

2. Tests of six varieties on a portion of above area.

3. One acre on alfalfa ground.

11. *Miscellaneous:*

Small trial plats of *Kaffir corn, hemp, Soja bean, field peas, sorghum, millet, flax, etc.*

The following recommendations of the local committee are also approved:

1. That an acre be devoted to small fruit culture.
2. That a thorough test be made of red clover for hay and seed.
3. That a good vegetable garden be maintained.

OUTLINE OF WORK FOR 1894.

SECTION OF

METEOROLOGY and IRRIGATION ENGINEERING.

FORT COLLINS, COLORADO.

LINES OF WORK:

Same as for several years past.

1. Duty of Water:
   (*a*) With co-operation of canals.
   (*b*) Duty on individual crops.
2. Continuation of the irrigation survey of the State.
3. Investigation of losses by seepage and evaporation.
4. Investigation of the return waters; experimentation in the Poudre valley; collection of data of same phenomena elsewhere.
5. Miscellaneous experiments, Modules, etc.
6. Meterology as hitherto.
   (*a*) This includes eye readings of the principal instruments twice daily; records of self-recording instruments as far as possible. The records include those of temperature, barometer, dew point

and relative humidity; also direction and velocity of wind, cloudiness, presence or absence of dew or frost, actinometric observations, solar and terrestrial radiation, evaporation, soil temperatures.

(*b*) The continuous records include the barometer, thermometer, duration of sunshine, velocity of wind, statoscope (instrument which shows the atmospheric changes on a magnified scale), during thunder or hail storms in summer and some of the wind storms.

(*c*) This also includes the collection of meteorological data through the cooperation of various observers, principally in the valley of the Poudre, the data being those which relate to irrigation questions.

(*d*) Also the compilation and reduction of the observations made at the substations.

Of the other lines of work I wish to give more attention to Nos. 2 and 3. Under No. 2, to take up the question of the plains especially, obtaining data by personal inspection and by correspondence. Under No. 4, to give at least two measurements on the return waters of the Poudre and, if a portable apparatus for gauging in high water can be procured, also to make a measurement during the period of high water to determine if the relations found true in low water are also true in high. Under No. 5, one special problem is the determination of the value of recording the height of water at a distance, electrically. For the use of wire and line we hope to depend upon the Ditch Telephone Co., and test the instrument either from the canon or from the head of No. 2 as far below here. The co-operation of some of these companies is necessary for the successful carrying

on of this test, and the aid of the water district or the Telephone Company of the associated ditches.

SECTION OF BOTANY AND HORTICULTURE.

SCHEDULE OF WORK FOR THE YEAR 1894.

1. The study of the flora of the State. Special attention being given to
   (*a*) The weeds of the farm and garden.
   (*b*) Grasses, native and introduced.
   (*c*) The various species and varieties of the genera *Oxytropis* and *Astragalus*.
2. The further introduction to the garden of such wild fruit plants as can be obtained.
3. Nursery tests of orchard fruits with a view to the study of the adaptability of varieties to this climate. The Department now has in store for this purpose: 125 varieties of apples, 30 varieties of plums, 11 varieties of pears, 2 varieties of apricots.
4. Tests of various small fruits.
5. Tests of the varieties of the culinary vegetables newly introduced; together with such other varieties as may be sent to the Station for trial.

ENTOMOLOGICAL SECTION.

OUTLINE OF WORK FOR THE YEAR 1894.

1. Work with Insecticides:
   (*a*) Testing the effects of arsenical combinations upon insects and foliage.
   (*b*) Testing the effects upon bees and honey of spraying arsenical mixtures upon fruit trees in bloom.
2. Work with Injurious Insects to Determine Methods of Prevention and Remedy.
   (*a*) By the use of insecticides.
   (*b*) By studying habits and life-histories. The latter to be done by making collections and by rearing such species as may be obtained in the preparatory stages.

3. Testing Insecticides and Insecticide Machinery:
4. Experiments in Apiary.
   (*a*) Testing the "K. D." hive and its furniture.
   (*b*) Experiments to determine the best method of applying foundation to sections.
   (*c*) Experiments to determine best method of using separators.
   (*d*) Experiments to determine best method of wintering bees.
   (*e*) Collection of and taking notes on flowering plants for the purpose of determining their value as forage plants for bees.
5. Preparation of a List of Colorado Insects for Publication.

   The plan is to make as complete a systematic list of the insects known to occur in the State as possible and to give in each case, along with the name of the insect, the name of the collector, the date, and particular location of capture, the altitude, and, as far as known, its food-habits and life-history.

CHEMICAL SECTION.

Outline of Work for the Year 1894.

1. Work in connection with the Association of Official Agricultural Chemists on Soils, Ashes, Potash, and Phosphoric Acid.
2. Tests to determine the average depth to which the roots of alfalfa penetrate.
3. The relative weight of the root and plant of alfalfa.
4. The relative composition of the root and plant of alfalfa.
5. Co-operation work with other departments.

AGRICULTURAL SECTION.

Outline of Experimental Work for the Year 1894.

1. Tests to find if possible some forage plant which, sown with wheat, oats, or barley, will

produce fall and winter pasturage. Trials of sandwick, sanfoin, seradella, spring vetch, rape, and constitution pea for this purpose.

2. Forage crops for fall and winter pasturage sown immediately after the cereal harvest, harrowed in without plowing. Trials of barley, rye, barley and rye, rape, sandwick, and winter vetch.
3. Forage crops with irrigation:
   Large and small varieties of corn, corn and horse beans, sunflower, carrots, artichokes, peas and oats, vetch and oats, sandwick and oats, constitution pea, rape, sugar beets, and stock beets.
4. Forage crop without irrigation:
   California barley, Polish wheat, red-branching dhoura flat pea, Polygonum *sachinahe*.
5. The weight of alfalfa at different cuttings and its composition. Influence on weight and composition of frequent cuttings. Losses of feeding value in drying and curing alfalfa.
6. Losses in shocking and curing corn.
   Growth of corn after the middle of September.
   Effect on growth and composition of removing ears before ripe.
7. Effect of soluble phosphates on corn and potatoes.
8. Feeding experiments with hogs on alfalfa, with and without grain.
9. Soiling with alfalfa for beef and milk.
10. Fattening steers on whole and cut alfalfa, with sugar beets and corn fodder.
11. Fattening sheep on alfalfa and sugar beets.

This outline of work is justly open to the criticism that the one for the previous year received. It is too comprehensive, too pretentious. The design was to make all experimental work under the control of your Committee conform as

nearly as possible to the requirements of the schedule. Then it was intended that the reports for 1894 should show what had been accomplished in the way of performance of scheduled work.

An examination of the outlines and a careful reading of the reports, herewith appended, will emphasize the force of the strictures heretofore and herein made upon the plans of experimental work we have attempted to follow. Let us attempt less and, by so doing, really acomplish more.

COMMENTS AND SUGGESTIONS.

Outside of the special appropriation of $2,500 made by the State and a donation of $1,200 from Cheyenne county—all to be used in the establishment of the Rain-Belt Station at Cheyenne Wells—the total experiment-station revenue, for the year ending June 30, 1894, was $15,975.26. Of this total the sum of $15,000 was received from the General Government; the rest came from the sale of station products. It is not to be expected that there will be any duplication of the special appropriation or the local donation. The revenue that may be relied on—and this is not wholly so—is the Government appropriation of $15,000 per annum. With the newly located Fruit Station in Delta county, there are six points in the State where your Committee has experimental work in progress. The aggregate of land under your control in these different localities is 828 acres, 643 acres of which are under cultivation. Are we to *farm* for experiment, or are we to *experiment* that others may farm to better purpose? If we are trying to farm, in the ordinary acceptance of the term, we are not securing results that any thrifty

farmer would prize very much. With an assured revenue of $15,000 yearly, with more than a square mile of cultivable, untaxed land, with excellent station equipments, and with specialists in charge of all station work, we managed to realize *less than a thousand dollars* from the year's labor. Surely this is not a flattering exhibit if, in our station work, we profess to farm for profit. The fact is the stations were not organized as *farms*. Their work is, and ought to be, almost wholly *experimental*. It is not the province of an experiment station to raise products of any kind for the market. Surplus products should not be allowed to go to waste if there is a market for them; but crops should not be raised with the sole purpose of securing a revenue from their sale. When a station farm is made large in area for the purpose that moves the farmer to till his acres, the working force is unnecessarily increased and the experimental work made much less effective and instructive than it should be.

We shall have to reverse what all experience teaches if we prove ourselves capable of farming through employes the land we now have in charge with good economic results. Our scientific farming will not meet with warm appreciation from practical farmers if it prove a treasury-depleting operation.

It seems to me that we are weakening our efforts, making them unproductive of much good to the people whom we desire to benefit, by attempting to round out properly all the work we now have in hand with the financial resources at our command. Would it not be well to draw our effort within narrower and more reasonable limits?

The tendency to multiply stations has not been checked. With a stationary revenue, there is a constant—and may I say useless?—increase in the amount of work attempted. A year or two ago, eighty acres were added to the experiment station at Monte Vista. Then came a quarter section, to be used largely as a money sink-hole, at Cheyenne Wells. There is a promise of something of value from the forty acres of fruit land recently located in Delta county; that is if State aid to a reasonable amount can be secured. Without such aid in larger measure than ever before given, it will be futile to expect desirable results from all the experiment stations now established in Colorado.

Some of the stations ought to be abandoned. Those kept in operation ought, in most instances, to be reduced in size. It requires some courage so to state, but I am of conviction that four experiment stations are the greatest number that ought to be supported in Colorado. Further, I am of opinion that none of the four should contain over eighty acres of land. Again, I repeat, the work of these stations should be, first of all, experimental work. Such work will prove of the highest advantage to the agricultural interests of the State.

Experimental work will often result in *failure*. That outcome is to be expected at times. Failure may be but the surest and most speedy road to ultimate success. When our experiments, if wisely conducted, result in failure an instructive and inexpensive object-lesson is given to every farmer who has knowledge of them. A successful experiment, secured by economic means, gives to others a vantage ground from which to direct their own

efforts. Let us try to hasten the time when our farming communities will look with confidence upon our station work and be willing to profit by the practical results secured by it.

As you are well aware, the students of the College are within seeing and handling distance of all work done on the agricultural and horticultural grounds of the College station. By requirements of the College course of study, some of them are compelled to labor, at stated times, upon the farm or in the garden. If this work is to have any special value to them, outside of the money it brings into their pockets, it should be carefully planned and intelligently supervised. It is not making too strong a statement to say that the required work has done nothing, or very little, to beget in the minds of those who perform it any interest in the operations of farm life. The work is not thought inciting. It is not so directed as to make it of any educational value whatever. The students would not voluntarily perform it. If there is any place where the heads of the departments devoted to instruction in scientific agriculture and horticulture can make their teaching power felt to best advantage it is on that part of the College grounds where the experimental work is in progress. Class-room lectures are well enough in their way, but it is the practical applications of well-known principles that will prove most interesting and serviceable to the student. The student that creeps unwillingly to the farm or garden, there to labor under College pay, becomes alive with interest when his feet are turned in the direction of the work-shop and forge-room where he labors for the price of his instruc-

tion alone. Is the reason for this disposition, so noticeable in most of the students, to be found in the fact that in the shop they come under the personal supervision of an expert and an enthusiast while on the farm or in the garden they are left to the direction and instruction of foremen and laborers? The classes in agriculture and horticulture are small; those in shop-work are crowded to overflowing. A greater effort must be made to popularize the out-of-door work. It is not of less importance than any other kind of manual labor. A step in the right direction will be made when the class-room instruction is made to articulate more closely with the practical operations in progress on the experimental plots.

Experimental work involves more outlay of time and money, in cultivating a given area, than does any ordinary farm work. Students should be made to see the necessity and reasonableness of this. Student life with us should lead to economic paths in the world's fields of effort Our experimental work, if it is to be instructive and profitable to the students who see it in progress, must show satisfactory results brought about by the most economic means.

Under favorable conditions, crop-raising can be make successful. If desirable results are secured by time-wasting processes, counteracted by unnecessary additions to the working force, no wholesome economic lesson is taught thereby. Students are pretty close observers of what is going on about them. They are quick to detect looseness of management in an administration or any want of energy on the part of those connected with it.

Every employe connected with the College or Station work is a living epistle read unerringly by on-looking students as he faithfully performs or willfully neglects his appointed duties. His example is forceful for good or ill. I have ever felt that one of the strongest forces for good about a College is the presence of capable instructors and employes who daily evidence to all with whom they come in contact that they are thoroughly in earnest in what they are doing. Perfunctory service, of any kind, on the part of any one connected with the College, has an unhealthy influence upon the students, not the least part of whose work is to acquire the habit of faithful and prompt performance of all duties that life's exigencies may impose upon them.

CONCLUSION.

Your records give testimony to the efforts you have put forth to advance the weighty interests committed to your charge. The station work, while open to criticism in some of its make-up, is in better condition than ever before. The year's work, on the whole, is satisfactory. Experimental work at the Rain-Belt Station came within reach of utter failure from reasons beyond any one's control. The reports from the other stations are highly encouraging.

Our State is of ample reach, and includes within its limits areas that make diversified agricultural operations a necessity. We have some problems to solve that do not confront agricultural interests in other parts of the country. Some of our difficulties, and opportunities as well, are pretty succinctly stated in the following quotation taken

from an editorial in *The Denver Republican* of December 19th, 1893.

"One of the best features of the work done in connection with the College is the Agricultural Experiment Station. There may be need for such stations in all parts of the country, but there is special need of them in the arid region. There is much to be learned about agriculture under arid conditions of soil and climate. Until the settlement of this part of the United States, agriculture in arid regions was carried on almost exclusively by people of but little enlightenment, if not of a low order of civilization. Agricultural experiments were not to be expected among such people, and consequently there was but little chance that anything new would be learned.

"But in Colorado it should be different. Here there is both the spirit of advancement and the opportunity for experiment. It may be that some exceedingly valuable discoveries in agriculture, adapted to arid regions, will be made at the experimental stations in this State. It is among the possibilities that varieties of grains, for instance, will be found, or rather developed, which will be so adapted to arid conditions that they will need no irrigation to bring them to maturity. Doubtless there is much also to be learned in regard to irrigation itself, the method of applying the water and the quantity that should be used for the different crops."

There is much room for effective experimental work at our various stations. The need of more money is the one closest in view at this writing. With the hearty co-operation of those of our people most interested in agricultural pursuits, there ought to be no great difficulty in securing from the State financial assistance to aid in the prosecution of the work already in hand and in promoting those new lines of work suggested by past experience. Respectfully submitted,

Alston Ellis.

Director.

Fort Collins, Colorado, December 12, 1894.

REPORT OF

THE EXECUTIVE COMMITTEE.

To the State Board of Agriculture:

GENTLEMEN—During the fiscal year just closed we have audited bills out of the various funds at your disposal, United States fund, Experiment Station Fund, Tax Fund, and Special fund, as follows:

1893.	
December 29	$5,356.28
1894.	
January 30	6,533.35
February 27	5,053.84
April 2	8,336.53
April 30	7,773.09
June 1	6,565.02
June 9	618.13
June 30	3,250.81
July 31	5,315.11
August 30	7,439.39
September 28	9,204.62
October 31	8,797.88
November 27	6,564.54
Total bills audited during year	$81,354.89

Your Committee would also make the following report, in detail, concerning the Experiment Stations which you have placed under our control:

HOME STATION.

Most of the experiments conducted the present season at the Home Station, have been with forage crops, ensilage corn, etc., for a full report of which you are referred to the report of the Agriculturist.

A series of experiments in feeding steers, sheep, and pigs are now in progress.

A root cellar, cattle pens, and a feed house have been erected the present year.

THE ARKANSAS VALLEY STATION.

Many experiments which should prove of particular value to the farmers of the State have been conducted the past season at the Arkansas Valley Station.

The growing of two hundred bushels per acre of potatoes on alfalfa stubble, or three hundred with manure, should be of more value to farmers living in the southern portion of the State (where it was thought this vegetable could not be profitably raised) than the entire cost of the station up to the present time. And this is but one of the successful experiments.

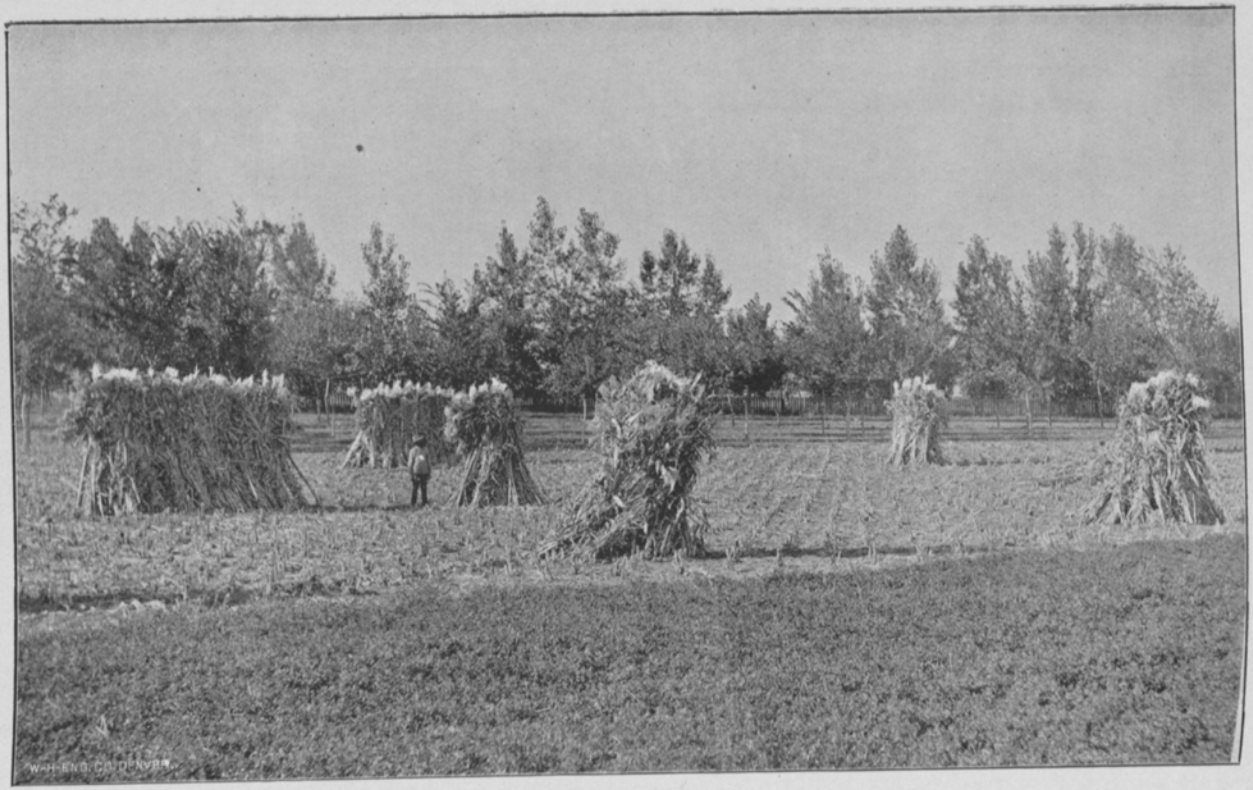
The crops this year are much larger than have ever been garnered heretofore. The following is a list of the principal marketable products and their value:

380 tons of alfalfa hay,	@	$3.50	$1330.00
1,000 bushels corn,	@	.45	450.00
650 bushels wheat,	@	.48	312.00
1,000 bushels oats,	@	.32	350.00
275 bushels potatoes,	@	.50	137.50
15 tons sugar beets,	@	4.00	60.00
4 tons turnips,	@	2.00	8.00
200 pounds *Bromus inermus* seed,	@	.25	50.00
364 pounds hemp seed,	@	.06	21.84
		Total.....	$2,719.34

The principal improvements made have been an addition to the dwelling and some sheds to the barn. An additional team of work-horses and some implements to assist in stacking hay are the principal needs.

THE SAN LUIS VALLEY STATION.

The resignation of the Superintendent of the San Luis Valley Station, in January last, was re-



FODDER CORN, COLLEGE FARM, FORT COLLINS, COLORADO

ceived and accepted. Charles A. Duncan, a graduate from the Agricultural College, was chosen to fill the vacancy.

The additional eighty-acre tract has been fenced. About one-half of it was put in experimental crops the present year.

Owing to a shortage of water in that section of country, the success of our crops was not what we had a right to expect from their promise early in the season.

The barn has been painted; a potato cellar constructed; a fence thrown around the house, yard, and trees; and some Berkshire pigs purchased.

The salable products of the year are as follows:

6 tons pea and oat hay,	@	$7.50	$ 45.00
575 bushels marketable potatoes,	@	.25	143.75
225 bushels seed potatoes,	@	.15	33.75
250 bushels wheat,	@	.65 per cwt.	97.50
220 bushels oats,	@	1.00 " "	88.00
15 bushels barley,	@	.80 " "	5.20
50 bushels seed wheat	@	1.00 " "	30.00
		Total.....	$443.20

It is believed that the coming year will witness this farm in a much better condition for sub-irrigation than heretofore, and then we may expect better results.

THE DIVIDE STATION.

The rainfall at the Divide Station the past season was ten inches in excess of that of the preceding year. This was plainly evident from all the crops grown, greatly increasing the yield. Irrigation is not possible at this Station.

The principal crops at this section are potatoes and oats, and while experiments along numerous other lines are in progress, most of the land is devoted to these principal crops.

We are endeavoring to demonstrate how the largest crops may be grown at the least expense, the best depth to plow and plant, at what date to plant, best varieties, etc., etc.

We have but forty acres in this farm.

Owing to the failure of the well to yield sufficient water for house and stock, we had it sunk deeper the past season. The barn has been painted and a potato cellar built. These are all improvements made during the year.

THE RAIN-BELT STATION.

A good substantial house and barn have been constructed at the Rain-Belt Station. A first-class equipment of farming implements has been furnished. Mr. J. B. Robertson was placed in charge as Superintendent.

Forty acres were planted to experimental crops on broken sod. The soil was very dry when the seed was sown, but showers falling soon after germinated the seed and started it into growth. There was no further percipitation, however, until the plants of every crop except corn and sorgum were thoroughly ruined. Of these latter there was for a time a renewed growth, but as the drouth continued for the rest of the season we gathered in all but six or eight tons for fodder.

THE DELTA STATION.

The new Station at Delta was located by the special committee appointed at your last meeting, and a warranty deed for the same is now on file. Ten acres of land have been plowed. This land is ready for the planting of trees.

SUMMARY.

The expenses of the several stations, the

amount expended for permanent improvements, and the value of products grown the past season are given below:

ARKANSAS VALLEY STATION.

Expenditures	$2,547.27
Permanent improvements	143.27
Value of products	2,719.34

Should we deduct the cost of permanent improvements from the expenses for the year we have a balance in favor of the Station of $684.66.

SAN LUIS VALLEY STATION.

Expenditures	$1,256.72
Permanent improvements	52.70
Value of products	443.20

After deducting cost of permanent improvements from the expenditures there is a balance of $760.80 against the Station.

DIVIDE STATION.

Expenditures	$532.39
Permanent improvements	98.54
Value of products	611.80

Deducting cost of permanent improvements from the expenditures we have a balance in favor of the Station of $177.95.

Your committee visited all the Stations except the Rain-Belt Station, in the month of August last, and are satisfied that all are being conducted in a creditable manner, and that results are being worked out that will prove of great value to the people of the State.

All of which is respectfully submitted.

J. S. McCLELLAND,
ALSTON ELLIS,
A. L. EMIGH,
JOHN J. RYAN,
A. L. KELLOG,
Executive Committee of The State Board of Agriculture.

Fort Collins, Colo., Dec. 12, 1894.

REPORT OF

THE AGRICULTURAL SECTION.

To the Executive Committee of The State Board of Agriculture:

GENTLEMEN—I have the honor to present the the following report of the Agricultural Section:

The scheme of work adopted by the Station Council for this Section contemplated effort in two general lines.

First: The raising of many different kinds of forage crops, several of them on an extended scale.

Second: The feeding of these crops to cows, steers, sheep, and hogs.

The largest fields were of course devoted to the standard crops. Of the cereal grains, there were raised nine varieties of wheat, eleven of oats, four of barley, and two of rye; also half-acre plots of several mixtuers of peas, vetches, oats, and barley and several acres of mixtures of grasses, clovers, and cereals. It can be said in general that all the crops grown separately were successful and that, in every mixture, some of the mixed crops were a failure. A more detailed account of these and other results of the summer's crops is reserved for a future bulletin on the experimental work of 1894.

It is desirable that a forage crop be found that will grow in Colorado as vigorously as alfalfa and still not produce bloat, so that it can safely be pastured with cattle and sheep. With this end in view, seeds were imported from France of nearly one hundred varieties of forage and grain crops. These were each sown separately in the spring for summer growth and such as seemed hardy have been again sown in the fall. While it cannot be said that any of them is as successful as would be desired, yet several of them show so much promise as to merit further and more extended trial.

Twenty-three varieties of corn were raised on one-eighth acre plots. Elaborate experiments were undertaken to determine the best time to harvest the corn plant and to compare the different methods of curing or preserving it. Much work was also started toward a comprehensive study of the growth of the alfalfa plant, the losses in curing and the methods of preventing these losses, the relative advantages of cutting three and four times, the composition of the different cuttings with reference to their adaptability for feeding to different classes of stock, methods of handling and preserving alfalfa, also the composition and feeding value of several of the new French fodders. The field work in all of these tests was carried through successfully—crops raised, harvested, weighed, and sampled. The chemical analyses of these samples, on which the value of the whole work depends, are now well under way.

The second part of the season's work, the feeding out of the crops, has but just begun. For these

experiments there are now on the farm, eighty sheep, twelve steers, thirty pigs, and eight cows.

The sheep comprise twenty head each of Western lambs, Western yearlings, Mexican lambs, and Mexican yearlings, as these are the four classes of sheep that are being fed by the thousand in this vicinity this winter. We are making a comparative test of these four classes and also a test of feeding alfalfa alone, alfalfa and corn, alfalfa and wheat, and alfalfa and sugar beets. These tests are to continue until April or May.

The experimental feeding of the steers is designed to show the relative merits of feeding on whole alfalfa as compared with chopped alfalfa, alfalfa and wheat, alfalfa and fodder corn, alfalfa and ensilage, and alfalfa and sugar beets.

The feeding of pigs has been carried on continuously for the past year. Last winter most of the work was devoted to determine the comparative value of corn and wheat as food for hogs. While corn gave the better results, wheat did so well as to show conclusively that it has high value as a pig food. In the early part of the summer, some of the pigs were allowed to run on alfalfa pasture, while the rest were kept in small yards and fed green alfalfa freshly cut. Both lots did well, those in the pens fully as well as those outside. All the pigs were then put on alfalfa pasture with nothing else. During the three months of the test they gained fifty pounds each, with but slight diminution of the hay crop from the field on which they were pastured. At five cents a pound for the increase in live weight, the alfalfa they ate brought not less than seven dollars a ton. The four breeding sows spent their whole summer on alfalfa pasture with

nothing additional. They kept in excellent condition and brought us some nice litters of pigs. These sows and their pigs have for the last six weeks lived principally on sugar beets, eating about thirty pounds of beets, per litter, per day. The young pigs are making a good growth and keeping in fine shape.

Experiments are now under way in the use of ensilage as part of the ration of stock of various kinds. While it is not expected that it will prove as advantageous with other stock as it has with cows, it is nevertheless desirable that definite facts be learned as to its proper place in Colorado stock-feeding.

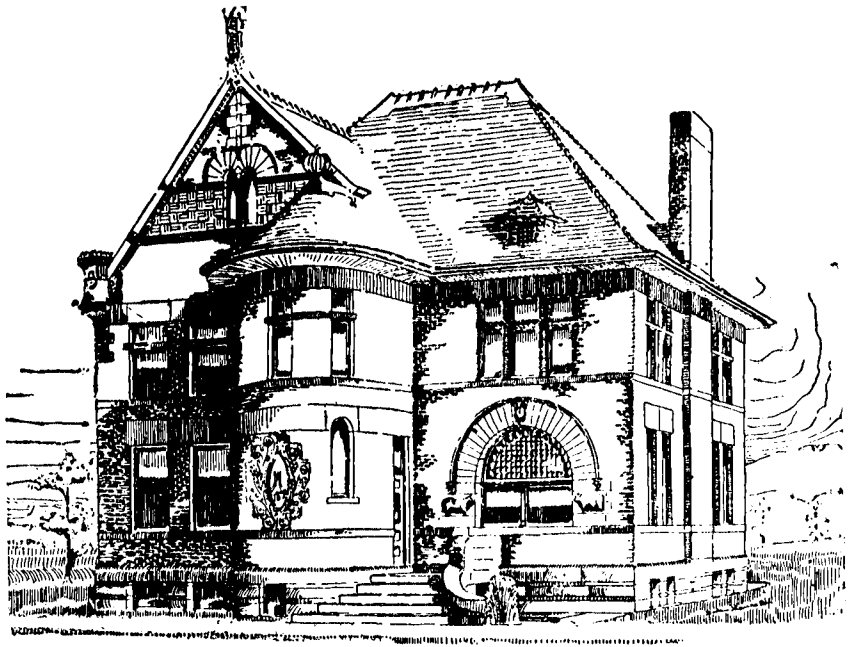
Stock-feeding is becoming one of the great industries of this part of the State and the feeders naturally look to the Station for information concerning its various problems.

Respectfully submitted,

W. W. COOKE,

Agriculturist.

Fort Collins, Colorado, November 30, 1894.



AGRICULTURAL HALL.

REPORT OF THE SECTION OF

BOTANY AND HORTICULTURE.

To the Executive Committee of The State Board of Agriculture.

GENTLEMEN—I have the honor to submit the following report of the Section of Botany and Horticulture as scheduled for the past season The main features of the garden work have been the starting of a nursery test of varieties of orchard fruits and the testing of new varieties of garden vegetables. For the nursery test we secured scions representing 157 varieties of apples, 33 varieties of plums, and 11 varieties of pears. These were root-grafted during last winter; the number of each variety varying according to the scions at hand from 10 to 100. The grafts were planted in two blocks, one on the high gravelly loam of the west portion of the garden, the other on the low black loam lying under the town ditch. The percentage of grafts starting was large, but varietal differences were early apparent. With some varieties every graft lived and made strong growth during the season; others were weak from the start, and some died out entirely. This was no more than was expected among so many varieties. The

stand obtained and the growth of the trees were better upon the high land than upon the low.

Our count made in November, excluding all of poor, weak growth, shows 5,145 apple, 80 plum, and 150 pear trees all of which appear to enter the winter in good condition. The adaptability of the varieties will in some measure be determined by the starting of growth in the spring. The 500 plum trees, representing 57 varieties, which were obtained from the East Shore Nurseries of J. W. Kerr have nearly all lived and most of them have made a fair growth.

Scions of 30 varieties of apples, 2 of plums, and 4 of pears have been obtained for grafting the present winter. I hope to make additions to this list before grafting season is over.

The notes for the season on Strawberries and Grapes have been written up by Mr. Huffington for a bulletin which is now ready for publication. The notes on garden vegetables are being arranged and will be ready in bulletin form at an early day.

A few additions to our plantation of small fruits were made last spring. I desire to make further additions the coming spring; increasing the number of varieties, and the number of plants of each variety in order to make the block more representative, and to afford a better basis on which to form a judgment of the varieties.

Ever since this Station was established the testing of garden vegetables has been a prominent feature of the work. From my experience I incline to the opinion that the Section will serve its purpose better by devoting less attention to this branch, and by confining our efforts more to the testing of fruits. It seems also advisable that some work be

undertaken in the line of Forestry. This latter subject is the basis of many letters of inquiry which show a lively interest in trees and shrubs and I believe that good would result from work in this direction.

In pursuance of my work upon the *flora* of the State, two trips were made during the summer vacation. The first trip occupied about thirty days and covered a route through North Park by way of Cameron Pass, across the Continental Divide by Muddy Pass, down the Bear River to Steamboat Springs and then to the Elk River some twenty miles northwest from Steamboat Springs. The return was by the same route. The collection obtained was large and representative of the country traversed. The task of determining and arranging the collection has just commenced, but I hope to push it to a completion during the winter. The second trip in company with Hon. J. L. Chatfield occupied two weeks, during which we collected in Gypsum Canon and across the White River Plateau to Trappers Lake where we remained four days. This region is in many respects different from any before visited, and the addition made to the collection is a large one. Owing to the difficulty of transporting by pack animal, only specimens of new and rare plants were collected, but lists with locality notes were made of all the familiar species.

It is my purpose to proceed with the arrangement of the material now in hand, as time can be spared for the work, and to bring it in shape for publication as soon as possible. I have not yet succeeded in completing the literature of the State flora, but am continuing my efforts in that direction.

Two collections of Colorado plants are offered for sale. One of these collections was made mainly in the southwestern region, the other in the South Park region. As I have done no work in these portions of the State I am very desirous that these collections be purchased to add to our herbarium. The cost of the two would be about $150.00 and they would be of great value to the work I have in hand.

Our list of Colorado weeds with accompanying notes I hope to present as a bulletin early in the new year. It has not been prepared earlier because my time seemed demanded in other directions.

The invasion of the "Russian Thistle," being deemed of great importance to the State, has received attention, and a bulletin treating of it has been issued; the bulletin was somewhat hastily prepared under press of other work and I was not able personally to inspect all the infested regions. Two trips were made to La Salle and one to Denver. From letters received I believe my effort will have some influence in inciting action against the weed.

Early in the year I sent to the National Herbarium at Washington about 500 specimens of plants from our duplicate collection; in exchange we this fall received from Chief Botanist F. V. Coville two lots containing 783 specimens. These plants come from various portions of the country; they have been mounted and distributed in the herbarium and form a valuable addition to our collection. I hope to make further exchanges in the future. Less trouble was experienced this year in regard to the water supply than in the two

preceding seasons; our only difficulty was on the land depending upon the No. 2 ditch. The plum trees were planted April 19 and the grafts immediately after. Water from the ditch was not available until May 11, and in the interval we were obliged to haul water for the young trees. Water was turned out of the ditch about August 1st, but owing to seasonable rains the trees did not suffer. I hoped for a late run to wet the ground for winter but did not secure it.

Respectfully submitted,

C. S. CRANDALL,

Botanist and Horticulturist.

Fort Collins, Colorado, November 30th, 1894.

REPORT OF THE SECTION OF

Meteorology and Irrigation Engineering.

To the Executive Committee of The State Board of Agriculture:

GENTLEMEN—The following is a report of the operations of this Section for the past year:

The plan of work has been essentially the same as for the past six years, the questions under investigation being such as require a series of years for their determination. More than that, in the case of meteorological questions, and in the case of many of those pertaining to irrigation, the collection of data has been one of the first things to accomplish, and as the labor of observation has not been materially increased by taking observations other than those pertaining to the questions under immediate investigation, we have taken more observations, not expecting that they would be immediately available, but would be of value as enough accumulated to make the examination of the data furnished by them desirable.

The lines of work have been the same as in the previous year. The outline has given the ques-

tions under investigation. It was not expected to secure data sufficient to furnish reports on each of the questions at this time.

The investigation on the Duty of Water the past year has furnished additional data, and, taken in connection with the record for 1893, now gives us the record of two unusually dry years. The records have been made as hitherto with self-recording instruments, which have been placed at the head of one of the largest canals, measuring the amount of water used on about 24,000 acres of land. An instrument has been placed so as to determine the total amount of water which has come into the valley; other instruments have been placed on farms of individuals. The records have been better this year than hitherto, except for the disturbance introduced by the more prevalent use of reservoirs. The instruments have required a weekly drive of about 75 miles, which continued throughout the irrigation season. One instrument is still out. The reduction of the records is in a forward state. With each weekly record we determine from the sheet the number of hours and minutes at which the water was at a constant height. When changing in height, by making these intervals sufficiently short the error introduced is small. From this the number of cubic feet is found. The question of the amount of water used in irrigation is one of considerable importance, and involves a number of collateral questions which we have not fully investigated as yet.

The seepage waters of the Poudre Valley have been again measured. Two measurements were made during the year, in one of which we were assisted by Water Commissioner Tenney.

It has been my hope to determine the increase due to the return waters at a time when the river was high. No determination has been made at this time, though we have measured it early in the spring and late in the fall. The quantity of water and the necessity to have a portable apparatus have made the question somewhat difficult. This season we procured a set of pontoons for the purpose. They were received after the river had passed its highest stage, but in time to make the attempt with the river carrying several thousand second-feet. The attempt was made at the exit of the canon which was found to be not without danger. Before the difficulties were overcome the river had decreased so much as to make it too late for this season.

The Poudre valley has been the most easily accessible and the one which could be in consequence the most easily investigated. It is, besides, a typical valley. It is desirable, before making a report on this subject, to examine other valleys, as those of Clear Creek, Boulder Creek, and others, which may be done at slight expense.

The question has some aspects besides the interest which attaches to it as giving some indication as to the irrigation possibilities of our water supply, which relate to possibly inter-state complications. In consequence, after the season was partly completed, I carried on, with your consent, the investigation of the seepage water of the Platte river, extending it to the State line. It was at a time when I was not able to go myself. Mr. Trimble was sent, and he was aided by Mr. Preston, a graduate of this College, sent from the State Engineer's office. I prepared written instructions for

the trip, and also sent a camera for obtaining record of the features of certain points to be observed.

The Platte valley being sparsely settled, has stretches under irrigation, and some streches without irrigation. By properly locating the points of observation, the measurements serve to throw some light upon the origin of the seepage.

In addition to these measurements, observations have been continued on a lateral four miles in length to determine the loss by seepage in this distance. We have placed two weirs with the ditch between, and have placed two of the self-recording instruments which have kept record of the amount of water passing each. As there is no outlet to the lateral between the two weirs, the loss is due to seepage and evaporation. We now have several years' records of similar character, but have not been able to give them the detailed study desired. In connection with this record, we also have a record of the crops to which this has been applied, in connection with the duty of water.

While testing some of the instruments before putting them in service in the spring, we obtained the record of the rise and fall of the water in a well on the farm which is located about 200 feet from the Arthur ditch. The facts revealed there were so interesting that a daily measurement of the height of water in the well has been made. It shows a close correspondence between the height of water in the well and the stage of water in the canal.

By the co-operation of the ditches of the valley we have been able to make a test of the electrical recording of the height of water at a distance.

There are many places in the State where the possession of the knowledge of the stage of water at some distance away would enable a more economical use of the water, by allowing the distribution into the ditches to be much more close. No attempts have hitherto been made, so far as I know, except for short distances, in no case with which I am acquainted above a mile. In this case the distance to the weir where we have placed the transmitter is nearly 12 miles. The associated ditches already had a telephone line the greater part of the way. They continued the line of poles for the extra miles, and strung an extra wire for the whole distance, bringing the wire into my office, and also placing a telephone in the office. The trial has been a modified success. The record has been interfered with by the wires being down and by the crossing of the transmitter wire with the telephone wire. These interferences occured after winds and sometimes when other duties prevented us from making an examination of the line. In this work Water Commissioner Tenney took an active interest. The trouble would be prevented with a line securely constructed. When the line was in good condition the record was perfect, except from thunder-storms, which caused less trouble by induced currents than was anticipated.

The observations of evaporation have been continued; we now have six years' records. Measurements are made twice daily during the summer season; once daily in the autumn months until the tank freezes. After that the reading of the height of the water surface is made monthly.

With all our observations, we now have the records of six years, and twelve years of rainfall.

The past year has furnished good records of the actinometer.

The funds available were not sufficient to do as much as hoped toward the investigation of the water supply of the plains. Some data have been collected by correspondence and by the sending out of several circulars.

With several of the above lines of investigation, we now have sufficient data to warrant their publication. Their preparation is mostly a question of finding time among other duties to devote to it. For the satisfactory prosecution of such work it is desirable to be able to devote some time which can be free from interruption of other questions.

In all the work of the section, Mr. R. E. Trimble has given faithful and constant service. The daily observations have fallen almost entirely upon him. His has been most of the labor of reduction.

Thanking you for the support given the work of the Section, this report is

Respectfully submitted,

L. G. CARPENTER,

Meterologist and Irrigation Engineer.

Fort Collins, Colorado, November 30, 1894.

REPORT OF

THE ENTOMOLOGICAL SECTION.

To the Executive Committee of The State Board of Agriculture:

GENTLEMEN—I have the honor to submit herewith the annual report of the Entomological Section of the Experiment Station for the year 1894.

INSECT PESTS OF THE YEAR.

There has not been, to my knowledge, any unusual outbreak of injurious insects within the State the past year, but a number of common pests that are always present occasioned severe losses to the crops that they attacked. Among the most prominent of these are: The Leaf-rollers of fruit and box-elder trees (*Cacoecia argyrospila and C. semiferana*), the Spotted Bean-beetle (*Epilachna corrupta*), the White Cabbage Butterfly (*Pieris rapæ*), the Cabbage Plant Louse (*Aphis brassicæ*), the Squash Bug (*Anasa tristis*), Grasshoppers (several species), and the Clover Mite (*Bryobia pratensis*).

LEAF-ROLLERS—The two leaf-rollers above mentioned were very abundant the past summer; the former on all kinds of fruit trees and the latter on the box-elders. These pests have been gradually increasing in numbers for several years and the

past summer a large proportion of the fruit and box-elder trees in the northern portion of the State were completely defoliated by them in the latter part of June.

A long series of experiments with various insecticide substances were conducted for the purpose of finding the best methods of destroying these pests. The report of these experiments will be reserved for a future bulletin, but some of the results may be properly mentioned here.

Ordinary applications of Paris green or London purple may be entirely ineffectual in destroying the worms or preventing their work of devastation.

The easiest and most effectual methods of keeping these pests in check is probably through the destruction of the eggs which may be accomplished, while the leaves are off the trees, through the application of a strong kerosene emulsion to the trunks and large limbs.

These pests will undoubtedly appear in large numbers again next year as examination shows that very many eggs have been deposited on the trees.

Grasshoppers were little complained of the past summer, largely from the fact that in those parts of the State where they are most abundant the people have learned to keep them in check by the use of poisoned baits and hopper-pans.

The Woolly Aphis of the apple tree I have found to be an almost universal pest in the orchards of the State but, in most of these, it seems not to have done very serious harm. Our more progressive fruit-growers are keeping this pest subjection by the timely and thorough use of kerosene emulsion or tobacco decoction.

The Cabbage Louse has been severely complained of by the market gardeners of the State and it is certainly one of our most difficult pests to contend with. Probably a rotation of the crop underand forcibly spraying with hot water or hot kerosene emulsion are the best remedies.

A TRIP ACROSS THE RANGE TO INVESTIGATE INSECT INJURIES.

Many inquiries have reached this office concerning insect injuries in the orchards of the Western Slope where, in the past, the grasshoppers were about the only known pests. Last summer urgent requests came from Mr. C. E. Mitchell, of Grand Junction, for me to go to that place to investigate what seemed to be insect injuries to sugar beets. I made the trip the latter part of August. Stops were made at Leadville, Glenwood Springs, Grand Junction, Fruita, Delta, Canon City, and Denver. At the first two stations named collections were made to add to our list of Colorado *Hemiptera*.

Several days were spent about Grand Junction and Fruita investigating insect injuries to orchards and sugar beets. In this work I was much aided by Mr. C. E. Mitchell, Mr. C. W. Steele, and Mr. H. C. Long, of Grand Junction.

Upon sugar beets the most abundant insect was a small leaf-hopper (*Gnathodus abdominalis* Van D.*). Two other leaf-hoppers (*Agallia uhleri* Say and *Platymetopius* acutus Van D.*), were also present on the beets in small numbers. None of these were numerous enough to do serious harm to the beets.

The only other insect that was sufficiently abundant on the beets to be worthy of mention was

a "Mealy Bug" (*Dactylopius solani?* Ckll.†), infesting the crowns of the plants. In only a few cases was this insect abundant enough to do perceptible harm. I can see no reason to suspect that injurious insects are likely soon to become a serious hindrance to the sugar-beet industry in the vicinity of Grand Junction.

The Codling Moth, which is a comparatively new pest about Fruita and Grand Junction, was found present in all the apple orchards visited and, in some cases where spraying had not been attended to, wormy apples were abundant. Unless the law requiring the spraying of apple orchards is strictly enforced, the orchards in this locality will soon be as badly overrun by this pest as any in the country.

At Delta, wormy apples are of rare occurrence as yet but a few were found, proving that this insect has worked its way there also. In a few years it will be no uncommon pest with the fruit-growers of that locality. It is, probably, useless to attempt to stamp out this pest, but prompt measures should be taken to keep it within reasonable bounds. About Canon City and Denver the Codling Moth is an old pest and is as abundant as in the East.

The Clover Mite (*Bryobia pratensis**), is one of the worst orchard pests observed on the trip. In the vicinity of Fruita, Grand Junction, Delta, and Canon City it was especially abundant and was also found in an orchard near Denver.

The attack seemed to be confined to pear, apple, plum, and cherry trees, the severity of the attack being in the order above named. On pear trees the pest was almost universally present and

* Determined by E. P. Van Duzee.

† Determined by T. D. A. Cockerell.

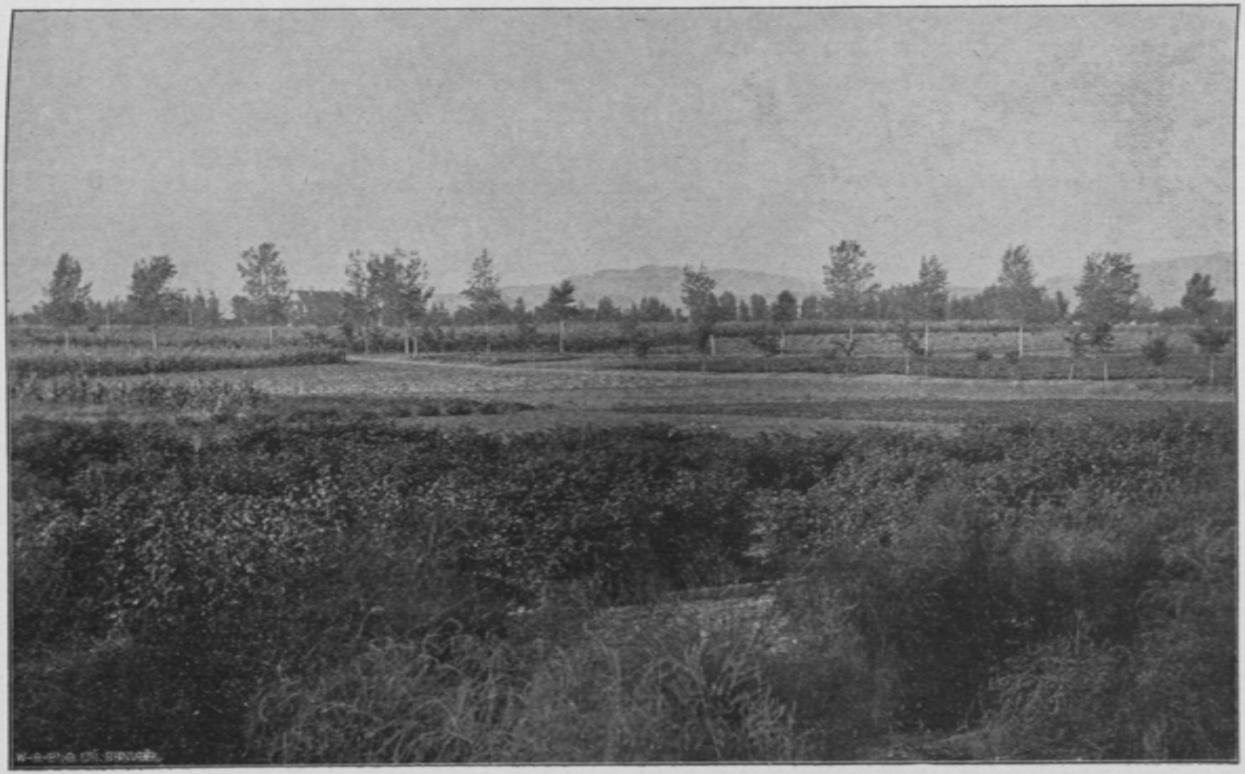
dead plum trees, said to have been killed by it, were pointed out to me.

The mites accumulate along the under side of the limbs, in the axils of the small twigs and in scars on the trunks. The mites are just large enough to be plainly visible to the unaided eye when moving about and are readily mistaken for Red Spiders. When accumulated on the bark, they give it a rusty-brown appearance. The egg-patches are of a rusty-red color. The empty egg shells and the cast skins of the growing mites are whitish in color and give a grayish cast to the bark where they are attached. Often the whole under-side of small limbs was rusty or gray in color due to the accumulations of the mites or their exuviæ. Badly infested trees could be readily distinguished from the others when some distance away by the blanched and sickly appearance of the foliage though it was rare, even on the worst infested trees, that mites could be found on the leaves.

I had no opportunity to try any remedies against this pest but should expect that a strong kerosene emulsion or one of the rosin mixtures used against scale insects would free the trees of these mites.

A Scale Insect, possibly the San Jose Scale but more probably another species, had appeared in considerable numbers in one small pear orchard near Fruita but the trees had been so thoroughly treated by the local Inspector, Mr. H. C. Long, that only dead scales could be found.

The Woolly Aphis (*Schizoneura venigera*), was found in small numbers in several orchards but seemed nowhere to be doing serious harm, west of the Range.



GENERAL VIEW, COLLEGE FARM, FORT COLLINS, COLORADO

At Canon City the orchards are older and most of the common orchard pests of the eastern states are present. A small leaf-hopper (*Typhlocyba comes* Say), was found enormously abundant in some places upon plum trees, causing the blanching of the foliage. The same insect was found, but less abundantly, on plum trees near Denver.

A New Scale Insect (*Aspidiotus hazardii* Ckll. MSS.*), was found occuring occasionally upon the fruit of plum and pear trees at Canon City. The scale is whitish and not larger than the head of a pin. In one case it was found quite plentiful on the fruit of a native plum tree. This insect is closely related to the terribly destructive San Jose Scale and should be closely watched. If it increases rapidly in numbers, prompt and vigorous measures should be taken for its destruction.

THE APIARY.

The experiments in the apiary have been such as indicated in the schedule for the year's work. A detailed report upon this work will appear later in bulletin form. Some of the conclusions that seem fairly well proved are given below.

The following dry foods as substitutes for pollen were repeatedly offered to the bees: oats finely ground, corn meal, whole-wheat meal, bran ground fine, coarse bran, dust from cleaners, fine wheat flour, oil-cake meal, rye meal, pea meal, bean meal, and barley meal. The foods are given in the order of preference as nearly as possible. Any of the above foods would be taken quite freely when alone but, when all were out at once, oats and corn were most taken and beans and barley least.

* Determined by E. P. Van Duzee.

Bees going to the field for pollen take honey from the hive in their honey stomachs to mix with the pollen to cause it to adhere to their legs. They do not gather loads of honey and pollen on the same trip, but if they return with a partial load of pollen there may be some of the honey taken from the hive left over in the honey stomach. With a full load of pollen the honey stomach is empty and with a full load of honey no pollen is carried.

Honey made from granulated sugar is a true honey and is as well liked by consumers as any, but it cannot be made with profit.

Our bees, wintered on pure granulated sugar honey (without pollen), have not done so well as those that have had natural stores.

A LIST OF COLORADO HEMIPTERA.

The work of making a list of the Hemiptera of the State has been continued during the year. If nothing prevents it will soon be presented for publication.

Very respectfully submitted,

C. P. GILLETTE,

Entomologist.

Fort Collins, Colorado, November 30, 1894.

REPORT OF

THE CHEMICAL SECTION.

To the Executive Committee of The State Board of Agriculture:

GENTLEMEN—As Station Chemist during the past year I joined in the work of the Association of Official Agricultural Chemists, as my predecessor had done in previous years. This work is profitable in that it keeps us acquainted with the work and the lines of investigation being pursued by the Association; it also gives our Station a livlier official recognition than it would otherwise enjoy. Still I deem it advisable, owing to the amount of work on hand or already planned for the next two years, not to undertake any work outside of the Station work except such as may come from citizens of the State and is deemed of sufficient importance to justify me in doing it.

The Station work on hand is more than I have had at any previous time since I assumed charge of it. My Assistant, Mr. Ryan, deserves the highest praise for his industry, perseverance and willingness; and though he is quite skilled and expeditious in the class of work we have to do, I foresee very plainly that we can not do the work which

will suggest itself—in fact has already suggested itself—and which ought to receive prompt consideration.

I am not to be understood as making any prediction as to the usefulness of the results, but the character of the work which I have in mind would certainly commend itself to the people of this State and would probably be of interest to the people at large. One such question is the composition of our river waters used in irrigation, also of seepage water. Such a study alone would involve much work and consume a great deal of time. Again, the Farm Department has no other way of obtaining certain facts than by submitting the samples to us for analysis. I recognize the fact that we are co-ordinate with this Department and am willing to do all I can in order to add value to, or extend the scope of, its experiments. This, however, very materially increases the amount of Station work. We are at present compelled to leave work undone and to request the Farm Department to curtail its demands upon us because of lack of time to do the work.

The bulletin work which we have undertaken and which we hoped to have completed by the first of the year is progressing as rapidly as our other duties permit. We hope to have it finished within a reasonable time, though there is still much to be done on it.

The Board of Trustees saw fit to delegate me to represent the Experiment Station at the meeting of the Association of Agricultural Colleges and Experiment Stations, held at Washington, D. C., Nov. 13–16 inclusive. I do not understand that it is expected that I shall give even a complete out-

line of the work of the Association. This would be impossible as some interesting discussions were had at the sessions of the various divisions which met at the same time but at different places.

Mr. Emigh and I arranged to attend the meetings of different sections in order to learn as much as possible of their work.

The discussions of the Association touched on several important points, particularly in connection with the administration of the various college funds. The accounting of the funds to the U. S. Department of Agriculture, as suggested by the present Secretary of Agriculture, received the unanimous approval of the Association.

The question of the legality of the expenditures made by the various boards in sending delegates to the meetings of the Association and otherwise in maintaining their membership therein was reported as having been passed upon by both the Treasury Department and the Department of Agriculture with entire and affirmative agreement.

Another point of much interest to some of the institutions represented was the illegality of the use of the funds derived from the Morrill Act for the support of schools, wholly or in part, which do not maintain a college standard in studies and scholarship. During this discussion, to which the Association returned several times, it was asserted that it was not the intent of the Morrill Bill to establish or support distinctively agricultural colleges, but institutions at which instruction higher than that provided by the present system of public and high-schools should be given. It was also stated that this is Senator Morrill's own interpretation of the bill, i. e., to provide the means of giv-

ing to all, to the poorer and humbler, as well as to the well-to-do, a higher mental training and to open to them the avenues to a broader scholarship than it is the province of the high school to give, because it lies beyond it. This question led to a rediscussion of another that was, Where are we to draw the line between the college and the high school and more particularly between the college and the preparatory school? The judgement of the speakers on this subject was clearly colored by the interests of the school which they represented, but the consensus of opinion was, that the work contemplated was higher than, and was a continuation of, that done in the high-school or the preparatory school.

From the discussions to which I listened it was evident that the interests of three separate classes of schools were advocated—not with definite intention, perhaps, but according to the mental character and bent of the speaker—largely influenced, without doubt, by the course of training which he had himself enjoyed.

Methods of instruction were also discussed at some length. It was evident from the general interest manifested, as well as from the remarks of speakers, that the methods of instruction in agriculture are less satisfactory than in other provinces of study. The whole tendency of the discussion was, that instruction in this branch and its allied branches should be brought into line with, in fact made a part of, our pedagogical system. There was a general and open avowal of the difficulties met in teaching these subjects to the students who most frequently wish to pursue them. It is evidently a question of attaining the desired results

without the expenditure of an incommensurable amount of work. I inferred that the results obtained are quite generally unsatisfactory to the teachers most directly concerned.

The last subject which I shall mention is one pertaining exclusively to the work of the Experiment Stations: it was the consideration of the feasibility of so organizing the stations that unnecessary repetition and duplication of work might be avoided as far as possible and of rendering the stations co-operative to a greater extent than at present. The desirability of such an arrangement seemed to be generally accepted and the question rested there.

In submitting this report no claim is made to even an approach to completeness as to the proceedings of the Association. My object has been to present some points having greater interest for us.

Respectfully submitted,

WM. P. HEADDEN,
Chemist.

Fort Collins, Colorado, November 30, 1894.

REPORT OF THE

Rain-Belt Experiment Station.

To the Executive Committee of The State Board of Agriculture:

GENTLEMEN—I have the honor to submit the following report, for the year 1894, of the Rain-Belt Station situated one-half mile from the town of Cheyenne Wells, Colorado, on the Union Pacific Railway:

This station has one hundred and sixty acres. It was located May 12, 1893. Owing to the delay in getting the title to the land, nothing was done until the following November, when forty acres were broken to a depth of four inches, and the entire quarter-section was inclosed with four strands of barbed wire, fastened to posts one rod apart.

The buildings were erected during the months of March and April, 1894. They consist of one neat four-room cottage, the rooms being quite small, one barn, 24 by 30 feet—capable of holding five head of horses—granary, one sample room, and one large hay mow.

This season has been an unusual one, the scarcity of rain being such as was never known before by the oldest settlers here. The total amount of

rainfall for the entire season, according to the rain gauge of the Station, was six and eighty-four hundreths inches, one-half of which fell on May 30 and July 31.

The entire spring was devoted to preparing the sod, which had been broken, by disking and harrowing.

All seed was received quite late. This was against us. Owing to dry weather nothing germinated until after the heavy rain of May 30.

Wheat—There were three varieties of wheat sown on the 3d of May, one acre of Defiance, one-half acre of No. 16, and one-half acre of No. 10, all of which came up after the rain of May 30th and looked quite promising, but the dry weather which followed injured it so that it could have made but little at best. The grasshoppers made their appearance in vast numbers about July 10th, took the wheat, and injured all other crops.

Oats—Two acres of Excelsior oats were sown April 7th, and one acre of White Russian oats was sown May 2d. This lay in the ground until after the rain before mentioned.

Barley—One acre of California barley and a trial plat of beardless barley were sown May 2d. All gave a good stand and withstood the dry weather beyond expectation. The grasshoppers destroyed the whole.

Flax—One trial plat of flax was taken by grasshoppers while it was in bloom.

Forage—About eight acres of forage was planted, such as Kaffir corn, Milo maize, Jerusalem corn and African millet, on May 12th. All stood the drouth remarkably well. The fodder was cut

September 5th and 6th, just as it was beginning to head, and made when stacked about 450 pounds of dry matter to the acre.

There were three varieties of field corn planted on May 10th and 11th: the Pride of the North, Queen of the Field, and White Australian. All were affected badly by the drouth and grasshoppers. At one time the corn promised nothing, but it revived after the rain of July 31 stand grew from two and one-half to four feet high. A great portion of it formed ears but failed to form whole kernels. It was cut about the middle of September for fodder, and made 440 pounds to the acre when put in stack.

Broom Corn—Four varieties of broom corn were planted with the drill: the Dwarf, the Golden, the Imperial Evergreen, and the New Japanese, about six acres in all. This came up and grew from two to four feet high, but owing to the dry weather when the heads were putting out it failed to make proper brush. It was cut for feed and made about 400 pounds of dry matter to the acre when stacked.

All field crops were harrowed three times and cultivated three times after they came up.

Alfalfa—One trial plat of alfalfa was sown May 14th. It gave a good stand but, owing to the drouth, was nearly dried up when the rain of July 31st revived it. Having no rain since that date it is going into the winter in bad shape.

Bromus inermis—One-half acre, sown in yard May 30th, gave an extremely good stand and looked well to July 10th when the grasshoppers destroyed it. A few other varieties of grass were tried on small plats. Different varieties of garden

seeds were tried but, owing to the unusual season, were a complete failure, except cucumbers and tomatoes which were planted near the hydrant and being occasionally watered gave good results.

Potatoes—Four varieties of potatoes were planted on one-eighth of an acre each, Chicago Market, Negro, Mountain Sprout, and Early Rose. The ground was plowed to a depth of about ten inches. All came up after the rain of May 30th and looked quite promising for a time but came to nought owing to dry weather.

Trees—Fifteen white ash trees were received from the College. All are alive and doing well. I received from the Rocky Mountain Nursery, April 20th, twelve apple trees, four Wealthy, four Duchess of Oldenburg, and four Ben Davis; twelve red currant, and twelve plums; twelve Rocky Mountain cherries; six gooseberries; twelve Cuthbert raspberries and twelve Gregg; and twelve grape vines. These were set out immediately after arrival, were all watered at the time of setting out, and three times since, on the 10th of July, 4th of September, and 10th of November. All are living except four plums and a few of the smaller vines.

I have fenced the trees and the ground about the house, broken two acres upon which to set an orchard the coming spring, and have fall-plowed about eight acres.

Respectfully submitted,

J. B. ROBERTSON,

Superintendent.

Cheyenne Wells, Colorado, November 30, 1894.

REPORT OF THE

DIVIDE EXPERIMENT STATION.

To the Executive Committee of The State Board of Agriculture:

GENTLEMEN—The past season has been favorable for the growing of wheat and oats, but not so much so for the growing of potatoes. Fairly good results have been secured. Up to November 1, 1894, the rainfall was 19.86 inches. For the corresponding period of 1893, it was only 9.87 inches.

Oats—On May 20, Excelsior oats were sown on three acres, divided into half-acre plats, at the rate of 1, 1½, 2, and 2½ bushels per acre on deep plowing; also 1 and 1½ bushels per acre on shallow plowing. All plats were injured by the sand storms of May and June.

Deep plowing,	1	bu.	per	acre,	yielded	32	bu.	per	acre.
"	"	1½	"	"	"	"	41½	"	"	"
"	"	2	"	"	"	"	49½	"	"	"
"	"	2½	"	"	"	"	28½	"	"	"
Shallow	"	1	"	"	"	"	40½	"	"	"
"	"	1½	"	"	"	"	48	"	"	"

Different varieties sown on other plats yielded as follows:

New Zealand,	35	bushels	per acre.
Golden Grant,	43½	"	" "
Silesian,	40	"	" "
Chinese Hulless,	29	"	" "

Oats and Peas—Two acres were sown May 20th. The yield, July 31st, was, on one acre, 2,117 pounds; on the other, 2,722 pounds. A second crop was cut, October 1st, which yielded 405 pounds for the first acre and 512 pounds for the second.

Buckwheat—One plat of Japanese and one of Silver Hull were sown. A poor stand was obtained. The yields, 73 days after germination, were as follows: Japanese, 20½ bushels per acre; Silver Hull, 25½ bushels per acre.

Corn—Two varieties, Red Cob Ensilage and Minnesota King, were planted. The first yielded 6,244 and the second 6,809 pounds of fodder per acre.

Forage Crops and Grasses—The rye sown in 1893, winter killed and it was plowed under. Sandwick was sown June 14th. The stand was thin. At present it covers the ground and is still green. Sand storms in May and June damaged the grass plats. Most of the grasses were killed in the winter. Those that withstood this season best are timothy, red clover, alsike clover, tall meadow oat grass, Italian rye grass, *Bromus inermis*, and large canary grass.

Bromus inermis yielded 3,733 pounds of dry hay per acre. Large canary grass, cut July 31st, yielded 2,334 pounds, per acre, of excellent hay. This hay, being mostly leaves, is well relished by horses.

Hungarian, fox-tail, and broom-corn millet, produced from one ton to one and one-fourth tons per acre.

Alfalfa did not grow more than six inches high and did not stand the severity of the winter. Two miles north of the Station, alfalfa, under irrigation, is successfully grown and two crops per season harvested.

Potatoes—The past season, while more favorable than some former ones, was not the best possible for potato growing. The results obtained

might be termed *avcrage.* Experiments are designed to give something like an intelligent answer to the following questions: 1. What varieties will make the best yield? 2. How to plant to the best advantage? 3. When should the seed be planted?

Results obtained this year indicate that the best seed is the small marketable potato, cut not more than one day before planting.

Varieties.	Planted 3 inches deep on 4 in. plowing.		Planted 3 inches deep on 8 in. plowing		Planted 6 inches deep on 8 in. plowing.		Planted 6 inches deep on 4 in. plowing.		Average yield per acre, early planting.	
	Large.	Small.	Large.	Small.	Large.	Small.	Large.	Small.	Large.	Small.
Rochester Rose	8694	1970	6360	812	6118	622	5081	916	6363	1080
Freeman	4200	864	5997	1261	4822	1469	4027	1503	4761	1274
Pearl of Savoy	6793	1400	6793	1067	4563	933	4857	1088	5751	1114
Chicago Market	4079	345	3991	483	3370	293	2264	483	3301	401
Early Rose	4407	1572	5341	1261	4563	933	2285	1123	4179	1222
People's	7397	1158	8965	829	5997	622	8002	535	7090	786
Empire State	6185	1451	7242	750	6143	659	6464	1123	6789	993
Vick's Perfection	2489	1037	6471	1140	5710	1227	4649	1279	4849	1170
Blue Victor	7207	1019	7198	1312	7894	694	6659	829	6745	963
Late Beauty of Hebron	4701	834	5185	1088	3194	1116	6983	967	7075	1106
Green Mountain	8469	1002	6844	1054	6481	691	5479	829	6818	894
Late Ohio	5337	1137	5270	628	5878	794	5853	654	5579	863
Average yield per acre	5820	1149	6145	972	5257	885	5226	977	5614	93

The following table shows some results from plantings made on May 2, 4, and 5, 1894. The figures given represent pounds:

Varieties.	Planted 3 in. deep on 4 in. plowing, June 4.		Planted 3 in. deep on 8 in. plowing, June 5		Planted 6 in. deep on 8 in. plowing, June 11		Planted 6 in. deep on 4 in. plowing, June 11		Average yield per acre, late planting.	
	Large.	Small.	Large.	Small.	Large.	Small.	Large.	Small.	Large.	Small.
Rochester Rose	8980	2229	9351	1676	7795	561	5582	950	7927	1357
Freeman	7785	1002	7128	1123	6049	569	6758	958	6884	905
Pearl of Savoy	7985	967	8158	1227	6257	1158	5683	1417	7021	1192
Chicago Market	2125	1050	3111	881	....	....	....	....	3120	956
Early Rose	6274	1196	....	....	....	....	....	....	....	....
People's	9544	881	9691	1086	7155	834	6922	777	8078	900
Empire State	7225	1024	7932	1215	7588	1296	7447	1054	7548	1297
Vick's Perfection	6657	1832	6334	1427	5038	890	4692	1002	5077	1287
Blue Victor	8037	1728	7798	1186	6654	743	6196	782	7171	1110
Late Beauty of Hebron	5664	777	4640	1654	4718	1529	2368	1088	4197	1112
Green Mountain	5967	2350	6899	777	....	....	....	....	6438	1563
Late Ohio	7875	596	7043	59	5246	691	3180	446	5331	581
Average yield per acre	6026	1345	7007	1103	6277	848	5425	941	6122	1059

The following table shows some results from plantings made on June 4, 5, and 11, 1894. The figures given represent pounds:

Varieties.	Large per row	Small per row	Large per acre	Small per acre
Rose's Beauty of Hebron	41	14	7,441	2,541
Early Norther	51	14	9,256	2,541
Early Ohio	42	9	7,630	1,633
Green Mountain	41	18	7,441	3,267
Iron Clad	47	12	8,530	2,178
Ohio Junior	40	13	7,269	2,359
Oxford	47	11	8,530	1,996
Polaris	32	8	5,808	1,452
Prize Taker	32	8	5,808	1,452
RedSnowflake	29	5	5,263	907
Salt Lake Rose	37	11	6,715	1,996
Seedling No. 75	57	8	10,345	1,452
Vanguard	61	17	11,071	3,085
Vick's Champion	54	9	9,801	1,633
Winner	60	14	10,890	2,541

The following varieties were tested in rows eighty feet long, seed being cut one eye to the piece and dropped sixteen inches apart in the row, from one pound to three pounds of seed being used. The yield is given in pounds.

A similar test was made with some varieties obtained from Mr. J. B. Swan, Loveland, Colo. The seed used weighed one pound each. Three pounds of seed were used on each row.

Varieties.	Yield in pounds per acre, large.	Yield in pounds per acre, small.
Magnum Bonum	4,556	1,996
Mammoth Pearl Sport	4,712	3,630
Rural New Yorker No. 2	3,993	3,074
Swan's Seedling No. 3	6,452	1,815
Swan's Seedling No. 5	3,630	2,521
Extra Early Vermont	9,255	4,537

Tests were made which go to show that halving or quartering seed produces the best results; that cutting to one eye is somewhat better than using whole potatoes.

On May 22, the following-named new varieties were planted in the manner before stated. The results were as follows:

Varieties.	Yield in pounds per acre, large.	Yield in pounds per acre, small.
Carmen No. 1	7,794	1,544
Early Minnesota	9,456	3,152
Manitoba Rose	4,198	3,395
Maggie Murphy	7,488	1,775
World's Fair	6,511	1,921

The following-named varieties were planted May 9th. The yields are herewith given:

Varieties.	Yield in pounds per acre, large.	Yield in pounds per acre, small.
American Wonder	11,580	812
Delaware	9,472	1,348
Dunmore	9,472	726
Lee's Favorite	7,985	1,002
Mammoth Pearl	9,921	553
Puritan, (late)	6,948	1,469
Plymouth Rock	8,815	569
Prince Ed. Island Rose	8,123	726
Rose Seedling	7,346	2,368
Seedling No. 58	7,363	1,382

Trees—Fifteen apple trees were planted. The varieties known as Whitney No. 20 and Duchess of Oldenburg thrived best. All trees of other varieties, planted prior to the present year, are dead.

Six plum trees, three Weaver, and three Miner, were planted with fair results. Twelve white ash trees were planted. They are in poor condition. The green ash, cottonwood, and box-elder do best in this region.

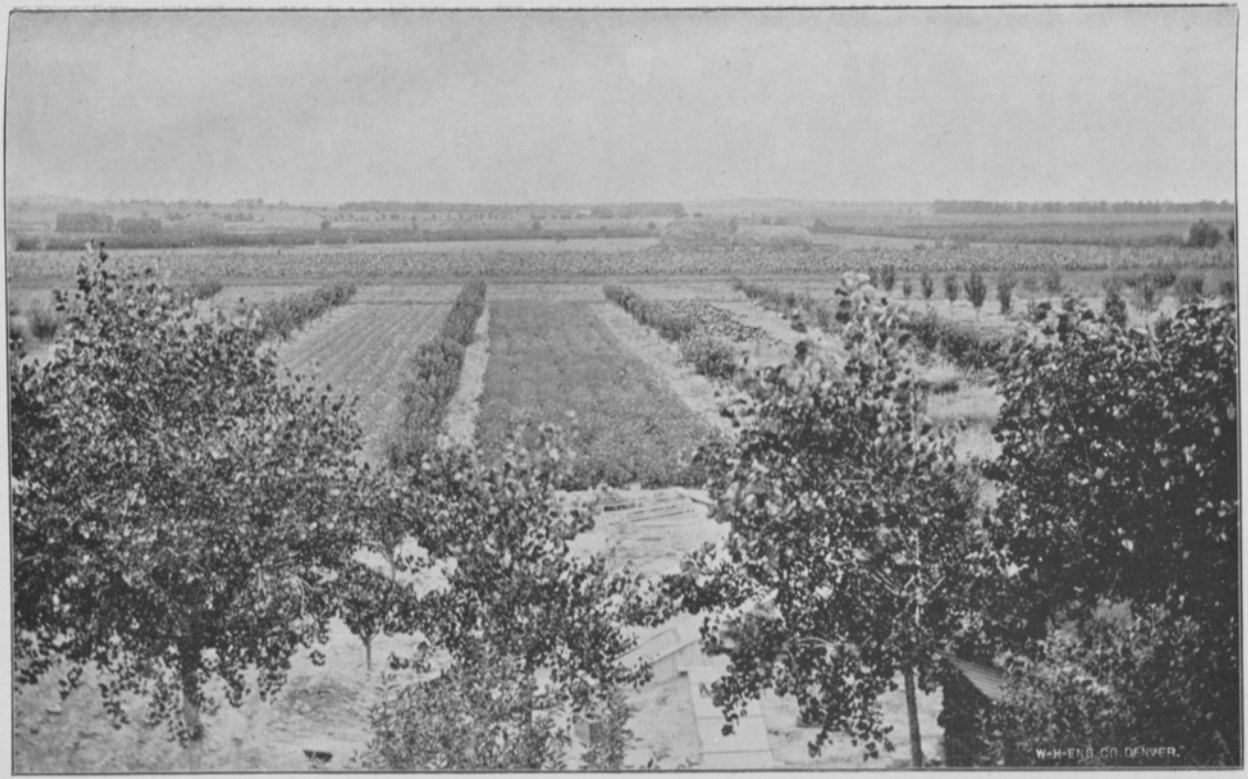
Garden—All garden vegetables did well. The best of these were radishes, turnips, lettuce, peas, carrots, and parsnips. The silver onion ripened at an average weight of one-half pound. Cauliflowers weighing from two to three and one-half pounds were grown. Cabbages weighed from five to thirteen pounds. Excelsior and Fottler's Improved Brunswick giving the heaviest heads.

Respectfully submitted,

J. H. McCLELLAND,

Superintendent.

Monument, Colorado, November 30, 1894.



ARKANSAS VALLEY STATION, ROCKY FORD, COLORADO. ORCHARD AND GARDEN, LOOKING WEST.

REPORT OF THE

San Luis Valley Experiment Station.

To the Executive Committee of The State Board of Agriculture:

GENTLEMEN—I have the honor of submitting the following report of the work done at this Station during the past year:

To those who are not familiar with the conditions of the San Luis Valley, the results will not compare favorably with what is actually accomplished on land located near the Station. In this connection an explanation is necessary to show the cause for the different results.

Owing to the particular formation of the soil and sub-soil the best results are not obtained until the land can be sub-irrigated. Before this can be done the sub-soil, which consists of sand and gravel, must be filled with water until is comes within eighteen inches or a foot of the surface, when enough water will be brought to the top by capillary attraction to supply the demands of vegetation. The advantages of this method are, first, that water can be applied before the seed has germinated, or when the plants are very small, without injury to the crop; second, the soil can be kept at about the same degree of moisture throughout the growing season.

When it is necessary to irrigate the land by flooding before the grain is high enough to shade the ground, the soil bakes, thus retarding the free access of the air to the roots of the plants, which weakens and stunts their growth. The sub-soil is of such a nature that all the surplus water is rapidly drained away while that retained by the soil is soon used up by the plants or evaporated by the winds which prevail at this season of the year. So rapidly does this soil become dry that a crop of wheat or oats will suffer in one week for moisture after being flooded.

The direction of the underflow, or sub-irrigation current, is generally south and east, and on this account it is very difficult to get land to sub-irrigate which has no farms cultivated to the west of it, because the water will benefit the land to the south and east of it more than that on which it is applied. The Experimental Farm, being situated as above described, all attempts thus far to sub-irrigate it have failed.

Last season the conditions were such that it became necessary to flood the crops early in the season. This, together with a very limited supply of water in the middle and latter part of the summer, made the results of the experiments very unsatisfactory.

Wheat—Twenty-nine acres of new breaking were sown with the following varieties: Defiance, Improved Fife, Australian Club, Indian No. 4, Niagara, Canadian Club, and Dakota Blue Stem.

Defiance—The area covered by this plat was twenty acres. It was sown March 26th and 30th and was irrigated, first, May 25th to 27th and, second, June 22d to 25th. No water could be obtained

for the third irrigation although it was badly needed. This not only damaged the crop, but also hastened its maturity, so it was ready for harvest August 15th. The yield per acre was eleven bushels.

Improved Fife—This received the same treatment as the Defiance. It matured August 17th and yielded twelve bushels per acre.

As the other varieties received but one irrigation, no results were obtained.

Oats—All the varieties were treated with sulphate of copper to prevent them from smutting.

White Wonder—The plats containing this variety covered ten and three-fourth acres. Eight and three-fourth acres were old ground which had been plowed the previous fall and the remainder was on potato ground. Those on the potato ground made the best growth and headed out and ripened several days earlier than those on the fall plowing. These oats grew more vigorously and taller than any other variety, but were badly damaged by smut, the number of heads affected being between 25 and 30 per cent. These plats received two irrigations, the first May 22d and 23d and the second June 14th and 15th. Plants on the potato ground matured August 7th and yielded 14 bushels per acre, while those on fall plowing matured August 14th and yielded 11 bushels per acre.

New Zealand—This plat contained one-half acre on fall plowing, and received the same treatment as the White Wonder. It is comparatively free from smut, there being less than three per cent. of the heads affected. It matured August 13th and yielded 14 bushels per acre.

Australian No. 2—This plat was sown on fall plowing and given the same treatment as the New

Zealand, but was badly damaged by smut, there being fully fifty per cent. of the heads destroyed. It matured August 16th and yielded 7 bushels per acre.

Excelsior—This variety received the same treatment as the others, and was not affected by smut. It matured August 20th and yielded 17 bushels per acre.

Lincoln Oat—While this variety was not damaged by smut, it was damaged more, for the want of water, than any other. It matured August 9th and yielded 9 bushels per acre.

American Banner—This is an early oat, but under the conditions grown on the Station, it was the last to mature. It was irrigated but once, and during the latter part of July it was thought to be beyond recovery. During the showers of the last of July and the first of August, it revived and commenced heading. It matured August 29th and yielded 17 bushels per acre. This plat was on new breaking.

Barley—Three varieties were sown on eight acres. None received more than one irrigation. The Success and Scotch barley yielded ten bushels per acre and matured August 3d.

Polish Wheat—This was sown on the 9th of April, on fall plowing, but was very slow in germinating and it was necessary to irrigate it when very small. The effect at first was beneficial, but when the ground baked the growth was stunted and only one or two shoots came from each plant. It was irrigated twice. It matured August 9th and yielded 10 bushels per acre. With the conditions under which it was grown it possesses very little value as a forage crop.

Field Peas—The area sown to field peas was ten acres, part fall the rest spring plowing. The peas sown on the fall plowing germinated better and withstood the drouth longer than those sown on spring plowing.

Peas and Oats--To test the value of peas and oats for fodder, ten acres were sown with seed so mixed that 40 pounds of peas were taken to one bushel of oats. The yield was about 1,000 pounds per acre. The product obtained made an excellent fodder.

Alfalfa—Ten acres were devoted to the experimenting with alfalfa. Another year's growth will show the results of these experiments.

With Nurse Crops—To test the value of nurse crops, one acre was sown with wheat and another with oats. The amount of seed used was 18½ pounds of alfalfa to one bushel of wheat and the same to one and one-fourth bushels of oats. That sown with the wheat made the best growth. Neither made as good growth as that sown without a nurse crop.

Different quantities of seed—Several plats were sown with different amounts of seed varying from fifteen to twenty pounds. So far little or no difference can be detected between the light and heavy seeding.

Fall and spring plowing—To determine the advantage, if any, of fall plowing, one acre was sown on spring plowing, a better stand was obtained on fall plowing while that on the spring plowing made the most vigorous growth. The fall plowing is preferable as the stand on spring plowing is not sufficient to insure a full crop.

Orchard grass with alfalfa—One acre was sown the first of May at the rate of fifteen pounds of alfalfa seed to five of orchard grass. This was sown broadcast, and received the same treatment as the alfalfa sown earlier. At first the prospect for a stand of each was good, but later in the season, when there was no water for irrigation, much of the orchard grass was destroyed by the drouth. The alfalfa was not damaged to such an extent and was easily revived by an irrigation in the latter part of August.

Different seasons of sowing—Small plats were sown at different dates; the 1st of April, May, June, July, August, and September. The plat sown on the first of May gave the best results. On the plat sown April 1st, there is a good stand. It was affected more by the drouth than that sown in May. That sown the 1st of June germinated well and at first promised a good stand but the plants were too tender to stand the long period in which it could not be irrigated. There is a fair stand on the three remaining plats but no definite idea can be formed regarding the results.

Experiments with grasses—All the different varieties sown on small plats, on which no water was turned, were destroyed with the exception of orchard grass and *Bromus inermis*. Only a few plants of either of these varieties survived.

Bromus inermis was sown on the lawn and in this case it received more irrigation than was given to the other plats, as a limited supply of water was furnished the garden. Unless it winter kills, there is an excellent prospect of its forming a sod next season.

Corn and cane for fodder—Small plats of each were planted the 28th of May. The cane did not

do well, and during the whole season it was delicate on account of the cool nights which prevail in the valley. If the results of last season can be relied upon it will not pay as a crop for fodder.

Corn—While corn does not grow so vigorous as in more favored localities, yet on land situated like the Station Farm, where it is difficult to produce other forage crops, it would undoubtedly be one of the best crops to grow for feed.

Potatoes—Although the experiments with potatoes were not satisfactory, they may be of some value in showing results under the conditions of last season.

The large percentage of small potatoes is due to the limited supply of water and the seasons at which we were compelled to irrigate. The time between the first and the second irrigations was of such length that many of the potatoes matured before the second irrigation took place. The effect of this irrigation did not give much growth to the potatoes already formed but caused a large number of new sets to appear. They were irrigated the third time early in September, before the ground had become dry, and most of the marketable potatoes were made from sets produced at the second irrigation.

Of the four varieties planted in the general crop the percentage of small potatoes was as follows: Mammoth Pearl, 25 per cent.; Barclay's Prolific, 45 per cent.; Rose Seedling, 20 per cent.; and Burbank's Seedling, 50 per cent.

The following is the marketable yield per acre in bushels:

Mammoth Pearl	$67\frac{1}{4}$ bushels.
Barclay's Prolific	$39\frac{1}{2}$ "
Rose Seedling	40 "
Burbank's Seedling	38 "

The results of the experiments in fertilizing with barn yard manure are as follows, the variety used in this test being Barclay's Prolific:

	Marketable potatoes.	Small.	Total.
Unfertilized,	39½ bushels	32½ bushels	72 bushels
Fertilized,	48½ "	32 "	80½ "

The results of the variety tests are given in the table below:

Name.	Date of Maturity.	Yield in bushels per acre of marketable potatoes	Yield in bushels per acre of small potatoes.	Total.
Early Northern,	Sept. 10	29½	18	47½
Polaris,	Sept. 20	9½	18	27½
Snow Flake,	Sept. 25	65	15½	80½
Burbank,	Sept. 20	39	33	72
Minister,	Sept. 20	23	25	48
Sterling,	Oct. 1	29½	25	54½
White Sport,	Sept. 20	56	27	83
Yankee Notion	Sept. 20	41	21	62
White Elephant	Oct. 6	52	27½	79½
Seedling 33,	Oct. 1	53	16	69
Seedling 102,	Sept. 15	48	16	64
People's Potato,	Oct. 6	78	16½	94½
Dunmore,	Sept. 15	40	27⅔	67⅔
Strawberry,	Oct. 1	64	18	82
Ohio's Fancy,	Oct. 6	93	27	120
Hoag's Seedling,	Oct. 1	21	43	64
Peach Blow,	Oct. 6	68⅓	26	94⅓
Monroe Seedling,	Sept. 20	62½	19	81½
Barclay's Prolific,	Oct. 1	42½	35	87½
Vick's Perfection,	Sept. 15	55	15	70
Plymouth Rock,	Oct. 6	60	31½	91½
Mammoth Pearl,	Oct. 6	46	46	92
Freeman,	Oct. 1	21½	42½	64
Dandy,	Oct. 1	44	47½	91½
Late Beauty Hebron,	Oct. 1	44	31	75
Negro,	Oct. 6	45⅓	45⅓	90⅔
Rochester Rose,	Oct. 1	62⅔	39⅓	102
North Spy,	Oct. 1	51¼	12¾	64
Early Beauty Hebron	Sept 20	43⅔	51	94⅔
Seedling 58,	Oct. 1	46	29	75
Dictator,	Oct. 1	63	31½	94½
American Wonder,	Oct. 1	53½	36	89½
Rose Seedling,	Sept. 20	76¼	7	83¼
Seedling 36,	Oct. 1	66	16½	82½
Vaughan,	Sept. 25	15½	15½	31
Arizona,	Sept. 20	31⅓	23⅔	55
American Giant,	Oct. 1	34	21	55
Burbank Seedling,	Oct. 6	47	43⅓	90⅓

Garden Vegetables—Peas: Sixteen varieties were planted, all possessing qualities recommending them to the grower. The two varieties giving

the best results, are the Stratagem and Alaska pea. The latter was ready for use three days earlier than any other variety. It can be recommended as an excellent early pea. The Stratagem was not ready for use until eighteen days later, but the quality and quantity produced were superior to any other variety. It was planted May 7th and was ready for use July 18th. It continued to bear until August 31st.

Squash, muskmellons, and watermellons did not mature. Two specimens of Corn-Field pumpkin were ripened.

Tomatoes—New Stone: The plants were taken from the hot-bed and planted in the garden May 25th. It was necessary to cover them at night until June 12th. The tomatoes were attacked by the dry rot when nearly mature and no specimens were ripened until the 31st of August. From this time until the vines were killed by frost only a few specimens were ripened.

Cabbage—Two varieties were transplanted from the hot-bed May 25th. The Early Jersey Wakefield was ready for use August 1st and the Early Winningstadt, August 10th. Nearly all the plants of both varieties formed solid heads.

Trees—The twelve ash sent to this Station last spring arrived in good condition and promised well. Seven of the trees were attacked by an insect which destroyed the leaves shortly after they appeared. The insect was possibly brought in the shape of eggs on the trees as the ash trees growing on the Station grounds, and some of those planted last spring, were not disturbed.

Improvements—The head ditches on the Station land were enlarged and seven check gates placed in them as well as several small gates for turning

water into the laterals. A weir for measuring the water used on the different crops was put in the Station ditch near its head. A new ditch, 294 rods of wire fence, a potato cellar 16 by 20 feet, and a gravel walk in front of the house have been made. The rooms in the house were papered and the inside wood work painted. An Oliver chilled plow and a Shaker potato-digger have been purchased. The sheds near the house have been torn down and rebuilt.

Respectfully submitted,

CHAS. A. DUNCAN,

Superintendent.

Monte Vista, Colorado, November 30, 1894.

REPORT OF THE

Arkansas Valley Experiment Station.

To the Executive Committee of The State Board of Agriculture:

GENTLEMEN—I have the honor to submit herewith the Seventh Annual Report of the Arkansas Valley Experiment Station:

The schedule as approved by your Committee early in the year has been my guide through the season, and it is with pleasure that I am able to report good results from most of the plans set forth therein.

GENERAL CONDITIONS.

The season throughout has been very favorable to agriculture in this portion of the State. But one storm occurred which resulted in any way injuriously to crops; that being a heavy rain the last week in May, doing injury to ditch banks and causing some fields of listed corn to be replanted. The Station weather record shows a precipitation of sixty-hundredths of an inch in April; four and twenty-five hundredths inches in May; seventy-hundredths of an inch in June; one and forty-hundredths inches in July; twenty-five hundredths of an inch in August; and eighty-hundredths of an

inch in September, making a total of eight inches of rainfall for the six months from April to September inclusive.

Insect pests have done no serious injury to crops this season. An abundance of the "Alfalfa Seed Louse" on the early bloom of alfalfa occasioned some anxiety, but its disappearance soon followed without apparent damaging results. The common squash bug proved destructive to early vines, but damaged late plantings but slightly. The most practical method found in dealing with the squash bug here was to take a long-handled stew-pan with about a pint of kerosene oil, and with the pan in one hand and a wooden paddle in the other force the bugs into the oil. Their eggs were also collected from the under side of the leaves and given the same treatment. The large potato bug which has become so prevalent in recent years appeared quite abundant on early plantings but troubled late crops very little. The same method was pursued in the destruction of this insect as in the case of the squash bug; and the efforts proved successful. Cabbage worms injured both early and late crops to about the same extent as in other years. The corn worm likewise became about as numerous as usual.

The water supply for irrigation purposes, though limited at times, has occasioned no loss of crops.

LAND AND SOIL RECORD.

In realization of the importance of a permanent record of plats with respect to crop rotation and supplied fertility, I present herein accurate measurements of the farm and its various divisions, with data such as will prove a reliable guide

in future experimental work. Taking up the east farm, a line starting at the section corner-stone in the center of the public road at the north-west corner, running direct to the stone which marks the north-east corner of the farm, the distance was found to be 2,650 feet. For measurement of the south line, there being no marks of corner intersections, the center of the road on the west was used as a bench mark. A line from this point due east to the corner field post measured 2,640 feet, or ten feet shorter than the north line. Since a considerable offset occurs on the east line in crossing the railroad, it is evident that the east line fence is not where it belongs. Measurements of the north and south line bordering the field on the west, and the north and the south line bordering the field on the east were found to be equal, or each 2,642 feet in length. The fence along south of the railroad bordering the right-of-way, now sets out 86 feet from the center of the track. The changing of this line to a distance of fifty feet from the center of the track, to which position I am informed it belongs, would be a desirable improvement inasmuch as the cultivation of the land would prevent an annual growth of tall weeds bordering that portion of the farm. The triangular field north of the railroad contains 598,687 square feet, or approximately 13 and ¾ acres. Three consecutive corn crops have been raised on this land, including the one of the present season. That portion of the farm south of the railroad is divided into three fields by two fences crossing from east to west. The small field in the north-west corner extends to the railroad right-of-way, and contains 134,104 square feet including the un-

fenced strip, or approximately three acres. During the two years previous to this, the land raised oats and wheat in the order given, and this year rye for pasture. Adjoining the pasture on the south lies the next division of land comprising 992,775 square feet, or approximately 22 and ¾ acres, includes the strip above mentioned adjoining the railroad. This field has been cropped with small grain during the last three years, with the exception of a plat of field corn in 1892, beginning 417 feet south of the north-west section corner, extending 143 feet southward and to the railroad property on the east. A plat of red clover raised this year with wheat now covers an area south adjoining the rye pasture. This comprises 144,250 square feet, or approximately 3 and ⅓ acres. Of the south division of the farm, the division fence line begins 763 feet south of the north-west section corner. Previous to last spring this field comprised two large plats of approximately 55 acres each, the north plat having been in corn and the south plat in alfalfa as at the present time. This year 20 acres of the corn plat on the west end raised a crop of oats and a seeded growth of alfalfa. Immediately on the east bordering the oats, which is the new alfalfa ground, six acres comprised a wheat growing test, and the balance of the field, about 29 acres, was again in corn. The alfalfa 55-acre plat was seeded in the spring of 1891. The southwest corner of the farm cut off by the Rocky Ford ditch was this year cultivated for the first time and raised a crop of corn. The corner piece measured to the center of the ditch includes 67,670 square feet, or approximately 1 and ½ acres. The only fertilizing ever done on this farm was done by means of

feeding the yearly crops of alfalfa by scattering over the alfalfa land and pasturing the corn fodder standing in the field.

A carefully drawn diagram of the west farm, which is now being prepared, will indicate the positions of the numerous plats with a brief history of their cultivation. This will be placed in your hands at a later date. Two years ago a plan of systematic manuring with barnyard manure was begun on the west plat of this farm. It has now extended eastward over a strip twenty rods wide and covering the area between the north line and the Rocky Ford ditch, about nine acres in extent. Twenty wagon loads to the acre was the amount hauled on the land. In 1892 the land raised a crop of winter wheat, and corn the two years following. The five-acre strip immediately west of the orchard was seeded to alfalfa and oats in 1892, raised wheat in 1893, and alfalfa the present season, with the exception of two acres on the south end in wheat and barley.

The balance of the forty-acre tract has been so much divided into small plats during the past two years that it is important to have the detailed records in diagram.

WHEAT CULTURE.

Winter Varieties—Four were in cultivation this year; Turkish, Red Russian, Canadian Velvet Chaff, and Clawson. The location of the three first named, on the east farm, has never been manured. The land was plowed to an average depth of eight inches or more before seeding. All varieties were sown with a press seed drill set to a depth of four inches. All the plats received one spring and two

summer irrigations and were harrowed twice in the spring.

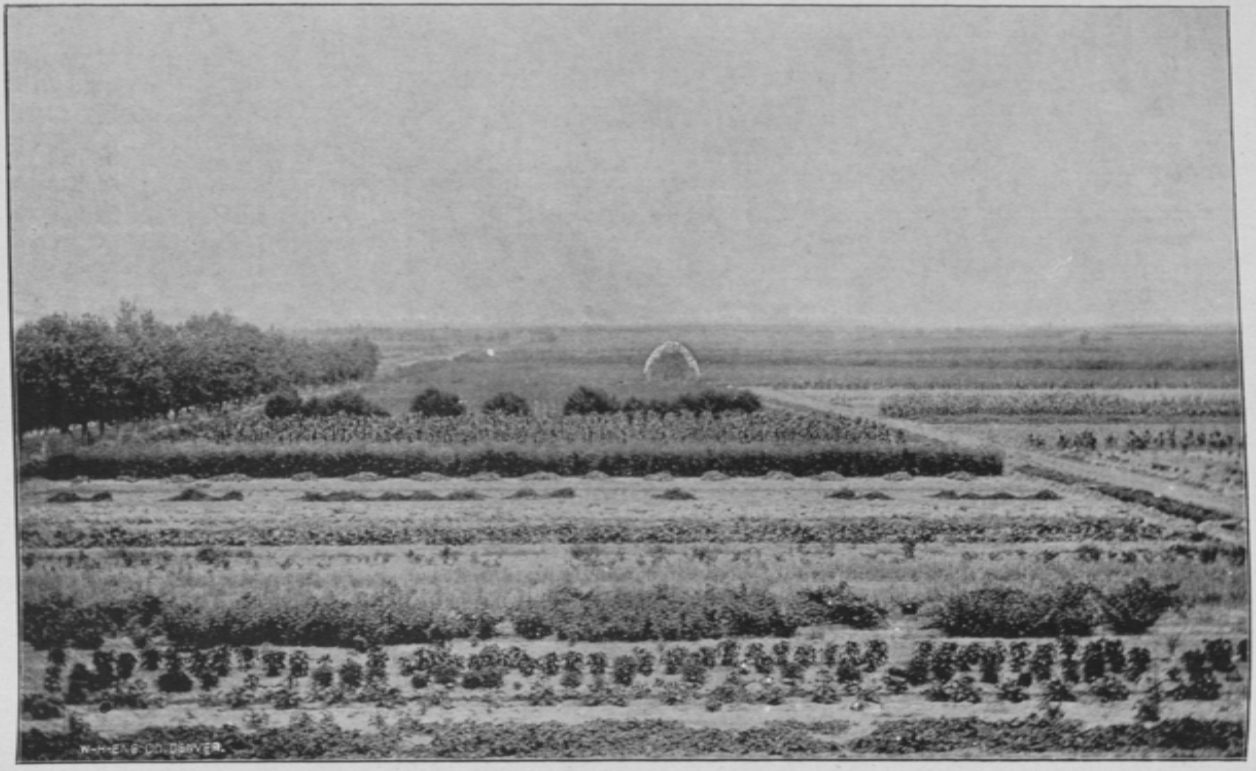
Turkish was sown in moist soil, September 30, 1893. It made good growth before winter. Rate of seed was five pecks to the acre, on eleven acres. The yield in weight, when thrashed September 23d, averaged 30 bushels and 56 pounds per acre.

The Red Russian variety covered an area of four and one-half acres. This was sown September 16, 1893, had the same cultivation and treatment as the foregoing variety, but owing to a scarcity of water for irrigation purposes at the time of seeding not more than fifty per cent. of germination took place. Spring irrigation started the balance of the seed but never to a state of perfect recovery. From this was harvested 19 bushels and 59 pounds per acre.

The seed of Canadian Velvet Chaff was imported by this Station last year from Wisconsin, the quantity being one bushel. After cleaning, and calculating that left in the drill as waste, the amount put upon the land was a very little over three pecks The drill was set to sow two pecks to the acre, the object being to raise as much grain as possible from the limited quantity of seed. This covered a little more than one and three-quarter acres. From this area the yield was 26 bushels and 30 pounds.

A half-acre plat of Clawson wheat on the west Station farm, where crop rotation has been more judiciously followed, produced 17½ bushels under similar conditions of cultivation.

In test of spring varieties sown in the fall, four adjacent quarter-acre plats were prepared and seeded October 12, 1893, to the varieties Australian Club, Sonora, Improved Fife, and Amethyst. Having all established good growth before winter they



ARKANSAS VALLEY STATION, ROCKY FORD, COLORADO. SMALL-PLAT GROUNDS, LOOKING SOUTH.

all looked equally promising. They received uniformly the same treatment in cultivation. The varieties Australian Club and Sonora made vigorous autumn growth the same as the other two varieties but did not survive the winter. The two latter were successful and compared favorably with the winter varieties in both yield and quality.

Spring varieties—In comparative test of three methods of land preparation, a six-acre tract of uniform character was selected on the east farm and subdivided into three plats of equal size. This land was well irrigated before plowing. Plat *number one* was not plowed but received a thorough cultivation with a two-horse corn cultivator. Plat *number two* was plowed to an average depth of about four inches. Plat *number three* was plowed to an average depth of at least eight inches. The seed used was the Amethyst variety, sown with a press drill set to five pecks to the acre. To insure uniformity of seeding the drill was run crosswise of all the plats. Subsequent harrowing and irrigation were likewise done uniformly over three plats. Plat 1 produced 33 bushels and 45 pounds; plat 2, 57 bushels and 10 pounds; plat 3, 63 bushels and 57 pounds. The deeper cultivation supplied the advantages of renewed fertility and increased capillarity for retaining moisture.

The small trial plats of spring wheat grew and produced successfully. The varieties tested were: Golden Drop, Feldspar, Royal No. 34, Algerian No. 2, China, Nox No. 5, Uxbridge, Eldorado, Chili, Gypsum, Ontario, Defiance, India Nos. 2, 4, 5, 11, and 12, and Australian Club.

OAT CULTURE.

The twenty-acre plat of Excelsior oats on old

corn land, to which no fertilizer has ever been supplied, except by cattle pastured to eat the fodder in winter, produced 35,730 pounds, or 55 bushels and 29 pounds per acre. The land received a thorough irrigation in the spring immediately before plowing. The land was plowed to an average depth of eight inches or more. The seed was put in to a depth of four inches with a press drill at the rate of two bushels to the acre. The crop received three thorough irrigations at regular intervals extending to the period of bloom.

Trial plats of Tartarian and Golden Giant varieties proved successful.

BARLEY CULTURE.

An acre of Smooth Hulless barley produced a fairly good crop but owing to the impurity of the seed which contained a large per centage of wheat the test was not completed.

Trial plats of the varieties Guy Malye, Excelsior, and Phoenix were successful. The two first mentioned are hulless and bearded, and the last named is a two rowed hull variety. The barleys invariably produce short straw in this locality, though in the formation of heads and plump grain they do well.

RYE CULTURE.

Three acres sown in autumn last year for pasture furnished good grazing until the first of June. Orchard grass and Bromus inermis sown separately on portions of the pasture made a good start but could not endure tramping by cattle on such a small range.

BUCKWHEAT.

Varieties of the Silverhull and Japanese were sown on wheat land, July 30th, after a crop this

year. Both varieties ripened seed but made short growth of stem. Here was indicated the necessity of sowing buckwheat not later than July 15th in this locality. The crop proved a success but a report on the yield is not ready at this time.

FIELD CORN.

A twenty-acre field of the variety Colorado White on the east farm was planted on the same ground for the third season. No fertility having ever been supplied to the soil, large returns could not be expected. The demand for labor on other crops in the spring necessitated the hiring of help by contract to do the plowing which was not done in a very satisfactory manner. The corn was planted with a check row planter April 24th to 27th. Previous irrigating insured an excellent stand and a vigorous growth. One harrowing after the corn had attained an average height of about six inches and two after cultivations made a reasonably clean field. One irrigation during the latter part of July, through furrows made by a single shovel plow, finished the labors of producing a crop. The crop was gathered in November in a dry and ripe condition. A test made by shelling a given quantity indicated 56 pounds of corn to 70 pounds of ears, and a yield of 33 bushels and 33 pounds per acre.

Listed Corn—Almost eight acres of listed corn adjacent, which has not been gathered up to this date, germinated well and made good promise previous to May 30th when the heavy rains on that date washed the soil over the plants to the destruction of about 50 per cent.

Eight acres on the west farm on manured ground were planted to Golden Beauty field corn

May 23d. The heavy rains following a week later and the bursting of the Rocky Ford ditch banks near by, flooded the crop beyond recovery. When the land became sufficiently dry to replant, the field was again listed, using the Colorado White variety for seed. The field received one harrowing after becoming well started in growth, and one cultivation later. It was irrigated once during the season. The field produced an average yield of 45 bushels and 66 pounds per acre. The season being too short for a finished growth indicated far greater possibilities under more favorable conditions. One man with a team can plant from five to six acres per day with a lister. Eight pounds of seed to the acre was found about the right amount of seed to use. Other trials will be necessary to test the comparative value of listing as against the check-row method.

Trial plats of the Pride of the North and Connecticut Giant Flint were successful in points of yield and quality.

Sweet Corn—The sweet varieties tested were Moore's Early Concord, Country Gentleman, and Stowell's Evergreen. They all proved successful. The two latter ripened at about the same time and both required the full season to mature.

Pop Corn—The small varieties usually suffer more by the attacks of the corn worm than the larger sorts, which fact led to a trial of Queen's Golden, a large yellow kind. This gave a rate yield of 1,817 pounds of ears to the acre on 12,370 square feet.

Fodder Corn—The schedule called for a test of a fodder variety, on a five acre plat, but due to misunderstanding, the seed could not be procured in

time to conduct the test. In its stead the variety Colorado White had to be used, and was planted with lister the 11th of June. The fodder was cut and shocked September 4th, before maturity of the grain. On November 17th, when in an almost perfectly dry state, the average yield per acre was found to be 3 tons and 218 pounds. This received the same kind of cultivation as the other corn and was grown on manured ground.

ALFALFA CULTURE.

A report of the same general character as made last year on the 55-acre field of alfalfa, is given in the following for this season; namely, the yield of each crop, and the cost of labor to put it in stacks. It is well to state that the haying tools of this Station consist of one mower, hay rake and wagon, the loading and stacking being done by hand. The tonage has been determined by means of a rule of measurement in general use in this locality. The width of the stack at the base is added to the average distance over to the ground line. These two measurements are added together to the measurement of the girth. One-fourth of the measurement of the girth is multiplied by itself and this product is multiplied by the length of the stack. The cube of eight feet, which is 512, is taken for a ton, and is used for a divisor of the product of measurements. The following itemized report shows the actual cost of putting up the several crops this year; the tonage by measurement; and the present market value of the product:

First crop harvested May 31 to July 3; second crop, July 23 to August 10; third crop, September 19 to October 10.

Man labor on first crop, 66 days, cost $115.50; team labor on same 34 days, $25.50

Man labor on second crop. 49½ days, cost 86.62: team labor on same 23¾ days, $17.80.

Man labor on third crop. 36½ days, cost $63.87: team labor on same, 19¼ days, $14.43.

Total of three crops 395¼ tons: first crop 168 9-125 tons: second crop 118 81-100 tons: third crop 108 46-125 tons.

Total value of three crops at $3.50 per ton, $1,383.37. Total cost of harvesting three crops $323.72. Net profit $1,059.65.

New Seeding—The twenty-acre field of alfalfa seeded with oats April 9th made an excellent stand and produced more than a half ton to the acre of cured hay in October. By investigation it was found that many of the roots had penetrated to a depth of over nine feet. Seed in the quantity of 18 pounds to the acre was used.

SUGAR BEETS.

The plat selected for sugar-beet culture this year had previously been wheat land where no fertilizer has ever been used, with the exception of plowing under a crop of green buckwheat in 1891. The whole area comprising one acre was subdivided into six smaller plats. The method of preparation was a thorough irrigation in the spring, followed by plowing to an average depth of ten inches, and pulverizing the surface with an ordinary field harrow. The hand drill used, the Mathews, deposited the seed to a depth of about two inches, at the rate of eight pounds to the acre. In due time a good stand came on, and a subsequent thinning to about five inches between plants established most excellent prospects of a crop. During the first hay harvest a scarcity of labor resulted in neglect of cultivation of five of the plats. A growth of weeds nearly took possession for a time, materially reducing the yield of beets as is shown below.

The variety Red Top Sugar, on plat one, had very good cultivation through the season, receiv-

ing two irrigations as did the others. It was hoed and thinned about three weeks earlier than the other plats but received the same amount of cultivation, the superior result being due to timely care. One hoeing and four cultivations with a small single-shovel horse cultivator completed operations to the time of harvesting, Oct. 22 to 24. The rows of this plat were twenty inches apart. Result, 24 tons 308 pounds per acre. The variety Kleinwanzlebener grew on plat number two; rows 18 inches apart; yield 13 tons, 251 pounds per acre. Knauer's Imperial on plat number three, rows 18 inches apart, produced 10 tons, 20 pounds per acre. Dippe's Kleinwanzlebener on plat number four, rows 18 inches apart, produced 10 tons, 506 pounds per acre. Vilmorin's Richest on plat number five, rows 18 inches apart, produced 11 tons, 797 pounds per acre. Imported Mette on plat number six, rows 18 inches apart, produced 16 tons, 860 pounds per acre.

Samples of all the varieties were sent to the United States Chemist at Washington D. C., for analyses, and the following results have been reported:

Variety.	Avge. Wt. ounces.	Sugar, per ct. of beets	Sugar, per ct. in juice	Yield, tons per acre
Red Top Sugar	24.5	15.62	16.44	24.2
Kelin Wanzlebener	27.5	19.00	20.01	13.1
Kauer's Imperial	17.9	17.00	17.90	10 2
Dippe's Klein Wanzlebener	22.5	17.18	18.09	10.25
Vilmorin Richest	23.4	17.50	18.42	11.4
Imported Mette	22.1	17.40	18.32	16.4

POTATO CULTURE.

The area in potatoes of early planting comprised a measured half acre divided about equally into four plats. The varieties used for seed were Empire State, Green Mountain, Vick's Perfection, and Pearl of Savoy. The plat having been in potatoes for five consecutive seasons, including the

present one, has had fertility added each year to more than compensate the requirements of the several crops. For the present crop, however, the land did not receive the usual amount of manuring, six large wagon loads in all having been applied last winter, partially decayed and from the barn yard. Before plowing in the spring the land received a thorough irrigation. The plowing was done to a depth of more than 12 inches. On April 11th the land was laid off in furrows 30 inches apart with a large single shovel plow. A rate of 400 pounds of seed per acre was used, the quartered pieces being dropped about one foot apart in the rows. Covering the seed was done by running the same plow between the rows and harrowing afterwards. A good stand was secured, followed by the three cultivations with a single shovel plow. The plat had one irrigation at the time of blossoming. They were harvested August 16th with the following results. Empire State, rate of yield 184 bushels, 46 pounds per acre. Green mountain, rate of yield, 152 bushels, 18 pounds per acre. Vick's Perfection, rate of yield 211 bushels, 18 pounds per acre. Pearl of Savoy, rate of yield 184 bushels, 46 pounds per acre. The varieties Empire State and Pearl of Savoy averaged good size, and about 70 per cent. of marketable potatoes; Vick's Perfection and Green Mountain averaged only about 50 per cent. of marketable potatoes. The seed of the above four varieties was grown at the Divide Station at Table Rock.

Late potatoes—The balance of the original potato ground contains approximately three quarters of an acre, conditions being supplied for five divi-

sion plat tests with two varieties. In all the tests the same general care, method of plowing and planting, and cultivation and irrigation were observed as with the early plantings, the dates of performing the work excepted, and also methods of fertilizing.

The Mammoth Pearl variety grown on identically the same kind of soil as the early plat, was planted June 8th and harvested October 17th with a rate yield of 244 bushels and 9 pounds to the acre. The seed was produced on this same plat last year, and the product is of good average size.

The Mammoth Prolific variety with like treatment, produced at a rate of 166 bushels and 58 pounds per acre, from seed raised on this farm last year.

Three plats measuring six square rods each were placed in comparative tests as follows: At a rate of about one ton to the spuare rod over two of the plats was spread chaffy alfalfa manure from a cattle feeding yard. On plat "A" the manure was burned to ashes and plowed under. On plat "B" the manure was worked well into the soil two months before planting, and irrigated frequently to hasten decay. Plat "C" was not manured this season, but like the two others adjacent had been well fertilized potato ground during previous seasons. Plat "A" produced at the rate of 309 bushels and 20 pounds per acre. Plat "B" produced at the rate of 338 bushels and 40 pounds per acre. Plat "C" produced at the rate of 186 bushels and 40 pounds per acre. The seed was Mammoth Pearl raised on the same ground last year.

Alfalfa land test—The same character of planting and tillage will be observed here as in the pre-

ceeding experiments. The land had been four years in alfalfa. The Blue Victor variety, on 2,462 square feet produced at the rate of 250 bushels and eight pounds per acre; People's variety, 2,622 square feet, rate 231 bushels, five pounds per acre; Freeman variety, 2,585 square feet, rate 75 bushels, 45 pounds per acre; Late Ohio variety, 6,417 square feet, rate 180 bushels, seven pounds per acre. The small yield of the Freeman and the reduced yield of the Late Ohio were due to the presence of a large back-furrow running through the plats, which did not get sufficiently irrigated. The total crop of late potatoes on all the plats weighed 16,655 pounds when harvested.

GRASSES.

Based upon trials of three years' duration at this Station, but two grasses out of eight tried have given promise of enduring field culture for pasture. They are Bromus inermis and Orchard grass. The unsuccessful ones were Hard Fescue, Meadow Fescue, Perennial Rye grass, Italian Rye grass, Red Top, and Blue grass. It is quite probable that some of these would succeed in moist soils of other localities in this part of the State. All grasses here are inclined to grow in bunches. Bromus inermis endures drouth exceedingly well, and I believe can be depended upon for pasture on a large area. Its roots penetrate to a good depth and grow vigorously. A plat sown last year, containing 9,581 square feet, produced 208 pounds of seed this year. The seed now sells at 25 cents a pound wholesale, making the value of the crop $52.00. A fairly good crop of hay was produced after the date of cutting the seed, July 2d.

HEMP.

A plat containing 9,120 square feet produced 364 pounds of seed. At the market price, six cents per pound, we have a crop worth $21.84. The rate yield per acre was 1,738 pounds. The seed was sown with a garden drill in rows three feet apart, in quantity about the same as seeds for root crops. The amount of cultivation given corn will answer for hemp.

TRIAL PLATS.

Kaffir corn, Jerusalem corn, and Milo Maize gave abundant yields on limited areas. But little moisture is required after the plants have become established. They were sown in drill rows, three feet apart, and received the same cultivation as corn. The seed is recommended as feed for horses.

Broom corn of two varieties, Japanese and Evergreen, grew thriftily and produced abundant crops. The former is a dwarf variety and the latter very tall and coarser.

Soja bean did not mature seed, though planted as early as May 22d. Trials of two seasons have been without success.

Canada field pea produced an abundant crop of green fodder and matured a large crop of seed. Its value as a soiling crop for cattle and hogs has made it popular in sections where a highly nutritious fodder crop is wanted.

Sandwick, or better known by the name Hairy Vetch, belongs to the pea family, and resembles the ordinary field pea in some respects. It is said to be valuable for pasturing stock and for a soiling crop for cattle and hogs. The seed was sown May 22d, and produced one heavy crop without maturing seed. It was cut and fed to cattle in November

after hard frosts which seemed to do it no injury. When fed in a semi-green stage with alfalfa it was not eaten, but when fed alone it was consumed without waste. In yield of bulk it was about the same as a heavy crop of alfalfa but considerably lighter in weight.

GARDEN.

The vegetable garden comprised an extensive list of varieties. Where practicable, horse culture has been employed and thus the expense of production reduced to a very low figure.

Beans—The varieties planted early, in May, were Burpee's Bush Lima, White Marrowfat, Emperor William, and Golden Eyed Wax. Burpee's Bush Lima, on trial two seasons, has not promised well for extensive cultivation. All other varieties have done as well as could be desired.

The question has often been asked, "How late in the season will it do to plant beans and have them mature?" To answer this question, a plat was planted July 13th with the varieties, Crystal White Wax, White Marrowfat, Golden Eyed Wax, Dwarf Caseknife, Date Wax, Large Yellow Six Weeks, Black Wax, and Large White Kidney. Only three of the varieties ripened. They were: Golden Eyed Wax, Black Wax, and Large Yellow Six Weeks.

Cabbage—The varieties Allhead Early and Buncombe were planted for early. The former is a desirable early sort, but the latter failed to produce solid heads, either early or late. The late varieties were Safe Crop, Drumhead Savoy, and Large Red Drumhead. They are all desirable.

A test of planting seed in the open ground where the plants were wanted to stand, and sowing

seed on the same date for transplanting, was made with the varieties Safe Crop and Red Drumhead. The result was the formation of solid heads at least three weeks earlier from seed planted in the open ground, but more uniform results were obtained from transplanting.

Carrots—The Ox Heart proved a desirable variety.

Egg Plant—The New York Purple, raised here for the third season, has done remarkably well. Single specimen this year weighed six pounds and fourteen ounces. Egg plant requires a rich soil and abundant moisture.

Ground Cherry—This proved a desirable addition to the garden list. It is very productive on a well enriched soil, and the fruit is excellent for preserving.

Okra—The new Lady Finger produced abundantly.

Pumpkins—The Potiron, which is a mammoth variety, produced a large crop. From eight hills the product weighed 5,480 pounds. Single specimens weighed 128 pounds. It is a good cooking pumpkin.

Tomatoes—Fifteen varieties were successful, but of special value the varieties Beauty, Stone, Fordhook first, Ignotum, and Golden Queen are recommended.

Watermelons—No variety to equal the Rocky Ford has been found, either for quality or prolificness. Two varieties, the Kentucky Wonder and Hungarian Honey, were tried here this season for the first time; they are both worthy of cultivation. The former would make a good market variety on account of its large size and beautiful appearance.

Other garden crops, probably not worthy of special mention here, were cucumbers, lettuce, beets, parsnips, squash, peppers, peas, onions, and cantaloupes.

ORCHARD AND SMALL FRUITS.

The apple trees have made thrifty growth this season, and there has been no loss of trees since my report of a year ago. Six varieties bore on the five year old division; they were Duchess, Cooper's Early White, Salome, Whitney No. 20, Early Harvest, and Missouri Pippin.

Of plums, Forest Garden, Desoto, Chicasaw, and Wild Goose bore fruit this season.

The vineyard made thrifty growth and the new portion set last spring made a fairly good start.

Raspberries, gooseberries, and currants have made thrifty growth.

JERSEY CATTLE.

There has been an increase of two calves, a heifer March 30th by Delight's Pansy and a bull by Aces Pogis Queen September 23d. Monthly milk records have been kept, recording weights, and tests for butter fat have been made three days of every month, by means of the Babcock tester. The cattle fly nuisance through the summer months is a matter of considerable importance. It is a hindrance to the successful management of cows. It is impossible to save degeneration of milk and flesh without blankets or stable protection. The herd now numbers six animals.

IMPROVEMENTS.

A new roof has been built over the kitchen and shed, together with other necessary repairs to this part of the residence, at an approximate cost of

$150.00. A new flume over the Rocky Ford ditch on the west farm to bring water from the Catlin ditch, and a bridge, crossing the lateral near the barn, are included in the improvements made this year.

Respectfully submitted,

FRED A. HUNTLEY,

Superintendent.

Rocky Ford, Colorado, November 30, 1894.

REPORT OF

THE VISITING COMMITTEE.

To the Executive Committee of The State Board of Agriculture:

GENTLEMEN—The undersigned, members of a Committee appointed to examine the work of The State Agricultural College and the Experiment Station connected therewith, at Fort Collins, Colorado, met with that object in view, September 11, 1894.

The College grounds are kept in good condition and present a neat and attractive appearance.

The Committee visited the several class-rooms and too much can not be said in praise of the deportment of the students or the efficiency of the President and the corps of teachers who seem to be untiring in their efforts to instruct the pupils in the different branches. We were favorably impressed with the mechanical instruction given to students, beleiving this to be of great practical value to them through life. In this connection we would call attention to the fact of their insufficient facilities for the practical training of the young lady students. We would, therefore, urgently recommend that the building now used as the Chemical Laboratory be used in the establishment of a Department of Domestic Economy, and that a larger and more suitable building be erected for chemical purposes.

There are now enrolled 177 students, this being a gratifying increase over the attendance of last year. We find that the College is now well-

equipped for teaching at least three hundred students. We therefore deem it unwise and injudicious for the State to grant appropriations to other institutions to be used in duplicating departments of special instruction now in successful operation in this institution.

The dairy interests of the State are demanding attention, and a vast amount of good will result from practical experiments along this line. We, therefore, recommend that proper steps be taken to further this object.

The experiments on the farm proper are not of a character to call forth much praise from the practical farmers of the State, but much of this may be due to frequent changes in management.

The Committee are well pleased with the efforts of the Board in securing text-books at wholesale prices and selling them to students at cost, thus securing for them a great saving. We, also, commend the action in securing an additional supply of water for irrigation purposes through the new pipe-line recently constructed.

The books and papers in the Secretary's office, as far as examined, are in perfectorder.

We believe that The State Agricultural College is worthy of the confidence and support of the people of Colorado.

All of which is respectfully submitted.

G. C. MILLER.
Representing the State Dairymen's Association.
TORRENCE WHITE.
Representing the State Grange.
R. H. RHODES,
President Colorado State Bee-Keepers' Asssociation.
JOHN TOBIAS,
Secretary State Board of Horticulture.

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THE STATE BOARD OF AGRICULTURE
ORGANIZED
March 19, 1877.
COLORADO.