Twenty-Fourth Annual Report

OF THE

State Board of Agriculture

AND THE

State Agricultural College

INCLUDING THE

FIFTEENTH ANNUAL REPORT

OF THE

AGRICULTURAL EXPERIMENT STATION

FORT COLLINS, COLORADO

1902

DENVER, COLORADO
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1903

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KATHARINE MURRAY,
Stenography.

AGRICULTURAL EXPERIMENT STATION.

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L. G. CARPENTER, M. S. . . . . Director and Irrigation Engineer
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F. C. ALFORD, B. S. . . . . Assistant Chemist
EARL DOUGLASS, B. S. . . . . Assistant Chemist
S. ARTHUR JOHNSON, M. S. . . . . Assistant Entomologist
F. M. ROLFS, B. S. . . . . Assistant Horticulturist
A. H. DANIELSON, B. S. . . . . Agronomist
H. H. GRIFFIN, B. S. . . . . Field Agent, Rocky Ford, Colo.
J. E. PAYNE, M. S. . . . . Field Agent, Cheyenne Wells, Colo.

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L. G. CARPENTER, M. S. . . . . Director
A. M. HAWLEY . . . . . Secretary
A. D. MILLIGAN . . . . . Stenographer

*Resigned September 1 to become director Wyoming Agricultural Experiment Station.

LETTER OF TRANSMITTAL.

To His Excellency,
THE GOVERNOR:

Sir—Herewith I transmit my annual report as Secretary of the State Board of Agriculture. It is respectfully commended to your attention and to the thoughtful consideration of the general assembly.

A. M. Hawley,
Secretary the State Board of Agriculture.

The State Agricultural College,
Fort Collins, Colorado, November 30, 1902.

SECRETARY'S STATEMENT

CONNECTED WITH THE GENERAL FUND.

FOR THE FISCAL YEAR, BEGUN DECEMBER 1, 1901, AND ENDED NOVEMBER 30, 1902.

RECEIPTS.

Tax fund	$59,592 89	
Land income fund	13,124 26	
Special fund	5,941 73	
Annie Jones library fund	343 75	
Special appropriation 1901-1902	8,000 00	
		$87,002 63

DISBURSEMENTS.

Salaries	$18,416 53
President's office	355 60
Secretary's office	641 13
Library	2,212 53
Horticultural department	3,358 97
Farm department	8,561 57
Chemical department	1,487 00
Mechanical department	3,465 29
Mathematical department	251 36
Physics and Engineering department	1,758 79
Zoology and Entomology department	441 25
Military department	149 87
History and Literature department	18 40
English and Rhetoric department	29 10
Domestic science department	529 06
Commercial department	291 39
Furniture	92 30
Insurance	1,477 25

DISBURSEMENTS—Continued.

Current expenses		3,171 25
State Board of Agriculture		1,774 30
General repairs		1,973 83
Permanent improvements		11,543 50
Text-book department		3,793 80
Freight and express		1,268 02
Fuel and lights		3,170 99
Student labor		5,897 07
Veterinary science department		223 58
Advertising		1,726 95
Farmers' institutes		385 75
Quarterly bulletins		506 20
Association of A. A. C. & E. S.		30 00
*Student labor	Special appropriation, 1901-1902	2,000 00
Horse barn	Special appropriation, 1901-1902	5,166 59
Hog house	Special appropriation, 1901-1902	833 41
		$87,002 63

*2,000.00 transferred to our special fund to reimburse us for money already paid out for student labor, and reported in our receipts above.

ITEMIZED STATEMENT OF SECRETARY'S CASH RECEIPTS.

Agricultural department	$2,892 03
Mechanical department	5 50
Text-book department	5,065 26
Domestic science department	8 80
Horticultural department	5 00
Freight, etc., refunded	114 32
Commercial department	1 40
Engineering department	12 49
Miscellaneous	268 19
*Agricultural College appropriation	2,000 00
Annie Jones library fund	809 43
	$11,182 42

*The $2,000.00 Agricultural College appropriation was drawn to reimburse us for money already paid out for student labor, and we immediately turned it over to the State Treasurer for credit in our special fund.

REPORT OF THE UNITED STATES OR "MORRILL" FUND FOR THE FISCAL YEAR BEGUN JULY 1, 1901, AND ENDED JUNE 30, 1902.

RECEIPTS.

United States draft	$25,000 00

DISBURSEMENTS.

Salaries	$25,000 00

REPORT OF EXPERIMENT STATION FUND (ACT OF CONGRESS OF 1887) FOR FISCAL YEAR BEGUN JULY 1, 1901, AND ENDED JUNE 30, 1902.

RECEIPTS.

United States draft	$15,000 00	
		$15,000 00

DISBURSEMENTS.

Salaries	$ 8,503 30	
Agricultural section	425 12	
Horticultural section	248 14	
Entomological section	186 95	
Chemical section	44 10	
Meteorology and Irrigation section	1,264 66	
Library	82 64	
Printing bulletins	1,221 88	
Stationery	4 42	
Arkansas Valley sub-station	1,326 60	
Plains sub-station	1,089 95	
Director's section	587 24	
Association of A. A. C. & E. S	15 00	
		$15,000 00

REPORT OF EXPERIMENT STATION SPECIAL FUND FOR FISCAL YEAR BEGUN JULY 1, 1901, AND ENDED JUNE 30, 1902.

RECEIPTS.

Balance on hand July 1, 1901	$ 298 40	
Irrigation department sales	6 45	
Divide sub-station sales	249 35	
San Luis Valley sub-station sales	566 10	
Agricultural section	75 00	
Entomological section	2 43	
Plains sub-station sales	92 10	
Arkansas Valley sub-station sales	1,736 26	
		$3,026 09

DISBURSEMENTS.

Salaries	$ 647 58	
Agricultural section	33 75	
Horticultural section	54 17	
Entomological section	56 53	
Meteorology and Irrigation section	110 12	
Library	5 19	
Printing bulletins	257 20	
Stationery	106 00	
San Luis Valley sub-station	67 75	
Arkansas Valley sub-station	1,014 19	
Divide sub-station	15 00	
Plains sub-station	85 81	
Director's section	68 28	
	$ 2,521 57	
Balance on hand July 1, 1902	504 52	
		$3,026 09

PRESIDENT'S REPORT.

To the State Board of Agriculture:

Gentlemen—Harmony and progress have marked the biennial period just closing. The influence of the college has greatly increased throughout the state by reason of the wise and honorable policies of the State Board of Agriculture and the responsive work of those who have been intrusted to concrete these policies. The clearly defined purpose—to keep the school entirely within the provisions of the Morrill act, of 1882—has its manifold reward.

I will at this time set forth the general situation, since detailed reports of the work in the various departments are to follow and shall be made a part of this report.

Our material prosperity is the more pronounced when one recalls the economy with which we have had to husband our all too meager financial resources. Only by the wisest forecasting of events and by the utmost caution in new adventures have we been able to make such goodly advancement and keep our unbroken reputation for paying all bills when due. This is due to your unflagging and often self-sacrificing devotion to the institution.

The evidences of this prosperity are to be found in the three new buildings now nearing completion—a horse barn, at a cost of $6,000; a hog barn, at a cost of $1,000; a lavatory, at a cost of $5,000. At the same time, we have been able to add somewhat to the equipment of several departments. No sort of education costs so much for its original equipment and the maintenance necessary to keep it abreast of rapidly changing demands as does the education growing out of the applied sciences. On the other hand, no education is so rich in its returns to all the people, affecting as it does, every phase of life of the producing masses.

Still further evidence is to be found in the building, just begun, for the department of electrical engineering, and a central heating plant, at a probable cost of $10,000. The demand for such a department, equipped in the most up-to-date manner, has been so persistent that we could postpone action no longer. The establishment of a central heating plant is strongly in keeping with our general policy—that money, properly expended, far more than saves itself. It is the finest sort of economy.

It is scarcely necessary to report to this Board the unprecedented condition of the College farm, since you yourselves have made it what it is. No one has ever before seen this farm in its present high state of cultivation. At last, we can claim to be producers rather than consumers. At last, we begin to prove ourselves of equal quality, whether regarded as theoretical or as practical farmers. The subduing of stubborn positions of the farm by rational methods, the procuring of additional water for irrigation by the purchase of the Andrews spring and reservoir and surrounding lands, and the employment of student-labor in a sensible way all give testimony to your insight and foresight.

Since but few of our citizens can inspect the work of the farm, it has been the part of wisdom to invite representatives from the State Grange to make an annual visit and report results at the annual meeting of the granges, and also to exploit our valuable herds at the State Fair. While not entering stock for competition or premiums, we have won the greater prize of having it said of us, that we lead the state in the excellence of many individuals from among our herds. Moreover, we have been for two years able to supply the stock breeders of Colorado with highly-bred types of several varieties. It is a pleasure to announce that we are about to render the same service to the state relative to horses and hogs as has been done in regard to cattle.

In this connection, it is proper to say that the Experiment Station, under Professor Carpenter's direction, aided by his valuable staff, is giving much time to investigating the agricultural and irrigational problems of this arid state. Every difficulty and every opportunity is studied with the greatest care. In fact, the work throughout the college itself has not failed to keep pace with the external prosperity. In spite of the fact that the requirements of entrance to the freshmen class have been raised three years, the enrollment

thus far, for the present year, being 479, as against 424 at this time last year, shows a gratifying increase. The total enrollment for the year 1902-1903 will not fall much below five hundred. The institution is fast attaining the true college atmosphere. There were many differences to be overcome, but one by one they are yielding.

I desire to make special mention of the library, under the efficient management of Mr. Daniels. It is safe to say that the library is worth five times as much to the school as it was a year ago. It is now a general and scientific library of high grade and far more usable than we had dared to hope it could be made in its present painfully inadequate rooms. In fact, the need crying to us on every hand is "more room." The students overflow into the corridors of the chapel entrances, and every recitation room is crowded with extra chairs. The library, museum, Domestic Science hall, physical and other laboratories have enormously outgrown the space allotted to them. We are forced to ask the coming legislature for relief from this gladdening but puzzling situation.

If we may be granted an appropriation of $75,000 for the erection and equipping of a civil and irrigation engineering building, it will give us growing space for the immediate future. Nothing less than this will suffice. To hinder our growth at this time in the direction of *irrigation* would work a great injury to the state. It is both a handicap and a menace that the greatest irrigation state in the nation has the most meagre irrigation-educational facilities; we lack only the equipment.

It is a pleasure to report that those added to our corps of instructors during the past year have, thus far, proved most acceptable: Samuel Boothroyd, in physics; Mabel Mead, in modern languages; E. D. Searing and F. L. Hadley, in mechanical engineering; L. A. Johnson, in entomology; S. L. Macdonald, in mathematics; J. S. Titcomb, in engineering. Four of our recent graduates, having proved worthy of fellowships, are assisting—three in the work of the Experiment Station and one in mathematics.

We are searching far and wide for an able man for the chair of agriculture, the most important position in the college at this time. Mr. Danielson, in agronomy, and Mr. Griffith, in animal industry, are meeting the emergency manfully. We are most fortunate in having these gentlemen

available at this time, but we must not be content until the greatest master of theoretical and practical agriculture in America shall find his life work here in Colorado where lie the greatest agricultural possibilities.

Reporting for the commercial department, I am happy to state that good will and the work that goes hand in hand with good will prevails in that department. Mr. Dwyre in bookkeeping and Mr. Taylor in stenography have made the year's work famous. A very large and well-trained class will be graduated in June from this department. The additional requirements for admission are proving popular and beneficial. The course must be further lengthened at the earliest possible moment.

A hand-book is in preparation—one which, for the first time, will fully and artistically set forth the many advantages of the college.

I have few recommendations to make. By way of a general recommendation, I urge that we shall not permit external progress to overshadow internal growth. I hope we may, at an early date, provide for a chair in constitutional history and philosophy of history, with irrigation law as a minor subject. It would greatly dignify our work and enhance the value of our training in national and state citizenship.

I am joined by the entire faculty in asking that you provide us with more room for class and general assembly as soon as possible. I also recommend that Mr. Daniels' salary be advanced to $1,400 per annum, beginning January 1, 1903. I also recommend that military drill be made elective for regular seniors. Those electing it to receive three credits per week. Since we are requiring almost double the amount of time at drill required by other agricultural colleges, I think we can safely make this change.

I desire, on my own behalf and for all the other employes of the college, to heartily thank the board for its sympathetic and inspirational relation to the college, as a whole, and to each of us who serve. Such a relation has rarely, if ever, fallen to the lot of a state institution. It is the secret of the institution's remarkable growth. May nothing ever break this wholesome unity.

Signed, B. O. Aylesworth,
President.

REPORT OF THE DEPARTMENT OF PLANT INDUSTRY.

The State Board of Agriculture.

Gentlemen—I hereby submit my annual report of work in my charge to the December meeting of the State Board of Agriculture. The Experiment Station work as planned has been reported through Director Carpenter.

Since Professor Buffum left this department for Wyoming the work has gone on without interruption, as outlined in the catalogue. Other work has also gone on smoothly. Through the fall term I have taught a class of seventy-two students in beginners' agriculture for two hours every day. As this was in part new work it required considerable preparation and work outside of class hours. The other subjects in the course in agriculture as outlined in the catalogue are also in part new work and will require considerable planning in advance.

The correspondence of this department has been promptly attended to, and we manage to keep a stenographer busy for half of each day. The quality of the student labor is considerably higher than last year and without the help of earnest, picked students much of the detailed work of this department could not have been accomplished. Besides the number of students employed on the farm during their vacant hours, a number have proved very valuable help in and around the office, being employed chiefly in methodically arranging, threshing and working up the experimental grains.

In the meantime I have managed to keep in touch with the more important experimental crops during the harvesting and threshing. There are many which require my personal presence at such times in order that the records may be properly kept.

As I understand it is the intention of the board to have an exhibit at the St. Louis fair, preparations for it have already begun to some extent. It is well to know what to exhibit and how it should be displayed; if crops, as grains and

grasses, are to be shown the seed and land should be carefully selected before planting. It would be well also to have a selection of a few good photographs and I am looking forward to making some, illustrating the work of this department with that view in mind.

I especially desire to thank the board and express my appreciation of their generosity in furnishing this department with a good photographic equipment. Although it takes more time and care than most people appreciate to turn out good photographs, we have gladly furnished, free, pictures to editors of papers and others, many of which have been reproduced. Our pictures, taken mostly as matters of record of experiments and other work, are continually in demand and we have granted such requests whenever possible. I would respectfully request to be allowed a little new material now and then and to add a little to the equipment occasionally. Some twenty new books of which we were greatly in need have also been added to the department library.

If the board sees fit to let matters in this department remain as they are, for some time to come, I would respectfully request that a new roller top office desk, a duplicate of the one we now have, be furnished this office.

We are also greatly in need of a specially made, small sized threshing machine for threshing and separating the experimental grains. As it now is, over two hundred varieties have to be threshed and separated by hand at a much greater expense than could be done with a machine made for the purpose. It is also exceedingly difficult to keep so many varieties from being mixed, using a common threshing machine. The Minnesota experiment station has invented one for its own use which answers the purpose admirably, and I respectfully request that we be allowed to have one bought or made on the same plan.

I am, your obedient servant,

A. H. Danielson,
Plant Industry.

REPORT OF THE DEPARTMENT OF ZOOLOGY AND ENTOMOLOGY.

To the State Board of Agriculture:

I have the honor to submit, herewith, the report of the Department of Zoology and Entomology for the year 1902.

WORK OF INSTRUCTION.

The subjects taught in this department have been given according to schedule. On account of changing to the new curriculum there was no physiology class for sophomores during the fall term. Elementary physiology will be taught instead to the first sub-freshmen class during the winter term. Hewes' "High School Physiology" has been chosen as a textbook for these students. In the new course higher physiology will also be taught to the juniors in the fall term. "Human Physiology," by Schenck and Gurber, will be used as a textbook.

Mr. Elmer D. Ball, who has been first assistant in this department for several years, has recently accepted a call to the chair of animal biology in the Agricultural College of Utah, and Mr. S. Arthur Johnson, science teacher in the West Denver High School, has been called to take his place. The new curriculum adds to the teaching work of this department, so that it will be necessary to have a first assistant who can do considerable teaching and manage college classes, in order to allow the head of the department time for experimental work.

INSTITUTES AND CORRESPONDENCE.

Attendance upon farmers' institutes, horticultural societies and beekeepers' associations, together with the correspondence concerning injurious insects and remedies for their ravages, takes much of the time of the head of the de-

partment, and the work in these lines increases year by year. During the past summer and fall the department has been supplied with the services of a stenographer from the office of the director of the Experiment Station, which has been a great help in keeping up the correspondence.

INSECT COLLECTION.

Considerable attention has been given each year since I became connected with the College to making a collection of the insects of the state. Of the larger and more economic orders of insects, viz.: Lepidoptera, hemiptera, coleoptera and orthoptera, the College now has a collection of the Colorado species of which, I believe, it can be justly proud. The entire collection numbers about 60,000 specimens, the great bulk of which are determined and systematically arranged. Such a collection is of great service to students in entomology, and also as a reference collection in all entomological work. The collection is made especially valuable by containing many original type specimens from which new species have been described. Such a collection should be kept in a fire-proof building or vault, as it contains much valuable material that could never be replaced, if once destroyed. I hope the time is near when the collection can be given suitable protection against fire.

GENERAL MUSEUM.

It takes no small amount of money to build up a good general museum. Such a museum, well arranged, and with the specimens plainly labeled, is a great aid in teaching zoology and comparative anatomy, and is an attractive public educator and a standing advertisement for a college. Because of our limited funds and cramped quarters the work of building up the museum has been neglected. In the meantime it becomes more difficult each year to procure many of the rarer birds and mammals of our state and country that should be represented in the College museum. If money could be afforded to employ a helper in this department who could devote most of his time to collecting and mounting specimens that are most needed, and in caring for the museum, and who could also give a portion of his time, especially during the summer, to the general work of the department,

I believe, in that way, much could be accomplished for the museum at a comparatively small cost. Such a man could be procured for about $600 a year.

Below is a list of additions to the museum during the past year, all of which is respectfully submitted.

C. P. GILLETTE.

NAME	Obtained From	Locality	No.
Eggs of Golden Eagle	H. L. Heckart (gift)	Robber's Roost, Wyoming	2
Mule Deer (head)	F. B. Finley (gift)		1
Loon (U. imber)	A. R. Beymer (gift)	Rocky Ford, Colorado	1
Fossil Shark Teeth	A. R. Beymer (gift)	Manzanola, Colorado	1
Muskrat Group (F. zibithecus)	A. R. Beymer (purchase)	Rocky Ford, Colorado	3
Antelope (A. americana)	A. R. Beymer (purchase)	Rocky Ford, Colorado	1
Coyote (Canis latrans)	A. R. Beymer (purchase)	Rocky Ford, Colorado	1
Jackrabbit (L. campestris)	A. R. Beymer (purchase)	Rocky Ford, Colorado	1
Mink (Putorius vison)	A. R. Beymer (purchase)	Rocky Ford, Colorado	1
Lesser Snow-goose (Chyperberea)	A. R. Beymer (purchase)	Rocky Ford, Colorado	3
Ruddy Duck (E. rubida)	A. R. Beymer (purchase)	Rocky Ford, Colorado	1
American Golden-eye (G. camericana)	A. R. Beymer (gift)	Rocky Ford, Colorado	1
Missouri Chipmunk (Tasiatiecus)	W. L. Burnett (gift)	Fort Collins, Colorado	1
Violet-green Swallow (skin)—(T. thalassina)	L. E. Burnett (gift)	Loveland, Colorado	3
American Crossbill (L. c. minor)	L. E. Burnett (gift)	Larimer County, Colorado	1
English Sparrow (P. domesticus)	L. E. Burnett (gift)	Loveland, Colorado	2
Slender-billed Nuthatch (skin)—(S. c. aculata)	L. E. Burnett (gift)	Larimer County, Colorado	1
Lark's Finch (C. g. strigatus)	L. E. Burnett (gift)	Loveland, Colorado	1
Flicker (C. cafer)	L. E. Burnett (gift)	Loveland, Colorado	2
Yellow-billed Cuckoo (C. americanus)	L. E. Burnett (gift)	Loveland, Colorado	2
Black-billed Cuckoo (C. erythropthalmus)	L. E. Burnett (gift)	Loveland, Colorado	2

Lewis' Woodpecker (M. torquatus)	L. E. Burnett (gift)	Larimer Co., Colo	1
Townsend's Solitaire (M. townsendii)	L. E. Burnett (gift)	Larimer Co., Colo	1
Red-headed Woodpecker (M. erythrocephalus)	L. E. Burnett (gift)	Larimer Co., Colo	1
Brown Thrasher (H. rufus)	L. E. Burnett (gift)	Larimer Co., Colo	1
Bald-head Grosbeak (Z. melanocephala)	L. E. Burnett (gift)	Larimer Co., Colo	1
Eve. Grosbeak (C. v. montanus)	L. E. Burnett (gift)	Larimer Co., Colo	2
Kingbird (T. tyrannus)	L. E. Burnett (gift)	Larimer Co., Colo	2
O-b Thrush (T. u. swainsonii)	L. E. Burnett (gift)	Larimer Co., Colo	1
Canon Towhe (P. f. mesoleucus)	L. E. Burnett (gift)	Larimer Co., Colo	1
B.'s Oriole (T. bullocki)	L. E. Burnett (gift)	Larimer Co., Colo	2
Redwinged Blackbird (A. phoeniceus)	L. E. Burnett (gift)	Larimer Co., Colo	2
La Tanager (P. ludoviciana)	L. E. Burnett (gift)	Larimer Co., Colo	1
W-c Sparrow (Z. leucophrys)	L. E. Burnett (gift)	Larimer Co., Colo	1
Catbird (G. carolinensis)	L. E. Burnett (gift)	Larimer Co., Colo	1
Lont-t Chat (I. vlongicauda)	L. E. Burnett (gift)	Larimer Co., Colo	1
Cowbird (M. ater)	L. E. Burnett (gift)	Larimer Co., Colo	1
Lark Bunting (C. melanocorys)	L. E. Burnett (gift)	Larimer Co., Colo	1
Crimson H-Finch (C. M. frontalis)	L. E. Burnett (gift)	Larimer Co., Colo	1
Yellow Warbler (D. aestiva)	L. E. Burnett (gift)	Larimer Co., Colo	1
W. Yellow-throat (G. t. occidentalis)	L. E. Burnett (gift)	Larimer Co., Colo	1
American Goldfinch (S. tristis)	L. E. Burnett (gift)	Larimer Co., Colo	2
Tule's Wren (C. p. paludicola)	L. E. Burnett (gift)	Larimer Co., Colo	1
B-c Chickadee (P. a. septentrionalis)	L. E. Burnett (gift)	Larimer Co., Colo	1
Lazula Bunting (P. amoena)	L. E. Burnett (gift)	Larimer Co., Colo	2

ADDITIONS TO THE MUSEUM DURING 1902—Concluded.

NAME	Obtained From	Locality	No.
Vireo	I. E. Burnett (gift)	Larimer Co., Colo	1
Prairie Hen (C. cupido)	A. N. Hendee (gift)	Larimer Co., Colo	2
N. Sharp-tailed Grouse (Ped. phasianellus)	A. N. Hendee (gift)	Larimer Co., Colo	
Quail (Ortyx virginiana)	A. N. Hendee (gift)	Hamilton Co., Neb	1
Grebe (P. podiceps)	A. N. Hendee (gift)	Hamilton Co., Neb	2
B. Thrasher (H. rufus)	A. N. Hendee (gift)	Hamilton Co., Neb	2
Rocky Mountain Screech Owl (M. maxwelliae)	A. N. Hendee (gift)	Hamilton Co., Neb	1
Burrowing Owl (S. c-hypogaea)	A. N. Hendee (gift)	Hamilton Co., Neb	1
Blue Jay (C. cristata)	A. N. Hendee (gift)	Hamilton Co., Neb	1
Crested Jay (C. s-macrolopha)	A. N. Hendee (gift)	Hamilton Co., Neb	1
Baltimore Oriole (I. galbula)	A. N. Hendee (gift)	Hamilton Co., Neb	1
Rose-B. Grosbeak (Z. ludoviciana)	A. N. Hendee (gift)	Hamilton Co., Neb	1
W. Phaparope (P. tricolor)	A. N. Hendee (gift)	Hamilton Co., Neb	1
Snowy Goose (C. hyperborea)	A. N. Hendee (gift)	Hamilton Co., Neb	1
Kingfisher (C. alcyon)	A. N. Hendee (gift)	Hamilton Co., Neb	1
Black Tern (H. nigra)	A. N. Hendee (gift)	Hamilton Co., Neb	1
Green Heron (A. virescens)	A. N. Hendee (gift)	Hamilton Co., Neb	1
Meadow Lark (S. m. neglecta)	A. N. Hendee (gift)	Hamilton Co,, Neb	1
Elk Fawn (Alce alces)	Colo. Museum of Nat. History (purchased)	Colorado	1
Elk Fawn (Cariacus Sp.)	Colo. Museum of Nat. History (purchased)	Colorado	1
Silver Fox (V. vulpes)	Colo. Museum of Nat. History (purchased)	Colorado	1

Red Fox (V. vulpes)	Colo. Museum of Nat. History (purchased)	Colorado	1
Cross Fox (V. vulpes)	Colo. Museum of Nat. History (purchased)	Colorado	1
Porcupine (E. dorsatus)	Colo. Museum of Nat. History (purchased)	Colorado	1
Lynx (L. canadensis)	Colo. Museum of Nat. History (purchased)	Colorado	1
Wolf (C. lupus) skin	Colo. Museum of Nat. History (purchased)	Colorado	1
Bear (U. americanus) skin	Colo. Museum of Nat. History (purchased)	Colorado	1
Bear (U. americanus) skin	Colo. Museum of Nat. History (purchased)	Colorado	1
Pine Martin (M. americana)	Colo. Museum of Nat. History (purchased)	Colorado	1
Long-t Weasel (P. longicauda)	Colo. Museum of Nat. History (purchased)	Colorado	1
Ptarmagin (M. leucurus)	Colo. Museum of Nat. History (purchased)	Colorado	3
Ptarmagin (M. leucurus) young	Colo. Museum of Nat. History (purchased)	Colorado	2
Long-h Owl (B. virginianus)	Colo. Museum of Nat. History (purchased)	Colorado	1
American Raven (C. corax)	Colo. Museum of Nat. History (purchased)	Colorado	1
American Goshawk (A. atricapillus)	Colo. Museum of Nat. History (purchased)	Colorado	1
Lamb (O. aries) double-headed	Colo. Museum of Nat. History (purchased)	Colorado	1
Egret (Ardea egretta)	Colo. Museum of Nat. History (purchased)	Colorado	1
Beaver (Castor fiber)	Colo. Museum of Nat. History (purchased)	Colorado	1
Bald Eagle (H. leucocephalus)	Colo. Museum of Nat. History (purchased)	Colorado	1

Loans to the Museum, twenty mounted birds and one mounted gray fox, by L. E. Burnett.

REPORT OF THE DEPARTMENT OF HORTICULTURE AND BOTANY.

To the State Board of Agriculture:

Gentlemen—I have the honor to submit the following report of the Department of Horticulture and Botany for the year 1902.

INSTRUCTION.

The work of instruction has followed closely the schedule as given in the catalogue. The laboratory method of teaching botany continues to be satisfactory both with the students and with the instructors. This method has been adopted in all the classes in botany.

Text books are used in the classes in horticulture and in landscape gardening so far as possible, lectures being used occasionally as needed to supplement the text. This plan has given better results than the use of either books or lectures alone.

The magic lantern has been put in good order and is a welcome addition as a means of illustrating class work.

CAMPUS.

Many changes have been made in the campus and more are in contemplation for the future. A great deal of time and energy has been given to this work and we are grateful for the words of encouragement that the members of the Board have been free to give.

It may not be out of place to mention some of the more important improvements that have been made during the past two seasons. A tile drain has been laid around the outside and at the bottom of the basement wall of the Domestic Science building and the outside of the wall plastered with cement. These improvements were necessary to prevent damage to the interior of the basement by seepage water.

The grounds around the Chemical, Commercial and Mechanical buildings have been graded and seeded. The fill in front of the Chemical building alone required in the neighborhood of 1,000 loads of dirt.

Extensive improvements were made to the irrigation system of the campus. A number of new ditches were made and open ditches were replaced with tile wherever practicable. Street washers were placed in front of the Mechanical Engineering building.

The old gates were replaced with eight steel lateral and ten steel check gates.

The planting on the lawns has been added to by a number of trees, shrubbery beds and herbaceous borders. The flower beds have also been materially changed, and a water bed has been made in the center of the sunken lawn west of the Civil Engineering building. About 1,000 trees, shrubs, vines and perennial plants have been used in this work.

The drives on the campus have been graded and the gravel spread and rolled. Gravel was also spread along both sides of the railroad at the switch. A portion of the sidewalks on the grounds have been raised and a large washout east of the ball grounds refilled. A large amount of dirt has been filled in on the inside of the walk on the east side of the campus and on the outside of the new fence east of the ball grounds. Also, a number of large trees have been removed.

GREENHOUSES.

The two older houses will soon need extensive repairs. It is doubtful, however, if the money required to put them in good condition would be well spent. We are, therefore, in hopes that these houses may be replaced by the new ones that have been in contemplation for some time.

INSTITUTE WORK.

A number of papers and addresses have been given at farmers' institutes and at the three meetings of the two state horticultural societies. A series of four meetings were attended during the past summer, which were called for the express purpose of discussing the subject of pear blight.

EQUIPMENT.

The department is well equipped with apparatus; the smaller things that were needed from time to time have been cheerfully furnished. But we lack time. With so many different, unrelated details to attend to there is but little time left for investigation, or when a few leisure moments do occur it is difficult to concentrate one's mind on systematic investigation.

In conclusion I wish to acknowledge my indebtedness to my assistants for the faithful and careful work that they have done.

Many thanks are also due to the president of the college and to the members of the board of control for their support and expressions of appreciation of all of the work that I have undertaken.

W. PADDOCK,
Professor of Horticulture and Botany.

REPORT OF THE DEPARTMENT OF CHEMISTRY AND GEOLOGY.

To the State Board of Agriculture:

Gentlemen—I herewith submit the annual report of the Department of Chemistry and Geology.

The work laid down in the catalogue has been carried out in every detail.

The question of extending the work in chemistry, particularly along the line of analytic work, has forced itself upon me repeatedly; but there seems to me to be too small a demand for extension in this direction to justify our undertaking it. The course, therefore, still adheres to the educational lines of former years. The results obtained, especially by the system of quantitative experiments adopted in the laboratory, have been entirely satisfactory.

There has been no increase in the facilities for chemical investigations during the past two years, and our inventory, notwithstanding the advance in the market value of some of the supplies, shows a falling off. The geological cabinet, on the other hand, has been increased by the addition of about two hundred (200) specimens, representing the lead and zinc ores of the Joplin district of Missouri. This is an admirable addition, as our collection was almost wholly wanting in an economic collection of zinc ores and their associated minerals.

The building is in good condition, and no changes or repairs are needed.

As head of the department, I have no complaint of any kind to make concerning my assistants and help. Mr. Alford is on leave of absence to pursue postgraduate work in an Eastern institution. This will delay the publications of the department, as I have not deemed it advisable to appoint, even temporarily, any one in his place, preferring to work on with our present force until his return.

The present depreciation in our chemical supplies and apparatus is the result of my policy of importing as largely as we can at intervals of two or three years.

Respectfully submitted,

(Signed.) WILLIAM P. HEADDEN.

REPORT OF THE DEPARTMENT OF VETERINARY SCIENCE.

To the State Board of Agriculture:

Gentlemen—I believe it is a common experience, that when first introducing a new department of instruction, many changes become necessary. The course in veterinary science has not been an exception in this respect, for I have found it advisable to vary somewhat from the prescribed course as originally adopted.

In looking up the character of the work done along this line in similar institutions in the different states, I find that one of two policies is generally adopted: First—To properly equip and maintain a complete course leading to a veterinary degree, with everything conserving to make this the prime object in view. Second—To limit the instruction to a short, practical course of lectures, adapted more especially to the students in agriculture, and, with well equipped laboratories and assistants, to work in conjunction with the Experiment Station and in closer touch with the live stock interests of the whole state.

We are now well along in the second year of veterinary science as a distinct department of instruction, and from the present viewpoint, I feel confident that no mistake has been made in adopting a middle policy, which promises to give us the best results of both.

The efforts of the head of this department have so far been directed largely to the building up of a thorough course of instruction, and our efforts in this respect have been rewarded by a recognition on the part of some eastern colleges, and arrangements perfected whereby the course here will count for two years there, in a regular three-year school; the student from here entering the senior class there and graduating in one year, with a degree.

With our new course of study, an excellent clinic, our new rooms fitted especially for the work, with some new equipment for bacteriological instruction and research, we

are now enabled to do good work, and I feel that we are justly entitled to such recognition.

I am now more convinced than ever that this department should be more closely in touch with the Experiment Station. So thoroughly imbued have I become with the importance of the investigation feature of the work, and of extending it beyond the class room for the more direct benefit of the live stock interests of the whole state, that I have diligently pursued several lines of investigation relative to some of the diseases which are hampering this important industry. There certainly could be much more accomplished if this part of the work were systematized and placed in harmony with the other departments and under the eye of the efficient director of the station.

EQUIPMENT.

I feel that your honorable Board has been generous with this department and there is nothing now needed that is imperative. There are several things which can be added from time to time and which will greatly facilitate the work. The class in bacteriology, which included students other than those strictly of this department, was enabled to borrow sterilizer, microscopes, etc., from other departments for this term only; these we should have, as they are needed throughout the year.

There are no up-to-date works of any description in the library bearing upon this important subject. The only books accessible to the students are a few volumes that I have placed at their disposal from my own library. I believe it will be well to start a library, in a small way, in our department rooms, by purchasing a few volumes relating to the diseases and treatment of live stock and the practical conduct of the live stock business, also two or three monthly journals.

BULLETINS.

The bulletins so far issued have been: One station bulletin in conjunction with Prof. Buffum on the "Relation of Human to Bovine Tuberculosis;" one College Bulletin on our "Veterinary Department." A Station bulletin on "Kafir Corn Poisoning" is in course of construction and will, it is hoped, be out before spring planting begins.

I have been making a careful investigation, in conjunction with Mr. Griffith, relative to actinomycosis, or lumpy jaw, its cause, prevention, and a practical treatment for the same, and hope to issue a bulletin on this subject before the close of the College year. We are constantly receiving reports of severe losses from certain poisonous plants which grow native on the range, as well as in cultivated fields. The localities where these particular plants flourish should be defined, their identity made easy, and also the time of year when they are most dangerous, and a reliable treatment recommended which would save a large per cent. of affected stock. The special phases of animal pathology in this western country are peculiarly our own, arising, in most cases, from unusual conditions, such as altitude, climate, soil, traffic, water, forage, etc. I think it is no exaggeration to state that there is no other country where the live stock industry flourishes under more favorable conditions and so unhampered by the ravages of contagious diseases as this, the arid region of the United States. Nor can we say that this satisfactory condition of things can all be attributed to what nature has done for this country, for it is due, more than any other, to an eternal vigilance on the part of national and state authorities, to well regulated and rigidly enforced quarantine laws, and in a general way to an efficient veterinary supervision.

The difficulties that we have to contend with are indigeneous to this country, and while comparatively insignificant, yet, they entail an annual loss which in the aggregate is enormous. I believe it is strictly within the province of this department to work diligently in search of ways and means to lessen the mortality from the diseases common to the lower animals throughout the state, and to mitigate, as much as possible, the ever present danger to the human family from the same.

Respectfully submitted,

GEO. H. GLOVER.

REPORT OF THE DEPARTMENT OF CIVIL AND IRRIGATION ENGINEERING.

To the State Board of Agriculture:

Gentlemen—I have the honor to submit the following report as professor of civil and irrigation engineering, for the current year:

The work of this department has several phases. This department was the first one in the state to include work in irrigation engineering. This was organized in 1890, and has since regularly continued, the first class having graduated in 1892. There having been no text books, and comparatively little reliable information on lines relating to irrigation engineering at the time of its organization, a necessary part of the work has been to collect such facts for use in instruction. Partly in consequence of this necessity, as well as from the double relation which the head of the department bears both to the Experiment Station and to this department of the College, the work has been so interwoven that in many cases it is difficult to determine which is College and which is Experiment Station. This, however, has been the less necessary because most of the work has been desirable and necessary from both standpoints.

During the existence of this department a number of classes have graduated. As our course had to content itself with relatively moderate requirements, we have not expected to turn out accomplished civil and irrigation engineers in the time given. Under the circumstances the most that could be done seemed to be to quality our young men as best we could in the time given in the essentials of engineering, giving them the ground work in practice and in draughting, and giving special attention to questions of hydraulics and irrigation in relation to agriculture, with the hope that the foundation would be sufficient to enable these young men to earn a living, or to build upon. An examination of the list of graduates from this department shows that, in a measure we have been successful in accomplishing this purpose. With

the improvements in the course during the past few years, and especially with the greater opportunities for field work, the better equipment in instruments and general facilities, we have been able to give more thorough instruction, and the young men who leave us are better equipped.

There is also plainly felt an increase in earnestness. As successive classes have passed out into active work and proved successful in the wider relations of life, the self-respect and confidence of the young men in their own capability has increased and they have a confidence that their success would depend largely upon their own efforts. This I consider one of the most important lessons which we can give. We desire to supplement this with the necessary skill and knowledge of how to work, and cause their confidence to be based upon a firm foundation.

With the increase in the length of the course of another year, increasing the requirements by this amount of work, we shall be able to strengthen the course and increase the training which we are able to give the young men before graduation. In this respect our work will be materially strengthened and our young men will be the better qualified for grasping the material problems which come before them. In this course we desire to lay special stress upon the questions of hydraulics and irrigation. There is considerable increase of interest in questions pertaining to irrigation engineering because of the passage of the national irrigation act, and the public attention which has been given to these questions in consequence. There is no place in the country that is as well situated for illustration of irrigation work as Colorado, and no place better situated than our institution for studying its developments.

Our most crying need at present is for increased room for the department. At the time of taking charge of this department, in 1888, the department consisted of a small store room, about six feet by ten feet, and a class room not much larger. It was soon afterwards given larger quarters, consisting of a small office, a better class room and a store room in the basements of the present main building. Afterwards, with the cessation of the dormitory system, the old dormitory was turned over to this department. Aside from the fact that this building has never been well adapted for the purposes of the department, it has long ago outgrown its present quarters, and the increase in the number of classes

and in their size makes the demand a very pressing one. The situation for sometime has been such that we have been very crowded for class room. During the present term it is impossible to hold one class at all on account of the lack of room for recitation, and also lack of room for laboratory work. For some time it has not been possible to have classes in laboratory work in hydraulics, which has been one of the pressing needs of our local situation. The classes in laboratory work have had to be divided into sections of from ten to fifteen, and in a room half underground, very poorly lighted, and not at all adapted to the purpose.

The draughting room for the engineering department may hold, conveniently, some six or eight students, but at times we have two or three times that many at work in it. The general growth of the work of the department and its contact with different parts of the state, has increased the office work so that the rooms available for office purposes are so crowded that work is done at a great disadvantage. It has for some time been the case that it is scarcely possible to put down one object without removing something else, consequently, there is a great loss of time and energy that would be more effective under better conditions.

It is hoped that the department would be of service to the state, and it is thought that it has been. Certainly the importance of the line of work is great, and the intrinsic merits would seem to justify giving it ample provision to do what it can for the benefit of the state.

The classes in this department are essentially the same as have been carried on for some years past. The following is an enumeration: Physics, three terms in senior and junior years; physics, three terms in the sophomore and freshman years. From now on, one course is to be given to the sub-freshman class. This class is so large in numbers that it is necessary to divide it into two, and probably three, sections for recitation. Also, the classes of engineers in special instruction in physics. Each of these classes also involves recitations and exercises in laboratory work. In such instruction a class needs to be divided into small sections. General experience in laboratory instruction has been that from six to ten students are as many as one instructor can profitably attend to at once.

Instruction in surveying is given in the sophomore year, in the future in the freshman year. This course also

includes field work, which continues throughout the term and requires overseeing for from four to six hours per day. Instruction in irrigation engineering, higher surveying, agricultural hydraulics and draughting is given in the junior year, and instruction in meteorology for one half term. Reservoirs and dams, strength of materials, trusses and bridges, railroad engineering and hydraulics are taught to the senior class. In addition to this, there is a large amount of field work which extends throughout the year. With the lengthening of the course, additional instruction, amounting to three to five classes per day, is called for from this department.

The improvement, which has been spoken of before, in the work done by the students is marked, especially in field work. Attention has before been called to the need of more practice in field work. This year, for the third time, a trip into the mountains for field practice was undertaken. The advantage of the previous work has been so marked that there can be no question as to the benefits. Under the present arrangement the students in engineering in the upper classes are required to report a week before the opening of the fall term. They then move with instructors into the mountains, where there is a variety of conditions, and camp out under field conditions. For the past three years the students have gone to Estes park, and have run lines of levels from the park to the summit of Long's peak. There have been here variations in topography from smooth ground to as rough as can be found in the mountains. There have also been other conditions which were of weight from the standpoint of the responsible head of the party. We were close to a source of supplies, so that it was not necessary to carry a complete outfit of provisions with us, and our store of provisions could be increased on short notice. We were within reach of daily mail and the telephone. We were also close to a physician, although, so far, there has been no need of his services either from sickness or accident. The aim has been to increase our camping equipment gradually. Thus, one year ago, we bought a camp outfit. The present year, several tents have been purchased, and are on hand for next year's trip. The responsibility of some of the arrangements, like commissary and cook, were left to the students themselves. They appointed a committee to engage the cook, subject to the approval of the professor, and to purchase sup-

plies. By this arrangement the system was elastic enough to adapt itself to the needs of the party, and if any serious faults were to be found, they were easily corrected.

During the past year the party ran a line of levels from a point in Estes park to the summit of Long's peak, an elevation starting with 7,625 feet and running to 14,270 feet, approximately. The distance was something like sixteen miles. The members of the party were divided into small parties of two or three, each consisting of an instrument man and one or two rodmen. The seniors were in charge of the respective parties and the junior students acted as rodmen. In the case of practice with levels, each party was required to level twice over the same distance, and required to check with only a very small error. If the difference was more than a certain amount, it had to be re-run.

Aside from the conditions being more like those of field work, the fact that for a period of ten days the students gave their entire time and thought to the question of surveying was very beneficial. The party was away from the disturbances of other duties and other studies, and thus there has been the singleness of thought which has greatly increased their power in working and accomplishing much better results than many weeks of field practice under ordinary college conditions.

During the past year, and especially since the beginning of this college year, there have been several changes in the personnel of this department. Mr. James A. Stump, who has for two years been first assistant, resigned the 1st of September to continue studies in an Eastern university. Mr. Amos Jones, who had been acting as second assistant for two years, was promoted to first assistant on the 1st of September, but resigned October 15 to take advantage of a position tendered him in the irrigation survey of the United States Geological Survey under the new irrigation law. Mr. S. L. Boothroyd, a graduate of this department in the class of 1893, and who has since been a student at the University of Chicago and professor at Mount Morris College, Illinois, also at Bellvue College, Nebraska, and assistant astronomer at Lowell Observatory, Flagstaff, Ariz., became second assistant, with physics especially in his charge. Upon the resignation of Mr. Jones, he was promoted to the place of first assistant. The department has been fortunate in its assistants, and it still is. While we regret the

loss of the tried and trusted assistants who have severed their connection with us, we are glad of their promotion, especially as we feel that one of our chief purposes is to train young men.

It is evident that it will be difficult to procure and retain assistants in this department at the salaries we have been offering. The opportunities in outside life are many, and the pay is so much better than that which he have offered, that except for other inducements equivalent to increased pay, it will be increasingly difficult to maintain the standard. We have been fortunate this fall in having the temporary services of Capt. J. S. Titcomb, long and well known in Colorado, formerly deputy state engineer, and of long and varied experience in field work.

With the beginning of this school year we have the help for a part of the time of Messrs. Oro McDermith and Harry True, who have been appointed to scholarships. By this arrangement they receive a moderate payment, and devote a certain part of their time to the work of the department. It gives them an opportunity for additional study, and to perfect themselves along their chosen lines.

One of our students, Mr. J. P. Mulder, showing some skill in photography last spring, was enployed to do some desired photography work during the summer season. By his help a good deal of necessary illustration work has been done. Several hundred lantern slides were made, a large number of bromide prints enlarged from small negatives, and photographs of various subjects valuable for illustration in instruction. A number of albums have been made, showing some of the work of the department. Some of the work undertaken was with the view of being used at the World's Fair, when it becomes necessary for us to make an exhibit. The work of Mr. Mulder was very satisfactory, and he seemed to be an excellent investment.

The field work done by the students, primarily as a matter of training them, has also been secondarily helpful in various College surveys. During the course of the year considerable College construction has been done, and in many cases the plan and surveys for these have been done by this department. In addition to the line to the College spring constructed a year since, there has been a survey and construction of a reservoir, the survey of the inlet ditch from the same, the

survey of the drains on the west part of the farm, and various other surveys of minor importance. These have also involved more or less supervision. In itself the work was not of great importance, but still the draft on time has been considerable. The work of the students has been rendered helpful where possible. Thus during the course of the year a contour map of the farm has been made so that we have the complete data for the whole farm. On these we now design to show the drives, buildings, drains, pipe lines and ditches, so as to have a complete record of the present state of the farm. There is considerable work of this character that ought to be done. Under the conditions of student work, a long time is usually required. The students work only two hours per day. It is always desirable that the work should be checked by a second party. For the purpose of instruction it is not fair to the students to keep them on one kind of work, to the exclusion of practice in other lines, consequently surveys are often long drawn out. While my purpose has been to direct these surveys so that the work will be helpful and all fall in with the general plan, yet it seems to me there is a great deal of work which is now behind and which ought to be done. This work has fallen behind because of the many other demands which come upon the department, and the completion of one piece of work is often prevented by the demands of another. It is increasingly important that we have a complete record in maps of all of our existing pipe lines, sewer lines, water pipes, drains, and that our spring line should be correctly surveyed and platted as it has actually been constructed. Also the contour of our reservoir should be represented and mapped, also the inlet ditch. We have begun the survey of another feeder for the reservoir. It will soon be necessary to survey the line for a ditch to bring water from the reservoir to the College farm. There is considerable grading on the west side of the farm which should be done and is desirable in order to bring the land under cultivation. Some ditches are also necessary. As a whole it will doubtless be good economy to push these surveys to bring them up to date. I have attempted to do this to a great extent by educational labor, but this has not been sufficient to keep up with the demands, and in order that the work shall be well done a person needs to give his time continuously. The contour topographic map of the farm which has already been

mentioned, is also available for use as a basis for map for representation at the World's Fair.

Already, by your authorization, a short course for water commissioners and canal superintendents has been arranged. As this is planned, the course will be either in the latter part of January, or early in February, and will last for two or three weeks. It is intended more especially for the benefit of water commissioners and canal superintendents, as it has been manifest for some time that some portions of the state were puzzling over the same problems which had been solved by other parts of the state years ago. This has been intensified by the frequency of changing officers in charge of the distribution of water. This has undoubtedly been an oversight, principally because each commissioner starts in practically at the point at which his predecessor commenced. There has been no opportunity to gain knowledge except by experience. It would seem that greater improvement could be effected by extending help to these people than by any other way. Even if the attendance should be small in numbers, each one who receives help forms a nucleus for others, and it is to be hoped that even if the present system of administration remains, that the result may be that a larger number of people may become qualified so that there will be competent people to choose from, in case of any change in office. Judging from the interest that has been taken there will be a fair attendance, but even if not more than a dozen come I think it may still be worth the time and effort.

In concluding this report of the department, I wish to acknowledge the constant support of President Aylesworth, his appreciation and encouragement of all that is intended for the development of this department, and to thank the Board for their continuous help and support.

Respectfully submitted,

L. G. Carpenter,
Professor of Civil and Irrigation Engineering.

REPORT OF THE DEPARTMENT OF MECHANICAL ENGINEERING.

To the State Board of Agriculture:

Gentlemen—I have the honor to submit the report of the Department of Mechanical Engineering.

Taking the classes in the order of their arrangement, I beg leave to report upon the instruction as follows:

Since my last annual report the members of the sub-freshman class have received instruction in free-hand drawing during the winter and spring terms; they have been taught how to make free-hand sketches of geometrical models and other objects; they have also been taught how to make sketches from copies of acknowledged merit made by artists of established reputations, and for this purpose a graded series of drawing books have been used.

In the free-hand drawing work, the students who are to work in the shops later on have been taught how to make sketches of machines; these sketches to be subsequently worked up into working drawings for use in the shops.

At the beginning of the past fall term the drawing courses were rearranged, and the sub-freshman free-hand drawing is now taught outside of this department.

The sub-freshmen have received instruction in the shops in bench work in wood, having been taught the common operations of the carpenter at the bench.

To accomplish this they have been required to complete a number of exercises, comprising the various joints used in wood work, in every case being guided by a set of working drawings made to scale.

The students of the freshman class have received class-room instruction in the principles underlying carpentry and joinery. This work has been done by means of a text book and lectures, the object being to aid the students in obtaining a knowledge of the correct application to their work in wood, of the principles explained in the class room.

They have received instruction in the proper shaping of the cutting edges of different tools and the manner in which they act upon the material under various conditions. The shrinking and warping of wood have been explained, and practical methods given for constructive work to allow for these conditions. The selection of joints for various uses has been explained.

The students have made a series of timber joints, which are now used in the class room in connection with lectures.

The members of this class have had two terms of instrumental drawing from copies and from measurements, and have also been taught how to shape into working drawings the free-hand sketches they made in the sub-freshman year.

Considerable time has also been spent upon tracing these drawings and reproducing them by the blue-print process.

In the afternoon shop work they have taken up bench work in wood, if they have not previously had it in the sub-freshman year, in every instance working from drawings, and some who have completed the regular course in bench work before the end of the term, have been put upon extra work, which has afforded them an opportunity to put in practice what they have previously learned.

Some of the freshmen have been occupied in the blacksmith shop, and have been receiving instruction in forging a set of exercises, educationally arranged, and they have acquired considerable skill at the forge. All the cutting tools used at the lathes and planers in the machine room have been made in the forge room.

The sophomores have been instructed in instrumental drawing, in orthographic projection, and have been required to work out a number of problems in that subject. They have received instruction in pattern making for one term; they have been taught how to make patterns correctly, so that they may be used to advantage in the foundry. Many patterns for appliances used about the college have been made by these students.

The juniors have pursued the study of steam boilers. The proper design of modern boilers has been studied—riveting, bracing, staying, etc., have received attention; the selection of boilers for various purposes has been discussed, and, wherever possible, all available boilers have been examined

with a view to having the students become familiar with varieties of construction.

The management of boilers has also been taught to the members of this class, and as opportunity has offered the students have been entrusted with the care of boilers in the mechanical engineering laboratory.

The principles of mechanism have received attention by the members of this class, and they have been taught the underlying principles upon which the working of machines depends, and the various mechanical movements have been explained and their practical application shown in various kinds of machinery.

These students have received instruction in the foundry, and have been taught how to mould, and also how to cast, both in iron and brass. They have received instruction in plain work in moulding and in core work.

The management of the core oven has been taught, the students making their own cores and finishing and baking correctly.

All the iron and brass castings used in the shops during the past year have been made in the college foundry.

As an additional aid to the more intelligent performance of their work in the foundry, they have received class-room instruction in the subjects pertaining to that work, the care and management of cupolas, the best practice of modern foundries, the proper selection and mixing of different grades of iron; and in brass founding, the proper selection of metals and the production of alloys.

The seniors have had two terms of drawing, part of that time being taken up with the study of machine design, the machine design having been carried on by means of a text-book and also by frequent reference to machines of acknowledged good design. This work calls for much original research and mathematical calculation.

Each student has been required to produce one or more original designs during the year.

The fall term shop practice of these students completed their line of shop experience, and their entire time for this term was spent in the machine room, where they were taught how to manage the lathes, planers, milling machines, and other machines and appliances. The members of the class have made a variety of small tools, two steam engines, and

a lathe, besides keeping in repair the machinery of the department.

In all the work of the shops the students have been required to work from drawings as much as possible, as it has become necessary for the workmen of to-day to be able to read working drawings.

The study of the steam engine has been another branch required of this class, and a very comprehensive treatise on the subject has been used as a text-book and the study taken up in a thorough manner. The thermodynamics of the steam engine have been worked up, as well as the practical working of the engine. Various kinds of valves and governors have been discussed. The Zeuner diagrams have also been studied and applied. The transmission of power by modern methods has been taken up, and a study of some of the best forms has been made.

The mechanical engineering laboratory, although as yet not fully equipped, has afforded the class a greater opportunity of becoming familiar with steam and hydraulic machinery than we have been able to offer to senior classes of previous years.

A fine eighty horsepower steam boiler has afforded them an excellent opportunity for study, and the five horsepower boiler has also proved of great value to them.

They have been taught how to use the indicator on the four steam engines of the department, the students themselves fitting the engine with indicator pipes, reducing motions and brakes.

They have been taught how to get the indicated horsepower, the brake horsepower, and the friction of the engines.

The two steam pumps have been fitted up with indicator attachments by the students, and they have made a series of experiments upon these pumps, determining their efficiency, etc.

They have been instructed in the use of thermometers, barometers and calorimeters, and in this advanced work have taken special interest. They have acquired a good degree of familiarity with indicator diagrams, and in connection with that work have learned to use the planimeter with accuracy. Gauge testing has also formed a part of their instruction.

In the spring term the seniors made their tour of inspection, and, in company with me, visited the important industrial establishments of Denver. We were very kindly received, and we were thankful to the managers of the plants we visited for the many courtesies extended to us.

There was so much of interest for us to see in the industries of Denver that we passed all the time at our disposal in that city. The previous year the class visited, in addition to Denver, Longmont, Loveland and Greeley. It is hoped that we may be able later on to extend our tours so as to include Pueblo and other cities. The expense of these trips is met by each student paying his share.

The students take note-books with them, and at each establishment visited make extensive notes of operations, processes, machines, etc., and, upon returning to the College, each is required to make a technical write-up of one or more subjects selected from his note-book.

Most of the science schools of the country have adopted the "inspection trips," and these trips are believed to be of great value to the students. Our own students certainly find them beneficial. Besides the technical information obtained on these visits, it gives them some idea of how closely their work at the College fits existing conditions in the commercial world, and shows them what may be expected of them after leaving College halls.

It affords me great pleasure to state at this point that our students are well received by those requiring their services, and, as the nature of the training they are receiving here is becoming better known, they are more and more sought after. A large list can be given of young men acquitting themselves admirably who have been trained in this department.

In revising the course of study, a number of subjects have been added, thus making the mechanical engineering course one of the strongest in the West.

Respectfully submitted,

J. W. Lawrence,
Professor of Mechanical Engineering.

REPORT OF THE DEPARTMENT OF DOMESTIC SCIENCE.

To the State Board of Agriculture:

Gentlemen—Domestic science, being new, as compared to other branches taught in our College, it might be well before giving the work actually done, to speak of the establishment of the department here.

It was the outgrowth of the conviction that no young woman could become thoroughly equipped for life without including in her general education those sciences and arts upon which the superstructure of the real home must rest.

Knowledge is an excellent thing, but knowledge and the ability and skill to apply that knowledge are incomparably better. If the best is to be attained, the eye and hand must be trained, as well as the mind.

Believing, then, in the education that aims to secure the most thorough development for the individual, the State Board of Agriculture established the department in June, 1894.

Hundreds of young women have attended the classes, and the work done by them and their interest in the same makes it manifest that this specialty has been greatly appreciated and is of much value.

Five terms of lectures and class room recitations have been given, as follows:

1. Hygiene and Sanitation—This subject is taken up at the beginning of the winter term of the sophomore year. The text-book used is a collection of "Public Health" essays, relating chiefly to the home and school, and are classified in this way:

1. Study of the home.
   (a) Selection of location.
   (b) The building of the home, from foundation to attic, including materials used, the plumbing, heating, lighting, ventilation, etc.

(c) The surroundings: lawns, trees and shrubbery; emphasizing sanitary and hygienic conditions.

(d) Furnishing the home for the purposes of convenience, adornment and the happiness of the inmates.

2. The use of disinfectants.
3. Individual prophylaxis against disease.
4. School hygiene.
5. Foods.
6. Preventable causes of disease.

II. Emergencies, Conversation, etc.—During the spring term of the sophomore year the leading aim has been to teach self-reliance, presence of mind, an interest in general subjects, and to train the student to express herself concisely, intelligently and entertainingly.

The scheme is varied for each day in the week. On Mondays the subjects always relate to the human organism. For instance, the skin is studied under the divisions of functions and care.

Tuesdays are devoted to emergencies. To illustrate: one subject taken is the resuscitation of the apparently drowned. In all cases of accident a physician should be called, but the attendant may be of great use while the physician is coming.

On Wednesdays each young woman is required to prepare for the class an item of interest that belongs to the general subject of home science.

The lesson for Friday morning is one of great importance. Some subject for discussion is announced one week in advance, with a member of the class as leader. For twenty minutes the one in charge presides; then the instructor takes the chair and recapitulates, adding and modifying wherever necessary.

Since the art of conversation has been very much neglected in recent years, the young ladies appreciate this opportunity of giving special attention to so valuable and cultivating a subject, particularly since it is absolutely indispensible in the well ordered home.

III. Chemistry of Cooking and Cleaning.—In the fall term of the junior year, one subject considered is the chemis-

try of cooking and cleaning. The practice of cooking can not be carried on successfully without some knowledge of chemical science. The text-book used is by Mrs. Ellen M. Richards, instructor in the Institute of Technology, Boston.

This study tends to lift the veil of mystery from many kinds of housework, and to fill the mind of the student with a broader conception of her sphere as a home maker. Further, the actual performance of the labor is materially lessened when these subjects are properly understood.

IV. Science of Nutrition.—During the winter term of the junior year the Science of Nutrition is studied, with "Atwater's Chemistry and Economy of Food" as the basis of text book work. Much supplementary reading is required, and the study of dietaries is made an important feature of this division. Blocks, charts and bottles are used to illustrate the composition of the human body and the nutrients in food materials.

V. Nursing.—At the beginning of the spring term of the junior year, Week's text-book in nursing is placed in the hands of the students and the practical, everyday subjects that pertain to the care of the sick in the home are taken under consideration.

Lectures by specialists in various lines are given in the spring term of the senior year, and these are of great importance to the young women in organizing and conducting their own homes.

In the new course adopted last spring, the following were added to the subjects already mentioned:

(a) Studies in hygienic and artistic pattern drafting. The human form is to be studied with health, beauty and utility in view in the making of patterns and clothing. Winter term, junior year.

(b) The Philosophy of Homemaking.—This study is designed to treat the whole province of homemaking from a philosophical standpoint. Fall term, senior year.

Sewing.—The work in sewing consists in drafting patterns, cutting out garments, plain sewing, plain and fancy stitches, embroidery and millinery. System, method, and the high educational value of this training are emphasized. Notwithstanding that no student is required to purchase material for work, it is invariably done, because in so doing she is entitled to the product of her labor.

The Kitchen.—The work in the kitchen includes the study of foods, with practice in all kinds of cooking and laundering. The serving of foods, and care of linen are carefully considered.

Housekeeping.—A thorough training in housekeeping is included in the general scheme.

General Topics.—A lecture is given from time to time upon some topic relating to the care of the house, clothing or person; social duties, customs of good society, and anything that will aid in the development of a perfect womanhood.

Most respectfully submitted,

THEODOSIA G. AMMONS,
Professor of Domestic Science.

REPORT OF THE DEPARTMENT OF MATHEMATICS.

To the Honorable State Board of Agriculture:

Gentlemen—The following is respectfully submitted as a report of the work done in the Department of Mathematics since my last annual report:

During the year this department has given instruction to twenty-seven classes in mathematics. The following subjects have been handled: Arithmetic, elementary algebra, plane and solid geometry, trigonometry, descriptive geometry, higher algebra, analytics, and differential and integral calculus.

The work as a whole has been good and the students seem interested and willing to work hard. It is pleasing to me to see the strenuous efforts put forth by some of the upper classmen to master a difficult problem. Of course, there are some lazy and indifferent ones. This is to be expected. But, as a whole, there is no complaint to make, for they certainly do the work required and do it well.

During the last three months the department has been hampered by overcrowding. Some of the classes in algebra contain sixty-seven students, while one of the geometry classes numbers forty-one. These classes are too large to handle with the best results to the members. Especially in mathematics must one get down to individual work, and when one must teach classes in mathematics which contain more than twenty or twenty-five students he does so at the expense of thoroughness. Having no laboratory work in this department, we keep "open house" for all who wish to come for *individual* help, and I have always felt that this afternoon work, which is sometimes tedious in the extreme, is productive of as much or more good as the class-room work itself. When one can find out just where the squeak is it doesn't take much time or oil to cure it; but when one has three classes per day running in numbers from fifty-five to seventy, he can not give the attention to each student he ought to give. *Gentlemen, we must have more room!*

I have been fortunate in having under me good assistants. Mr. R. H. Hess, who was with me four years, was a splendid teacher, and his successor, Mr. S. L. Macdonald, seems to fit in exactly, and the work with him is progressing satisfactorily.

Mr. R. S. Howlett, who is now serving his second year as a post-graduate student, under your excellent scheme of scholarships, is doing good work. He has much natural ability for teaching, and, although at first he had a hard position to fill, he has straightened things out and is now doing excellent work.

During the summer vacation, through your kindness in granting me a leave of absence, I was able to attend Chicago University. My stay there was beneficial to me, I am sure, and I hope because of this to do better work for you.

The following is a detailed account of the work of the year:

SUB-FRESHMAN CLASS.

Throughout the winter term this class continued the study of elementary algebra begun the term before. It was divided into two sections and was made up of 101 students. The work done during this term covered the subjects of factoring, highest common factor, lowest common multiple, fractions and a start in simple simultaneous equations.

The spring term found seventy-six students enrolled. Those not able to do the work were dropped into an arithmetic class and given a thorough review in this subject. The work of this term comprised simple simultaneous equations, involution, evolution, theory of exponents and radical expressions.

At the opening of college last September a new course of study governed the lower classmen. This course provides for *two* preparatory classes, known as first and second subfreshman.

FIRST SUB-FRESHMAN.

This new class began the study of elementary algebra and has been duly initiated into the mysteries of addition, subtraction, multiplication and division of algebraic quantities, together with simple equations and problems and some of

the first factoring. The class this term numbered 134 students. There were two sections and each was too large to handle with the best results; however, lack of classrooms compelled us to get along with them.

SECOND SUB-FRESHMAN.

This class has been in existence only one term, and during that time they have taken up the study of geometry, covering the work of Books I and II of Wentworth's Plane and Solid Geometry, together with many exercises and problems.

FRESHMAN CLASS.

The ninety-six students of this class, during the winter term of 1901 and 1902, continued the work in geometry begun the term before, and during this time finished the plane geometry as given in Wentworth's text.

The spring term found eighty-five students in this class, and their work in solid geometry covered the books usually given to students in this work.

The fall term found them again at work in algebra, beginning where they left the work in their sub-freshman year, and covering the subjects of quadratic equations, ratio and proportion, variation, inequalities, arithmetical and geometrical series, and the binominal theorem. This class contains many excellent students.

SOPHOMORE CLASS.

The mathematical work scheduled for the sophomores for the winter term is trigonometry and descriptive geometry. This has been a strong class in mathematics throughout their entire course, and their work in trigonometry was fully up to their standard, several of the class making an almost perfect grade for the term's work. There were forty-nine students in this class, and the subject of plane trigonometry was mastered by most of them.

The students of the engineering courses carried, also, in this department, the subject of descriptive geometry,

taking up the elementary problems of this subject, and many practical problems later on in their spring term's work. This class was made up of thirty-three as hard-working boys as the College ever saw, and their work with me during the two terms in descriptive geometry was the best ever done by any class in the subject since I have been connected with the college.

On account of the new course of study coming into effect, there is no sophomore class for this year, and hence I have no report for the fall term of this year for this class.

JUNIOR CLASS.

The winter term of last year found twenty-two students at work with analytical geometry. The text-book used was Wentworth's Analytics, and the work was fairly done. This class has not been strong in any of their mathematical work, not on account of lack of ability, but because of a lack of application on the part of about one-half of its members. The spring term brought the differential calculus, and the work was taken up as given in Taylor's text-book on this subject, bringing in many practical problems from the outside. There were twenty-one members of this class.

The present juniors have, since the opening of College, been studying college algebra, which, to my mind, is the hardest term's work in the mathematical course. The work takes up extensively the study of series. The subject of derivatives and the solution of equations of higher degrees all come in for their share. I wish to compliment the class on the excellent work done for me. There were twenty-one members of this class, three of the best of which were ladies.

SENIOR CLASS.

The class that graduated last June was a fairly good class in their higher work in mathematics, their fall term's work in integral calculus being the best term's work they ever gave me. They seemed to be impelled by the desire to show what they *could* do if they tried, and the results were very satisfactory indeed. The work was chiefly done as given

in Taylor's text, with proofs and demonstrations brought in from the outside.

In conclusion, I have to thank you, gentlemen, for the kind consideration and courteous treatment I have received at your hands.

Respectfully submitted,

E. B. HOUSE,
Professor of Mathematics.

REPORT OF THE DEPARTMENT OF LITERATURE AND HISTORY.

To the State Board of Agriculture:

Gentlemen—Permit me to submit the following report of the Department of Literature and History for the year ending November, 1902.

During the Fall term, 1901, the work of the department consisted of literature for the senior and sophomore classes, history for the two divisions of the large freshman class, and two courses in German, then offered by this department as an extra study for students requesting the same.

Literature in the senior year is offered in the courses in general and domestic science, and agriculture, and twelve students registered for this work. Selected masterpieces of English literature, covering the period from Milton to Tennyson, and one drama from Shakespeare, were made the subjects of critical class room study, and furnished the basis for frequent papers and reviews of special topics assigned.

The sophomore class in literature had an enrollment of seventy-eight, and was consequently too large to permit satisfactory work on the part of either teacher or students. You will readily agree that with a class of that size, meeting only three times a week for three months, it is impossible to ascertain whether or not literature is exercising its beneficent influence upon the minds of individuals. A new text, Painter's Introduction to English Literature, was used, which placed extracts or entire works from typical authors of the great literary periods in the hands of the student, thus supplementing the library, which it was impossible to use to any great extent for reference work, owing to the size of the class, and the lack of room in the library.

In the freshman class in history, there were 103 enrolled, who recited in two sections, one consisting of thirty-six, and the other of sixty-seven students. The irregularity of divisions seemed unavoidable, as the same class recited in mathe-

matics in three sections, two of which had to be consolidated for recitations in history on account of lack of sufficient teaching force in the history department. The larger section was consequently hampered for the same reasons as already given in connection with the overcrowded literature class. The period studied during the Fall term was ancient Greece and Rome. Sheldon's collection of sources was placed in the hands of the students, and the suggested historical studies there outlined were supplemented by class lectures, notebook work and reference readings from the library, so far as it was possible for the large class to use the facilities offered. A collection of stereopticon views, added to the equipment of the department during the past year, helped to bring scenes of historical interest into the class room, and thus aroused lively sympathy with people and events widely separated by distance, as well as by intervening centuries.

I find that the inspiration and suggestions received by my summer in England and on the continent have been of very practical benefit, both in the work in literature and in history, and I wish to extend my thanks to your honorable Board for the leave of absence granted me during the summer of 1901 for this purpose.

Five students applied for a course in beginning German, and two for second year German reading. Recitation periods had to be arranged for these extra classes at hours that would not conflict with regular recitation and laboratory work, and three hours a week were thus finally selected for each class.

During the winter term the work in German, and of the freshmen in history, was a continuation of that commenced in the fall. The senior class exchanged literature for philosophy of history, twelve young ladies constituting the class in this subject. The term's work consisted of an outline review of European history, with particular attention to the growth of modern institutions and governments, and their underlying causes as seen in events of ancient and mediaeval times.

The sub-freshman class, numbering 108 members, and reciting in two sections, commenced during the winter term the study of American literature. The first term was devoted to an historical review of the subject, following the outline suggested by Watkins' American Literature Primer. Frequent written papers and note book reviews helped to make

the student familiar with the important periods and leading writers of American literature. During the Spring term this course was continued, and supplemented by a critical study of masterpieces, which were read in class, and made the basis of much composition work.

The junior-senior class in recent American history, consisting of thirty-four students, made a special study of the period from the election of Jackson to and including the Civil War.

The term was only about half finished when I was prevented, as you know, by illness, from completing the work of the year. I wish to thank the entire Board for the very kind and courteous treatment I received at that time. My place was at once very ably filled by Mrs. A. M. Hawley, who took charge of the classes in American history and literature, and the German classes were discontinued for the rest of the year. I wish to express my hearty appreciation of the improvement in library service during the past biennial. The hours when the library is open for the use of students have been increased and the librarian's service in connection with the work of this department is invaluable. We are sadly in need of more library room to accommodate our large classes in reference work, and trust that as soon as possible this improvement will be provided.

At the opening of the present College year my department was relieved of the elective courses in German, by the employment of an instructor in modern languages, in accordance with the change in its courses of study, which require a choice of modern languages in the second sub-freshman year.

A course in history has been introduced in the first sub-freshman year, in which there are at present 129 students, reciting in three sections. The seniors in literature are pursuing work similar to that already outlined in this report as taken by the seniors of last fall.

Our numbers are constantly increasing, but heavy work is lightened by perfect harmony in the teaching force, and the most helpful co-operation of our president at all times. Our greatest need is more room.

Respectfully submitted,

VIRGINIA H. CORBETT,
Professor of Literature and History.

REPORT OF THE DEPARTMENT OF MILITARY SCIENCE.

To the State Board of Agriculture:

Gentlemen—I have the honor to submit the following report of the Department of Military Science and Tactics:

The department has a larger enrollment for the present term than at any previous time in the history of the college. The number having received instruction is shown in the following: The four companies—A, B, C and D—show on their rosters the names of 250 cadets and four recruits, not yet assigned to companies, a band of twenty-two pieces, and a staff of four members, making a total of 280 students in the department. The organization is an infantry battalion of four companies, staff and band. Our work for the term just closed has included the school of the soldier, company and battalion in close order. Practical instruction is given four days each week. On Wednesdays the officers and non-commissioned officers are assembled for recitation in infantry drill regulations and manual of guard duty. Later in the year this time will be devoted to theoretical instruction, as prescribed by orders from the adjutant general's department.

In June, 1902, was held the second encampment of the college cadets. The time allotted to this purpose was six days. The total number of cadets taking part was 125. The affair was conducted, as nearly as was practical, according to the usages of the regular service. A camp guard was mounted and maintained for twenty-four hours each day, thus affording the cadets an opportunity to become acquainted with sentinel duty. Special attention was given to target practice. A range was established immediately upon entering camp, and each cadet had an opportunity to practice at 100 yards and 200 yards, and a portion at a range of 300 yards. The scores made, with a few exceptions, were very creditable. The total expense to cadets for the outing was $2.00 each. This included the freight charges and drayage on equipment from and to Denver.

The college course having been increased to six years, the question arises as to the advisability of making military drill compulsory for the full course. It is the practice in some schools similar to our own to limit the work in the military department to a fewer number of years. If it should be the judgment of the Board that some such plan be adopted in our college, I would recommend that the change be gradual. That is, not to make any greater change than to have military drill elective with seniors of the regular college course who have satisfactorily completed a certain number of terms of work in this department.

In the order issued from the office of the adjutant general, known as General Order No. 94, is outlined both the practical and the theoretical instruction in the land grant colleges. In addition to the practical instruction which has been given here, it requires that a guard be mounted five times each week and one hour's instruction be given in the posting and relief of sentinels and their duties. It is the present understanding that this work will begin with the winter term. Another requirement of this order is that infantry target practice shall be a part of the practical work of this department. The ordnance department furnishes the ammunition for this practice, and I would recommend that steps be taken towards the establishment of a suitable range for firing at short ranges, at least. This practice would be of considerable value, and would create new interest in the work.

Some purchases have been made during the past term which have put the ordnance stores of the college in good repair. From the ordnance department we have received seventy-five gun slings, so that each of the rifles is equipped with a sling, thus adding much to the uniformity of the equipage. The greatest need of the department is a regimental color. That in use now is too well worn to present a good appearance. Otherwise, the equipment is in a good state of preservation.

Respectfully submitted,

R. A. Maxfield,
Commandant.

REPORT OF THE DEPARTMENT OF RHETORIC AND PHILOSOPHY.

To the State Board of Agriculture:

Gentlemen—In compliance with the laws of the state I transmit to your honorable body, through the president of the college, my annual report as head of the Department of Rhetoric and Philosophy from December 1, 1901, to December 1, 1902.

During the winter term of 1901-1902, there were five regular classes conducted by the department, viz.: The senior-junior class in logic, the freshman class in rhetoric, in two divisions, and the sub-freshman class in elementary rhetoric, in two divisions.

The class in logic consisted of twenty-two students—seniors of the civil engineering and the ladies' courses, juniors of the mechanical engineering course, and several unclassified students. This class met three times a week in the chemical class room, the regular room for logic being at that time used for mathematics. It was found that the study suffered a good deal from its being shortened as to time. This, to make matters worse, has since been shortened to two hours a week. As logic has always been regarded as the rounding out of any education, it is certainly a grave error to allow it thus to be practically thrown out. I, therefore, most respectfully request that the subject of logic be restored as an elective for students of the engineering and literary courses.

The freshman rhetoric, including junior commercials and freshmen, was composed of one hundred and eight students. No particular text-book was followed, although Herrick and Damon's "Composition and Rhetoric for Schools" served as a sort of guide. The principal time and energy of the students was devoted to themes. This work was continued with a slightly smaller class during the spring term.

One hundred and eighteen students of sub-freshman rank composed the class in elementary rhetoric. The text followed was Herrick and Damon's. Faithful and fundamental work

was undertaken. The class, with but a slight reduction in numbers, continued similar work throughout the spring term.

The class in psychology consisted of twenty-five students of sophomore rank. The text book used was Dexter and Garlick's "Psychology in the Classroom." As was suggested in my last annual report, this subject, being a prerequisite for all philosophical and educational work, should be by all means offered as an elective to all students above sophomore rank.

During the fall term just closed, I have conducted classes in ethics, advanced rhetoric, elementary rhetoric, and Latin.

The class work in ethics was based upon the fourth edition of Mackenzie's "Manual of Ethics," supplemented by research and lectures. This course, owing to its sociological value, ought to be thrown open as an elective to all seniors.

One hundred and forty-one students of first sub-freshman rank were enrolled in elementary rhetoric. These recited in two divisions. As the greatest seating capacity of the classroom of rhetoric and philosophy is sixty-four, it can easily be seen how thoroughly short we have been in the proper accommodations, room enough for our large classes being altogether out of the question.

The class in advance rhetoric, or themes, numbered eighty-six, reciting in two divisions. As these divisions were very unwieldy, owing to their size, it was nearly impossible to do the subject of themes justice. However, considering the numbers, with but one person to look after the work, no one can deny that progress was made.

At the rate the school is growing, the problem of sufficient class rooms becomes a very vital one, as well as the imperative need of an assistant in this department. A reader, at least, should be assigned from the graduate students, whose duties as set forth by the college should be to help read and correct exercises and themes. As soon as this can be done, the work of the department will appreciably improve.

For all confidence in my work and forbearance for my shortcomings, I am deeply grateful.

Respectfully submitted,

Edward M. Traber,
Professor of Rhetoric and Philosophy.

ANNUAL REPORT AND INVENTORY OF THE LIBRARY.

To the State Board of Agriculture:

Gentlemen—The following report is a brief account of the work of the library, its growth and its inventory.

The library has been well supported by the College and has been well used by students and faculty.

SHELVING.

We have 875 feet of floor space in which we have 2,716 feet of shelving, make-up case for periodicals, work bench, catalogue tables and cabinets, reading room, with its equipment of racks and tables, and a room for documents and duplicates. We have added more than 1,000 feet of shelving and nearly six thousand volumes since August, 1901. With cross shelving and double decking we have reached the limit for this year and the next step will be into the reading room, from which we shall have to take all tables to make room for books and cases.

When we move into another building it would be best to provide the library with Library Bureau Steel Bracket Stacks, which are lighter, cleaner and less expensive than good wooden cases, well finished. We have only two small pieces of good stack. We need steel stacks to the amount of about $750, but we can use our old ones, as we have been doing.

DOCUMENTS.

The documents of the United States (Washington) are poorly shelved, but we have lately acquired a good set of indexes for them, and their usefulness has been increased.

Sets of the documents of the several states, and particularly of the scientific publications, might be gathered to this library, but we have already taken most of the reading room and there is no place for the collection now here.

We have a very good (though incomplete) set of the bulletins and reports of the Experiment Station, which should be bound soon. I believe that a fair valuation of this set is $500, and that it will be worth much more in a few years. It is not possible to buy a set. We have a printed card catalogue covering this set, but it is almost useless in our present crowded condition.

LIBRARY SCIENCE AND LIBRARY HANDICRAFT.

This class grew out of our apprentice system and makes much of this unusual work possible. These students make lists, do the accession work and many other things to increase the efficiency of the library. We require a standard in the work much the same as that required in the best library schools and, in addition, considerable manual training, such as making portfolios, binding books, etc. We have no room for this work, but are doing it after a fashion on the window sills.

DONATIONS.

Library donations have increased to about 1,200 pieces in the past year (not counting the exchanges, and documents from the superintendent of documents). These have all been sorted and have contributed to broken sets of periodicals, and the duplicate list which we use for sale or exchange; or, have been accessioned and placed on the shelves. Following is a list of the names of donors:

Ralph Voorhees, Dr. B. O. Aylesworth, Mrs. F. G. Logan, (grant), Swedenborg Pub. Co., Prof. L. G. Carpenter, Mrs. L. G. Carpenter, Library Bureau, Mrs. Sarah E. Howard, Carl Potter, Silver Spruce editors, Herbert Myrick, B. C. Buffum, State Library, Mrs. Frank J. Annis, Mrs. J. Murray, Mrs. Taylor, Mrs. A. M. Hawley, Mr. Davis, and several unknown donors.

FINANCES.

The library has had splendid support and more has been done than we thought possible at first.

We have a small library, as compared with other state institutions, and it will take several years to catch up. During the past year we have purchased books and equipment

which should have been bought during several years, a little at a time, but we were obliged to buy now or miss the opportunity. Of such nature is the set of Library Journal, which cost about $185, and which is well worth $300. The accumulated binding is another example.

The binding has been expensive, but worth the money. The expense has been on two accounts: (1) the number of books waiting to be bound that should have been bound long ago, and (2) the standard of binding requiring something that would stand shelf use for several years. We have a great deal of the other sort of binding in the library which must be rebound soon. We get good binding for a few cents more than the price of weak binding.

If we could have a fee from each student we could increase our library in periodical literature, which is continually called for in reference, and in which we are so very weak; we could buy good reference books which we do not have now, and all the binding and new equipment could be paid for with such money, leaving the rest for new books. The State Normal School library requires $7 from each student each year, but $5 would yield more than $2,000 here. It is hardly in order or correct to compare this library with others, but our results and our influence will be compared inevitably, and most of the libraries have the advantage of a fee of some kind.

The money spent on this library this year is quite out of proportion to that of any previous year, and is probably as much as that of any series of years. It has been large and good and the library has sprung into new life under the impetus of money. All the transactions have been generous and the librarian is grateful and happy in contemplation of it all.

VENTILATION AND HEATING.

Books suffer because of lack of ventilation, and the people in the reading room complain of the same thing. The air is foul and dry most of the time. We can not use hot glue for book binding upstairs and during the winter we can not work down stairs, where there is no heat. I speak of glue with reference to book binding and such work for which we have no room now, and which might net us about $100 a year in larger quarters. The use of paste, glue and tools in

the library, as it is now, must be offensive to students, because of the odor, the flies, and the noise.

THE CATALOGUE AND SHELF LIST.

The catalogue will be completed within another year, we hope, and at that time we shall need two (possibly three) thirty-tray close-construction cabinets, at about $60, for the cards of the catalogue and the shelf list, which, in all, will amount to about seventy-five thousand separate cards.

This card catalogue will be the most valuable assistant in the library.

NEW BOOKS.

We have good collections in the classes of history, literature, fiction, biography and bibliography which are well supplemented by the private collection in the president's office.

We are deficient in reference and scientific books in agriculture, engineering, domestic science, architecture, veterinary science, horticulture, botany, nature study, fine arts and commerce.

Each professor sends lists of books needed, to the library on cards, and we have already a good accumulation of orders in reserve.

PICTURES AND LANTERN SLIDES.

A good collection of photographs and mounted prints goes a long way toward satisfying the constant and growing demand for information. They may be gathered slowly and cost less than books. For five cents each a good collection of one hundred Japanese prints may be bought, and black and white prints range from three-quarters of a cent to twenty-five cents. Photographs and lantern slides cost a little more. Nearly every department in the college needs this supplementary matter. For lectures in art, nature study and engineering they are almost indispensable.

EXTENSION WORK.

There are two sources of frequent inquiry and appeal for help, and, whether we owe it or not, we can do a great deal

for the rural teacher and the ranchman or farmer by supplementing the work of our Experiment Station with that of the library. The expense would be small and the returns very large.

USE OF THE LIBRARY.

While we have made the reading room smaller the use of the library has increased, and the circulation of books for home use has doubled. There is no room for even a part of the students who try to get into the library every period during the morning, and the late afternoon and evening the jam is too great.

The library receives lists of subjects from the faculty and makes reading lists for the students, which are posted on the bulletin boards. The same method applies to the work of the societies or other special calls.

We have made book lists of every description for teachers, schools, clubs, club women and others from Idaho to Arizona, but for the most part we are busy with the students of this college.

It should be mentioned, under the extension work, that the librarian has many calls for personal service, such as lectures and other public work which takes a great deal of time. The library class make this possible, and when the librarian is called away there is always someone in training for the day's work.

The librarian has also been useful (and glad to be so) in the matter of free-hand drawing, which included teaching in the sub-freshman class every day for two hours. The librarian respectfully suggests that it would be less expensive to hire this work done by someone else so that he could be pushing the work of the catalogue. The work is very pleasant and agreeable in either case, and the judgment of the president should be sufficient.

The librarian appreciates all that has been done for the library, and thanks are due and overdue.

THE STATE AGRICULTURAL COLLEGE
OF COLORADO

THE FIFTEENTH ANNUAL REPORT

OF

The Agricultural Experiment Station

For 1902

THE AGRICULTURAL EXPERIMENT STATION.

FORT COLLINS, COLORADO.

THE STATE BOARD OF AGRICULTURE.

		Term Expires.
Hon. B. F. Rockafellow	Canon City	1903
Hon. J. A. Newcomb	Golden	1903
Hon. P. F. Sharp, President	Denver	1905
Hon. Jesse Harris	Fort Collins	1905
Hon. Harlan Thomas	Denver	1907
Mrs. Eliza F. Routt	Denver	1907
Hon. James L. Chatfield	Gypsum	1909
Hon. B. U. Dye	Rocky Ford	1909
Governor James B. Orman, President Barton O. Aylesworth		Ex-Officio

EXECUTIVE COMMITTEE IN CHARGE.

P. F. Sharp, Chairman.

B. F. Rockafellow. Jesse Harris.

STATION STAFF.

L. G. Carpenter, M. S. ..... Director and Irrigation Engineer
C. P. Gillette, M. S. ..... Entomologist
W. P. Headden, A. M., Ph. D. ..... Chemist
B. C. Buffum, M. S.* ..... Agriculturist
Wendell Paddock, M. S. ..... Horticulturist
R. E. Trimble, B. S. ..... Assistant Irrigation Engineer
E. D. Ball, M. S.** ..... Assistant Entomologist
A. H. Danielson, B. S. ..... Assistant Agriculturist
F. M. Rolfs, B. S. ..... Assistant Horticulturist
F. C. Alford, B. S.*** ..... Assistant Chemist
Earl Douglass, B. S. ..... Assistant Chemist
H. H. Griffin, B. S. ..... Field Agent, Arkansas Valley, Rocky Ford
J. E. Payne, M. S. ..... Plains Field Agent, Fort Collins

OFFICERS.

President, Barton O. Aylesworth, A. M., LL. D.

L. G. Carpenter, M. S. ..... Director
A. M. Hawley ..... Secretary
A. D. Milligan ..... Stenographer and Clerk

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*Resigned September 1 to become director Wyoming Agricultural Experiment station.

**Resigned October 15 to become professor of biology, Utah Agricultural College.

***Resigned October 1.

LETTER OF TRANSMITTAL.

TO HIS EXCELLENCY,

JAMES B. ORMAN,

GOVERNOR OF COLORADO.

In accordance with the act of Congress providing for the establishment of agricultural experiment stations, I have the honor to present herewith the fifteenth annual report as director.

Respectfully submitted,

L. G. CARPENTER,
Director.

The Agricultural Experiment Station,
State Agricultural College,
Fort Collins, Colorado,
December, 1902.

SECRETARY'S FINANCIAL REPORT OF THE COLORADO AGRICULTURAL EXPERIMENT STATION FOR FISCAL YEAR ENDING JUNE 30, 1902.

DR.	U. S. Fund	Special Fund	Total
From the Treasurer of the United States, as per act of Congress, approved March 2, 1887	$15,000 00	.....	.....
Balance July 1, 1900	.....	$ 298 40	.....
Farm products	.....	1,036 26	.....
Miscellaneous	.....	1,691 43	$18,026 09
CR.			
Salaries	$10,537 81	$ 923 08	$11,460 89
Labor	396 70	43 20	439 90
Publications	1,275 18	257 20	1,532 38
Postage and stationery	145 53	149 54	295 07
Freight and express	147 86	1 49	149 35
Heat, light, water, power	.....	.....	.....
Chemical supplies	15 55	26 87	42 22
Seeds, plants, sundry supplies	53 04	20 90	73 94
Fertilizers	59 50	.....	59 50
Feeding stuffs	.....	.....	.....
Library	96 18	21 69	117 87
Tools, implements, machinery	104 79	.....	104 79
Furniture and fixtures	88 65	.....	88 65
Scientific apparatus	494 47	36 61	531 08
Live stock	256 00	.....	256 00
Traveling expenses	1,278 77	79 56	1,358 33
Contingent expenses	40 00	355 00	395 00
Building and repairs	9 97	606 43	616 40
	$15,000 00	$2,521 57	$17,521 57
Balance June 30, 1902		504 52	504 52
Total	$15,000 00	$3,026 09	$18,026 09

A. M. HAWLEY,
Secretary.

REPORT OF THE DIRECTOR.

The Agricultural Experiment Station, in accordance with the law of Congress, is made a department of the State Agricultural College. By its fundamental act the Agricultural College was required to do considerable experimental work, so that the passage of the Hatch act by Congress did not inaugurate agricultural experimentation at the Agricultural College, but endowed work for that particular purpose. In furnishing this annual income, the government made certain conditions, which were accepted by the state legislature by act of 1889.

The Experiment Station is the special organization for carrying on the work of experimentation and as distinct from that of teaching. Nearly every member of the staff of the Experiment Station is also on the staff of instruction, and where this is the case, the salary is borne jointly by the two funds. While sometimes the demands of the station work and those of instruction seem to conflict, there is no doubt that the association of the college and station has been of benefit to each; to the station because it has thus found an organization already in existence, with high ideals, with equipment of building and libraries, and much apparatus available for investigation; and to the College because it secures the inspiration which comes only from contact with scientific problems at first hand. The connection has enabled both to secure men which neither could alone. It has also enabled the College to meet one of the purposes of institutions of learning—the development as well as the dissemination of knowledge.

The station has its own executive head, termed the Director. Since September, 1899, this has been separate from the presidency of the College, as the experience of other states has shown to be desirable. The Director is the official head of the station, has charge of matters relating to it, the au-

thorization of expenditures, preparation of plans in conference with the staff, and subject to the approval of the executive committee. As the station as a whole is termed a department of the College, the branches of the station have been termed sections, directed by a specialist. The officers are the agriculturist, the horticulturist, the chemist, the entomologist and the irrigation engineer, with assistants. There are two field agents—one for the Arkansas Valley at Rocky Ford, one for the plains.

The regulations of the station, as established by the State Board of Agriculture, and substantially following the suggestions laid down by Director A. C. True, of the office of experiment stations of the Department of Agriculture, are given in full in the thirteenth annual report, published in 1900. As compared with the previous loose organization, they place added responsibility on the Director, and give him correspondingly greater power.

The intent of the regulations is to unify the work of the station, and to enable its work to be more effective. Colorado is so rich a scientific field that every worker is tempted to attempt more investigations than time or means will permit to be carried out successfully. Colorado has an area nearly equal to the combined areas of Rhode Island, Connecticut, Massachusetts, Vermont, New Hampshire, Maine and New York. There is a much greater difference in elevation, a greater diversity of climate, as great a difference in the character of agriculture. Irrigation brings in an entirely new class of questions. The plant and insect pests are largely new, or arise from unusual development under the new conditions. And, besides the ordinary class of scientific investigation, the lack of accumulated experience, even the lack of knowledge of the agricultural characteristics or possibilities of the state, render unusually useful, if it does not fully justify, a line of inquiry for which there is no occasion in older communities.

There is, therefore, as great, if not a greater, variety of problems before the station than in the states mentioned. As the general government appropriates the same sum to each state, irrespective of its size, there is then $105,000 given by the government to agricultural investigation in those states of the same combined area as Colorado. But even this has been insufficient, and, from local sources, from the legislatures and local sources of revenue, this sum was in-

creased by $160,000, and two additional stations established by state support.

We have $15,000 slightly increased from minor sources for the problems of Colorado.

In view of the limited number of inquiries that can be taken up it is especially desirable that the station should be in touch with the conditions and interests of the different parts of the state. Only thus can we hope to be able to choose the lines of inquiry which will be of the greatest service. As it is, there are portions of the state nearly as large as Massachusetts in which no member of the station staff has ever been.

With a fixed income and an almost unlimited field the policy of confining the station to a relatively limited number of lines of inquiry is evidently the only possible one. We must omit or postpone many questions, or take them up incidentally. It is desirable to choose more especially the questions peculiar to our state, using the results of other states, where applicable, confining our efforts principally to those lines in which we can derive no help from others.

There are five sections in the station—the agricultural, horticultural, chemical, entomological, irrigation engineering. In addition to these there are two field agents, who report directly to the director. While there are many invitations to extend the lines of work, sound business sense seems to require that conditions for the most effective work should be arranged for those we have.

The scientific worker requires peculiar qualities. He must have a special education, often on broad lines, for effective work. He must also have a scientific imagination, such as can plan investigations and construct working hypotheses, and see the results of investigation. He must be possessed of patience and perseverance to carry through an enormous amount of drudgery that his conclusions may be based on a firm foundation; persistence to continue a line of work for years, if need be; an intellectual honesty, to be able to see and report facts as they are, even if they contradict his most cherished hypothesis; a love for his work for his own sake, and, as a rule, an indifference to public reward or approbation. In the agricultural experiment stations he must also have an appreciation of the questions whose solution are of importance to agricultural interests, for while an adherence

to the so-called practical inquiries is often the least productive of practical results, a lack of sympathy with the application of his investigations disqualifies him for the most effective station service. Besides these qualifications, a station worker needs to have under our conditions some ability to teach, and to present his results, both by writing and by public address.

The best conditions for scientific activity are also usually peculiar. It is generally true that the productive hours useful for comparison and analysis of data, for developing results, and, in general, applying scientific imagination are few in number. It is akin to literary production where the almost universal experience is that the highest quality of work can be produced for only a few hours per day. This does not mean that other hours, often long, may not be given to the labors of investigation. During such time he needs to be free from distraction for the best results. It is for such reasons that routine work often interferes with and prevents productive work, for the hours available for such purpose often can not be made to fit into a routine. It is poor economy for the time of capable investigators to be used in work like typewriting, which can be done with cheaper help. Some working fund is also needed to be available at any time for special investigations which emergencies may require, to assist in any special line as occasion requires, and to render it possible for the staff to investigate many questions in different parts of the state as they arise. As it is the margin between the income and the expenses which may be classed as fixed or semi-fixed is small. Except for the indirect help received through the connection with the Agricultural College because of the very proper view that the station is the research portion of the college, and a proper part of its activities, the work of the station would be lessened.

The activities of the station are shown in the reports of the various members of the staff forming part of this report. These do not show the full extent, nor the scope of the inquiries under way. While the principal work is done at the central station, it is not confined there. The constant effort of the present management has been to render it possible to take up lines of inquiry in other portions of the state when conditions required it.

Only a partial list can here be given. Experiments on the development of special varieties of wheat have been continued in the San Luis valley, fruit investigations at Grand Junction, Delta, and the South Fork, trials with potatoes at Greeley, seepage investigations over several hundred miles of streams, trips of the entomologists down the Platte and to the fruit sections of the state, the trips of the field agents on the Arkansas, and on the plains give a small record of trips of investigation which have required thousands of miles of wagon and railroad travel during the year.

The results of the investigations reach the public in various ways. The publications form one and the most common way, but not the only one. Public addresses at farmers' institutes, and elsewhere, conferences at different places with fruit men, irrigation men, prospective settlers, and, more time-consuming still, the correspondence. This is welcomed, and while inquiries are almost infinitely varied, and often have no relation to our work, we always answer them or attempt to put the inquirers in the way of getting the information desired. The increase in the draft on time from this source is shown by the fact that the expense for postage for the past three years has been over five times that of the previous three years.

But the most effective means for the distribution of the results is through the bulletins. There are, however, four classes of publications, as follows:

1. *Bulletins.* These are issued from time to time giving results of the investigations of the Experiment Station and are sent to all on the regular mailing list.

2. *Press Bulletins.* These include results which it is thought best to report at once, and are brief enough to issue in the press. They are sent to all Colorado newspapers and to special lists of persons, according to the subject matter.

3. *River Press Bulletins.* These give records of the Poudre river, and are reported weekly during the irrigation season. They are issued more especially to those interested in irrigation in the Poudre valley. There is also some demand for them from other portions of the state.

4. *Annual Reports.* These are required by law to be complete statements of the work of the station made to the Governor. The edition is limited, and in consequence it is not sent to the general mailing list. This also does not make

a desirable place for information requiring general distribution. The tendency is to make it a place for technical progress reports, or matter not adapted to bulletins.

The principal publications are the bulletins. They are now printed in editions ranging from 8,000 to 10,000. As the work of the station becomes more useful and more in demand, there is a corresponding increase in the expense required for printing.

The following is the list of bulletins issued during the past year:

No. 67. The Distribution of Water. Powers and Duties of Irrigation Officials in Colorado. 32 pp., by Hon. H. N. Haynes, of Greeley. This gives a summary of the principles of the law relating to the duties of officials having to do with the distribution of water. It also includes a tabular statement of irrigation administration by the director.

No. 68. Pasture Grasses, Leguminous Crops. Cantaloupe Blight in 1901. 14 pp., by H. H. Griffin, of the Arkansas Valley substation.

No. 69. Plant Diseases of 1901. 24 pp., 9 plates, by Wendell Paddock.

No. 70. Potato Failures, A Preliminary Report. 20 pp., 12 plates, by F. M. Rolfs. This bulletin calls attention to Rhizoctonia Solani.

No. 71. Insects and Insecticides. 40 pp., 4 plates, 27 figures, by C. P. Gillette. This includes in a compact form the principal insects attacking the different plants. The insecticides are also classified and arranged so that reference can be made from the insect to the remedy.

No. 72. Soil Study, Part IX. The Ground Waters, 48 pp., by Dr. Wm. P. Headden. This is a continuation of bulletins Nos. 46, 58, and 65. This includes a study of the ground waters in the plat which had formed the subject of study in the three preceding bulletins.

No. 73. Part 1. The Feeding Value of Beet Pulp. Part II. Feeding Beet Pulp and Sugar Beets to Cows, by B. C. Buffum and C. J. Griffith. This gives a general summary of general trials of feeding beets and beet pulp made elsewhere, and especially to feeding pulp to cows here.

No. 74. Swine Feeding in Colorado. 30 pp., 2 plates, by B. C. Buffum and C. J. Griffith. This includes results

of three classes of experiments. Beet pulp and sugar beets for fattening hogs; home grown grains vs. corn for fattening hogs; and other trials with corn, barley, alfalfa and wheat.

No. 76. Feeding Beet Pulp to Sheep. 10 pp., by H. H. Griffin, of the Arkansas Valley substation. This gives a result of feeding beet pulp to 250 sheep in two lots; one that was fed pulp and one that was fed corn.

Press Bulletins.

No. 12. Potato Failures. By W. Paddock. Gives results reported at greater length.

No. 13. The Best Time To Cut Alfalfa. By Wm. P. Headden.

The Poudre river bulletins were first issued this year in April and continued weekly until October 21, making 20 issues in all.

The following is a list of the publications exclusive of the annual reports and the river bulletins issued previous to this year.

No.	TITLE.	AUTHOR.
1	Reports of Experiments in Irrigation and Meteorology	Elwood Mead
2	Report of Experiments with Grains, Grasses and Vegetables	A. E. Blount
3	Concerning the Duties of the Secretary and Distribution of Seeds	Frank J. Annis
4	Experiments with Potatoes and Tobacco	James Cassidy
5	Experiments in the Apiary	C. M. Brose
6	Notes on Insects and Insecticides	James Cassidy
7	Potatoes and Sugar Beets	James Cassidy David O'Brine
8	Alfalfa: Its Growth, Composition and Digestibility	David O'Brine James Cassidy
9	Soils and Alkali	David O'Brine
10	Tobacco	David O'Brine James Cassidy
11	Sugar Beets	C. L. Ingersoll 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

No.	TITLE	AUTHOR.
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
	"A" Special Bulletin Concerning Subjects Investigated by the Experiment Station.	
19	Observations Upon Injurious Insects, 1891	C. P. Gillette
20	The Best Milk Tester; The Influence of Food on Milk Fat	W. J. Quick
21	Sugar Beets; Potatoes; 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	Garden and Farm Notes for 1893	
	Seeding, Tillage and Irrigation	
27	The Measurement and Division of Water, 3d Ed	L. G .Carpenter
28	The Russian Thistle	C. S. Crandall
29	Strawberries and Grapes; Notes on Varieties	M. J. Huffington
30	Farm Notes for 1894; Notes on Tomatoes	W. W. Cooke F. L. Watrous M. J. Huffington
31	(Technical.) The Hemiptera of Colorado	C. P. Gillette C. F. Baker
32	*Sheep Feeding in Colorado	W. W. Cooke
33	**Seepage or Return Waters from Irrigation	L. G. Carpenter
34	*Cattle Feeding in Colorado	W. W. Cooke
35	**Alfalfa	Wm. P. Headden
36	**Sugar Beets	W. W. Cooke Wm. P. Headden
37	*(Technical.) The Birds of Colorado	W. W. Cooke
38	**Sheep Scab; A Few Insect Enemies of the Orchard	C. P. Gillette
39	**A Study of Alfalfa and Some Other Hays	Wm. P. Headden
40	Barley	W. W. Cooke
41	Blight and Other Plant Diseases	C. S. Crandall
42	Sugar Beets in Colorado in 1897	W. W. Cooke Wm. P. Headden
43	**(Technical.) Colorado Lepidoptera, Etc	C. P. Gillette
44	*(Technical.) Further Notes on the Birds of Colorado	W. W. Cooke
45	*The Loss of Water from Reservoirs by Seepage and Evaporation	L. G. Carpenter

No.	TITLE	AUTHOR.
46	*A Soil Study. Part I. The Crop Grown: Sugar Beets	Wm. P. Headden
47	*Colorado's Worst Insect Pests and Their Remedies	C. P. Gillette
48	Losses from Canals from Filtration or Seepage	L. G. Carpenter
49	*Meteorology of 1897, with Illustrations	L. G. Carpenter R. E. Trimble
50	Notes on Plum Culture	C. S. Crandall
51	*Sugar Beets in Colorado in 1898	W. W. Cooke
52	*Pasturing Sheep on Alfalfa; Raising Early Lambs	W. W. Cooke
53	Strawberries	C. H. Potter C. S. Crandall
54	*Apiary Experiments	C. P. Gillette
55	**Forests and Snow	L. G. Carpenter
56	Birds of Colorado	W. W. Cooke
57	Farm Notes	W. W. Cooke
58	A Soil Study. Part II. The Crop Grown: Sugar Beets	W. P. Headden
59	Field Notes of Trips in Eastern Colorado	J. E. Payne
60	Bush Fruits	Carl H. Potter
61	Bromus Inermis	F. L. Watrous H. H. Griffin J. E. Payne
62	Cantaloupes	H. H. Griffin
63	**Sugar Beets. A Resume of Work Done by Colorado Agricultural Experiment Station	W. P. Headden
64	**Press Bulletins Nos. 1 to 11, inclusive.	
65	**Soil Study. Part III. The Soil	W. P. Headden
66	**Relation of Bovine to Human Tuberculosis. Tuberculin Tests of College Herd	G. H. Glover B. C. Buffum

PRESS BULLETINS.

No.	TITLE	AUTHOR.
1	The Sugar Beet Caterpillar	C. P. Gillette
2	Colorado Sunshine	L. G. Carpenter
3	Beet Army Worm	C. P. Gillette
4	The Cantaloupe Blight	H. H. Griffin
5	The Rusian Thistle as Forage	J. E. Payne
6	A So-Called Blight Cure	C. H. Potter
7	The Seepage Measurements of the Experiment Station	L. G. Carpenter
8	Potato Failures	W. Paddock F. M. Rolfs
9	Sunshine for 1900	L. G. Carpenter

No.	TITLE	AUTHOR.
10	Conclusions Relative to the Culture of Sugar Beets	W. P. Headden
11	How to Fight the Codling Moth	C. P. Gillette
12	Potato Features	W. Paddock
13	The Best Time to Cut Alfalfa	Wm. P. Headden
14	Seepage Measurements, Boulder Creek	L. G. Carpenter
15	Seepage Measurements, Uncompahgre	L. G. Carpenter

SUB-STATIONS.

The Department of Agriculture has held that permanent sub-stations can not be maintained from the appropriation furnished by Congress, and that the appropriation for the purpose of *an* experiment station does not mean several. This, however, does not prevent the station carrying on investigations where the conditions require. The establishment of the sub-station was a recognition of the diverse questions of different parts of the state, and a feeling that they needed to be investigated in the various localities. But the sub-stations have generally proved the least effective method of accomplishing the desired results, at least unless supported with abundant funds. They require much expense in fixed plant, such qualities in a superintendent as are difficult to find in a number of men at any price. The result, wherever tried, has been to restrict outside work, instead of increasing it, as was the desire. The sub-stations in this state for the period of their existence practically took one-third of the funds that have been received to date from the general government, and took much more than one-third for the period when they were operating. While, under the ruling of the Department, it is not possible to maintain permanent sub-stations, outside or co-operative investigation is not affected, but rather increased, and the station activities become more flexible because they may be directed to the part of the state where aid is most needed.

The condition of the sub-stations has not materially changed since the last report. The one at Monte Vista, whose property still belonging to the station was sold last year, is partly paid for. The improvements were sold for $1,900, of which $450 has been paid, and the remainder is to be paid through a period of three years. One note is now due. The interest on the whole amount has been paid, and the good faith of the purchaser has been shown. As crops in that

region have been shortened by low water this year it has not been considered desirable to be harsh in pushing payment.

The Plains sub-station is still under our direction. The Superintendent now makes his headquarters at Fort Collins. Having been set free from the confining supervision, he has been able to give his time to the questions of the Plains. This has already resulted in bulletin 50, and another one soon to be issued. The land is possessed by the station under conditional title. There are some improvements. During the year the house and land was leased to Mr. J. B. Robertson on the condition of furnishing record of the operations. These are given in his report. The station gains almost as full information as when a paid agent was there all the time.

The land at the station at Rocky Ford is now reduced to forty acres. The remaining 160 acres were transfered to the state, as reported in the report of last year. The improvements were sold and have been partially paid for. It was claimed by the donors of the water rights used by the place that the gift was conditional, and with the cessation of use of the land as an experiment station that it should be returned to the original donors. After fully hearing the claims and the evidence, examining the original papers, the Board of Agriculture decided that the claim was just, and provided for the return to the original donors. As in one or two cases the original donors had died, on request of the others it was transferred to a trustee, who became responsible for the proper distribution of the stock. Six shares were retained for use on land still under the control of the station. Of this portion some is retained for the use of the station. It was finally decided to accept the offer of Mr. Griffin by which certain field experiments were to be carried on and reported, he to assume the expense connected therewith. His report as field agent is given later in this report.

CHANGES IN THE STAFF.

The Station has been fortunate during its organization to have had relative few changes in the staff of responsible workers. During the year Professor B. C. Buffum was invited to return to the Wyoming Experiment Station, and to assume the directorship in addition to his former responsible duties. He resigned his work, to take effect September 1.

Professor Buffum was formerly connected with that Station, and in both connections his active work and enthusiastic interest was an inspiration to his co-workers. The Station likewise regrets to lose E. D. Ball, who for several years has been assistant entomologist. Professor Ball leaves, to take the chair of biology in the Utah agricultural college. Mr. F. C. Alford, assistant to the chemist, also leaves, to continue chemical study in the East. The work of Professor Buffum in the Station is continued by his assistant, Mr. Danielson, and that of Mr. Ball is assumed by Professor S. A. Johnson, of Denver.

RECOGNITION OF THE WORK OF THE STATION.

The bulletins have been in increasing demand. A large number are called for from other states and countries. There is an increasing number of references to our investigations. Many of the bulletins have been printed in full in various and varied publications, and in abstract in many others. The Station received a diploma for contributing to the exhibit from experiment stations at the Paris exposition. One of the workers was recognized at the same exposition by the award of a gold medal, this Station being, in that respect, one of the few thus honored.

The general outlook for the Station work is bright. The field of work is unexcelled. The College authorities are in sympathy with the work, and in general it is meeting with warm support.

Respectfully submitted,

L. G. Carpenter,
Director.

PLATE I. 1, border of alfalfa field devastated by locusts; 2, cornfield devastated by locusts; 3, hopper-dozer (for end view see Plate II). Original.

INVENTORY.

COLORADO AGRICULTURAL EXPERIMENT STATION.

NOVEMBER, 1902.

DIRECTOR'S OFFICE.

Office fixtures and equipment	$1,337 53	
Stationery supplies	127 10	
Half tones and zinc etchings	127 05	
Bulletin library	636 50	
		$ 2,228 18

ENTOMOLOGICAL SECTION.

Laboratory supplies	$ 89 05	
Entomological supplies	72 00	
Insecticides and insecticide apparatus	83 30	
Apiary	137 95	
In charge (microscopes, etc.)	310 00	
		$ 692 30

HORTICULTURAL SECTION.

Glassware	$ 3 25	
Photographic apparatus and supplies	97 95	
Instruments	43 00	
Herbarium	1,630 00	
Tools	34 55	
Miscellaneous	25	
		$ 1,809 00

CHEMICAL SECTION.

Two balances		$ 150 00

AGRICULTURAL SECTION.

Implements and tools	$ 134 70	
Office equipment and miscellaneous	486 00	
		$ 620 70

METEOROLOGICAL AND IRRIGATION ENGINEERING SECTION.

Meteorological instruments	$ 538 75	
Office fixtures	280 13	
Stationery, books, maps, etc	30 55	
Irrigation and hydraulic apparatus	445 45	
Photographic supplies and negatives	168 87	
Miscellaneous	164 68	
		$ 1,628 43
Library		1,540 00
Total main station		$ 8,668 61

ARKANSAS VALLEY SUB-STATION.

Apparatus, fences, etc	$ 85 50	
Buildings and improvements	1,570 00	
Live stock, implements and tools	408 45	
Photographic apparatus	25 00	
Miscellaneous	89 25	
Forty acres land, water rights (conditional)	6,600 00	
		$ 8,778 20

PLAINS SUB-STATION.

Fences	$ 132 00	
Dwelling house and barn	800 00	
Three thousand feet galvanized pipe (iron)	210 00	
Tools and miscellaneous	18 50	
One hundred and sixty acres of land (title conditional)	160 00	
		$ 1,320 50
Total experiment station		$18,767 31

EXCHANGES.

BOOKS, PAMPHLETS, SCIENTIFIC PROCEEDINGS, ETC.

ARGENTINE REPUBLIC:

Anales del Museo Nacional de Buenos Aires. Dr. Carlos Berg.

AUSTRALIA:

Department of Agriculture, Ottawa.
Department of Agriculture, Ontario.

ENGLAND:

Journal of Royal Horticultural Society, London.
Report of Demonstration Farm, Cockle Park, Morpeth.

FINLAND:

Skadeinsekters Upptradande I Finland.

FRANCE:

La Grele et La Defense des Recoltes. Station Viticole de Villefranche.
V. Vermorel. Les Pieges Lumineux et la Destruction des Insectes Nuisibles. Villefranche.
V. Vermorel. Agenda Agricole et Viticole, 1902.

GERMANY:

Dr. C. Brick. Botanisches Museum Abtheilung fur Planzenschutzes.
Dr. C. Parrot. Ornithologischen Vereins Munchen fur 1899 and 1900.

INDIA:

A. Lehmann. Report Agricultural Chemist, Madras.

MEXICO:

Boletin de la Red Meteorologica. Toluca, Mexico.

NETHERLANDS:

Prof. Dr. J. Ritzema Bos and G. Staes, Tijdschrift over Plantenziekten, Amsterdam.

NEW SOUTH WALES:

Botanical Gardens, Sydney.

PERU:

Las Montanas de Ayacucho, Lima.

WEST INDIES:

Prof. J. P. d'Albuquerque. Agricultural Work.

UNITED STATES:

American Philosophical Society, Philadelphia, Pa.
American Southdown Breeders' Association, Quincy. Ill.
Bulletin of Agriculture, Raleigh, N. C.
Contributions to Biology, Stanford University, California.
Department of Agriculture, Harrisburg, Pa.
Department of Agriculture, Richmond, Va.
Dunn County School of Agriculture, Menominee, Wis.
Elisha Mitchell Scientific Society, Chapel Hill, N. C.
El Paso County Horticultural Society, Colorado Springs, Colo.
Florida Monthly Bulletin, Tallahassee, Florida.
Hadley Climatological Laboratory, University, Albuquerque, N. M.
Journal of Applied Microscopy, Rochester, N. Y.
John Crerar Library, Chicago, Ill.
Kansas State Horticultural Society, Topeka, Kan.
Lloyd Library, Cincinnati, Ohio.
Laboratory Bulletin, Oberlin, Ohio.
Missouri Horticultural Society, St. Joseph, Mo.
Massachusetts Horticultural Society, Boston, Mass.
Missouri Botanical Gardens, St. Louis, Mo.
Minnesota Botanical Studies, Minneapolis, Minn.
New York Botanical Gardens, New York City, N. Y.
New York State Museum, New York, N. Y.
Public Library, Boston, Mass.
Report on Births, Deaths, Marriages and Divorces in the State of Maine, for 1900, Augusta, Maine.
State Board of Agriculture, Topeka, Kan.
State Board of Agriculture, Boston, Mass.
State Board of Agriculture, Providence, R. I.
State Board of Agriculture, Albany, N. Y.
State Board of Agriculture, Richmond, Va.
State Board of Health, Trenton, N. J.
State Board of Horticulture, Des Moines, Iowa.
State Board of Entomology, Athens, Ga.
State Board of Horticulture, Minneapolis, Minn.
Southern Nut Growers' Association, Ocean Springs, Miss.
United States Weather Bureau:
    Nebraska Section.
    Illinois Section.
    Colorado Section.
    New Mexico Section.

United States Weather Bureau:—Continued—
Minnesota Section.
Tennessee Section.
Wyoming Section.
Oregon Section.
West American Scientist, San Diego, Cal.

SCIENTIFIC PERIODICALS.

Insect World, Gifu, Japan.
Kongl. Landtbrusk-Akademiens Handlinger och Tidskrift, Stockholm, Sweden.
Le Naturaliste Canadien, Chicoutimi, Quebec, Canada.

AGRICULTURAL JOURNALS.

Agricultural Experiments, Minneapolis, Minn.
Agricultural Epitomist, Spencer, Ind.
Agricultural Gazette, Sydney, New South Wales
American Agriculturist, New York, N. Y.
American Hay, Flour and Feed Journal, New York, N. Y.
American Fertilizer, Philadelphia, Pa.
Acker und Gartenbau-Zeitung, Milwaukee, Wis.
Beet Sugar Gazette, Chicago, Ill.
Breeders' Gazette, Chicago, Ill.
Breeders' Monthly, New York, N. Y.
Boletin da Agricultura, Sao Paulo, Brazil.
Chicago Daily Drovers' Journal, Chicago, Ill.
Chicago Live Stock World, Chicago, Ill.
Dakota Farmer, Aberdeen, South Dakota.
Daily Drovers' Telegram, Kansas City, Mo.
Dairy and Produce Review, San Francisco, Cal.
El Agricultor Mexicano, C. Juarez, Mexico.
Elgin Dairy Report, Elgin, Ill.
Farmers' Guide, Huntington, Ind.
Farmers' Voice, Chicago, Ill.
Farmers' Advance, Chicago, Ill.
Farmers' Tribune, Des Moines, Iowa.
Farmers' Institute, Chicago, Ill.
Farmers' Advocate, London, Ontario, Canada.
Farmers' Review.
Flour and Feed, Waukegan, Ill.
Feather, The, Washington, D. C.
Homestead, Des Moines, Iowa.
Inter-Mountain Farmer, Salt Lake City, Utah.
Indiana Farmer, Indianapolis, Ind.
Kansas Farmer, Topeka, Kan.
Live Stock Reporter, St. Louis, Mo.

Live Stock Record, Chicago, Ill.
Milk News, Chicago, Ill.
Missouri Valley Farmer, Topeka, Kan.
Modern Farmer, St. Joseph, Mo.
Mirror and Farmer, Manchester, N. H.
National Farmer, Winona, Minnesota.
National Stockman and Farmer, Chicago, Ill.
National Farmer and Stockgrower, St. Louis, Mo.
Ohio Farmer, Cleveland, Ohio.
Operative Miller, Chicago, Ill.
Orange Judd Farmer, New York, N. Y.
Practical Farmer, Philadelphia, Pa.
Prairie Farmer, Chicago, Ill.
Pacific Coast Fruit World, San Francisco, Cal.
Practical Fruit Grower, Springfield, Mo.
Rural New Yorker, New York, N. Y.
Reliable Poultry Journal, Quincy, Ill.
Ruralist, Gluckheim, Md.
Rural World, London, Eng.
Ranch News, Denver, Colo.
Sugar Beet, Philadelphia, Pa.
Sanitary Inspector, Augusta, Maine.
Southern Fruit Grower.
Southern Planter, Richmond, Va.
Southern Farm Magazine, Baltimore, Md.
Station Farm and Dairy, Sydney, New South Wales.
Trade, The, Baltimore, Md.
Up-To-Date Farming and Gardening, Indianapolis, Ind.
West Virginia Farm Review, Charleston, W. Va.
Wallace's Farmer, Des Moines, Iowa.
Western Fruit Grower, St. Joseph, Mo.

GENERAL NEWSPAPERS.

Colorado Springs Gazette, Colorado Springs, Colo.
Chronicle-News, Trinidad, Colo.
El Paso County Democrat, Colorado Springs, Colo.
Fondis Herald, Fondis, Colo.
Golden Globe, Golden, Colo.
Grand Valley Sun, Grand Junction, Colo.
Holly News, Holly, Colo.
Montrose Press, Montrose, Colo.
Public Ledger, Philadelphia, Pa.
Republic, St. Louis, Mo.
Salt Lake Herald, Salt Lake City, Utah.
Sun, The, Baltimore, Md.

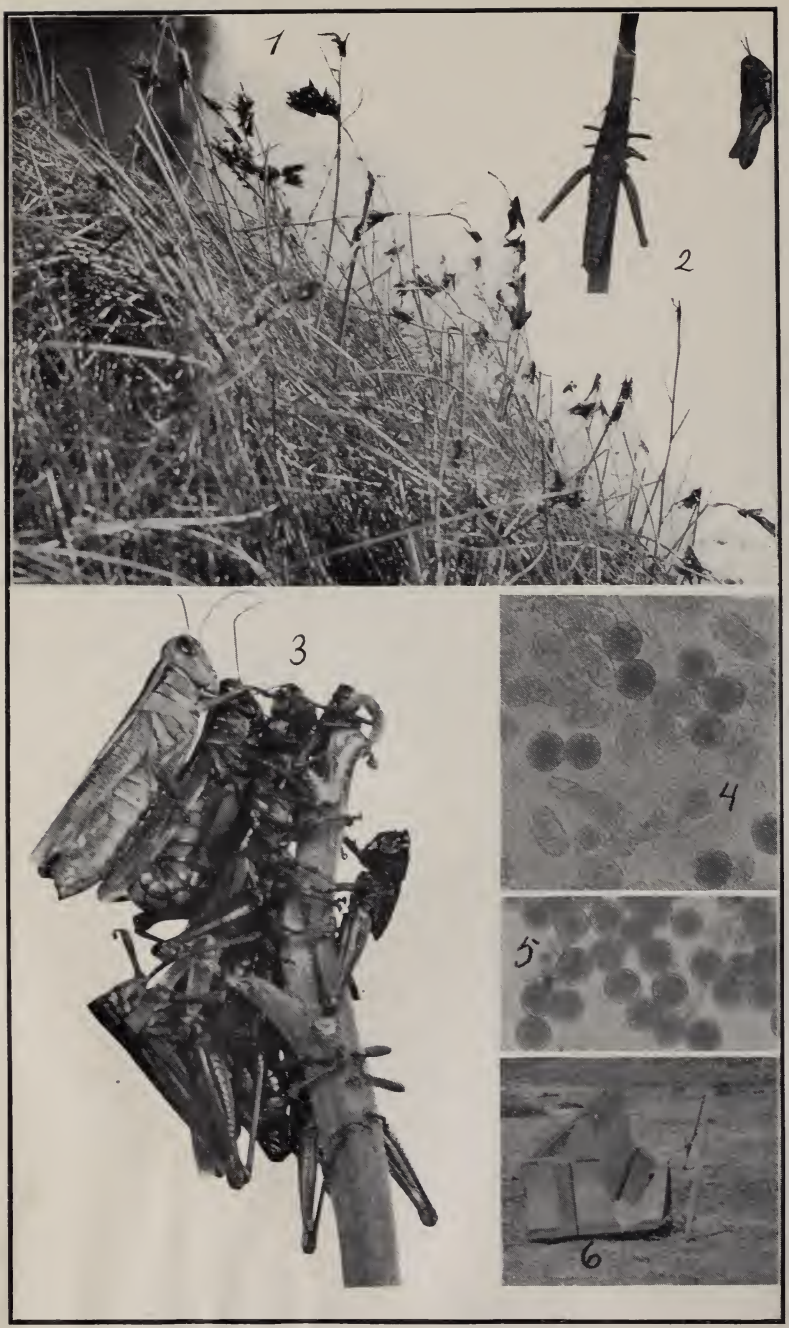

PLATE II. 1, locusts, killed by a disease, clinging to the side of an alfalfa stack; 2, two of the locusts, natural size, dead from the disease; 3, a cluster of eleven of the locusts, natural size, all dead from the disease; 4 and 5, the organism, in two stages of development, that produces the disease (greatly magnified); 6, end view of hopper-dozer (for front view see plate I). Original.

REPORT OF THE ENTOMOLOGIST.

I have the honor to present herewith the annual report of the entomological section of the Experiment Station for the year just closing.

The past year has been a very ordinary one, as far as the severity of insect depredations is concerned. A few injurious species, however, have been found for the first time within the state, and a few species that have been with us for years have been rather more than usually abundant.

Among those that I have to report for the first time is a saw-fly upon strawberries, an insect burrowing into and destroying the fruit of grapes, and bark beetles destroying pine trees in the mountains. Of those that have been more than usually abundant, might be mentioned plant lice in general, and especially the apple and snowball lice; grasshoppers in several localities in the state; the cottony maple scale in some of the parks in Denver and in Colorado Springs; and upon sugar beets, a leaf-eating beetle (*Monoxia puncticollis*).

The experiments with codling moth were interfered with, or prevented, by the fact that the experimental orchard was in a district that was hailed out last year so there were no apples maturing, and, as a result, there were no codling moths in the orchard to speak of the past summer.

The first report upon the *Orthoptera* (grasshoppers) of the state is being prepared for publication.

Bulletin No. 71, upon "Insects and Insecticides," was published from this section early in the year.

A fuller report upon the insects of the year, together with an invoice of the property in this section, and an outline for the work proposed for 1903, are appended herewith.

All of which is very respectfully submitted.

C. P. GILLETTE.

Fort Collins, Colorado, December 6, 1902.

INSECTS OF THE YEAR.

Probably there are no other insect enemies in Colorado causing as heavy annual losses to the farming classes as is caused by locusts (grasshoppers). The extent of damage seems to be comparatively constant year by year, though the number of locusts in a given locality fluctuates considerably. The causes for this fluctuation are chiefly weather conditions, parasitic enemies and contagious diseases.

While the more destructive locusts are general feeders, and may attack almost any vegetable, they have their preferences in the bill of fare offered them. Among the crops that most often suffer from their depredations are alfalfa, corn, potatoes, cabbages, onions and all kinds of grain. Beet leaves are also well suited to their tastes.

Plate I, Figure 1, shows a very common condition in alfalfa fields in Colorado. The photograph from which the cut was made was taken near Fort Collins, and shows a border from twenty to forty feet wide about the margins of the field where the alfalfa has been almost completely killed out by the locusts, its place being taken by squirrel-grass and other weeds. The sweet clover along the fence is also stripped of its leaves, making it appear white in the picture. Figure 2 is a photograph of a corn field near Julesburg, taken in August, 1902, by Mr. E. D. Ball, showing the stalks stripped of their leaves by the locusts. The differential locust (*Melanoplus differentialis*) and the two-lined locust (*M. bivittatus*) being the chief depredators. The red-legged locust (*M. femur-rubrum*) was also abundant.

REMEDIES.

Wherever possible plow, during fall or early spring, borders of fields, ditch banks and other locations where the eggs are deposited in large numbers. If plowing is impossible harrow thoroughly. Poisoned bran about potato, beet and cabbage patches or in gardens, and among small fruits, will kill large numbers of the hoppers. In fields where they can be used, the hopper pans, or "dozers," are probably the most effectual means of destroying the adult or the growing grasshoppers. A favorite form of the dozer in the northern portion of the state is shown at Figure 3, Plate I. The front

(white in the picture) of this dozer is of sheet tin. At the lower edge is a narrow opening which allows the locusts to drop through and pass back of the tin. The back portion is inclosed so that the insects can not escape, and is covered with wire gauze on top, so as to give plenty of light. Otherwise the locusts would try to escape at the narrow opening where they fell in. The opening shows more plainly in Plate II, Figure 6, which is an end view of a similar dozer. When a large number have accumulated in the box, they are emptied through a door at the end and buried, or killed by wetting with kerosene.

Grasshopper Disease.—So many inquiries are made of the Station concerning the value of grasshopper diseases, and such glowing reports of the success of the "South African Grasshopper Fungus" have been published by the department of agriculture of the Cape of Good Hope, I thought it best to secure some of the African fungus and try it upon the locusts so destructive in this state. I therefore wrote to the department of agriculture at Washington for a quantity of the fungus which had been prepared under the direction of Dr. L. O. Howard for distribution. Dr. Howard sent six tubes of the fungus, which was cultivated for me under the direction of the Station hortculturist, Professor Paddock. Over four hundred cultures were made by Mr. F. H. Rolfs, which proved upon examination to be identical with the fungus sent. Nearly four hundred of these tubes were sent to farmers of the state who requested the fungus for trial, and a considerable number of tubes were used at the Station. During the period that the tubes were being sent out in largest numbers, there were frequent showers, and the conditions were considered unusually good for the spread and growth of the fungus in this state. Each party receiving a sample of the fungus also received a sheet sent out by the government, giving full directions for introducing it into the field, and also a blank sheet with questions upon which to report results to this office. A few reported good results, a large number reported no results at all, and many did not return their blanks. It is to be presumed that these last obtained no good results. The attempts at the Station to inoculate the locusts and spread the disease were an utter failure, both in our breeding cages, where the conditions of heat and moisture could be controlled, and in the field. In no instance did we find any substantial evidence that a single hopper was killed by the fungus.

The fungus, as determined by Mr. Rolfs, was a mucor. It grew freely upon agar and luxuriantly upon potato.

In a few instances where we were able to investigate the reports of success with the disease, we found the locusts had died from the attack of an entirely different organism, which is shown greatly enlarged at Figures 4 and 5, Plate II. Locusts attacked by this organism die clinging to the tops of plants, as shown in Figures 1, 2 and 3, Plate II. The manner of dying is the same as when attacked by the fungus *Empusa grilli.** In the sick or freshly dead locust the organisms are nearly all oval or much elongated, granular bodies appearing like amœbæ under the microscope. Soon after the locust dies, nearly all become globular in form and darker in color. These forms are shown in Figure 4, Plate II. When the insect becomes dry and brittle, these organisms are all, or nearly all, globular and are surrounded with a dense cuticle, as shown in the photographic reproduction at Figure 5, Plate II.

This disease is generally distributed over the state upon both sides of the range, and it has been very active in the destruction of locusts in many localities the past summer. I am fully persuaded that this is the organism that destroyed so many locusts in certain localities in Colorado in 1895, and which I thought at that time to be a bacterial disease. Cultures made from the dying locusts always gave a bacillus which grew rapidly, but this organism, which does not grow in nutrient media, was overlooked.

While I believe it advisable to scatter locusts dying from this disease into localities where it is seldom or never known, still it is so well distributed throughout Colorado that it seems doubtful if much benefit will result from its dissemination unless we can discover some more effectual method of causing it to multiply and spread when artificially introduced among the locusts.

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*Some of the dead locusts were sent to Dr. Roland Thaxter, of Cambridge, and since writing the above a letter has been received from him saying: "There is no doubt about its (the organism) being Empusa grilli, which seems common all over the world."

HOWARD'S SCALE (*Aspidiotus howardi* Ckll).

This scale, which was first reported from Colorado upon plums, was reported last year as very abundant upon the fruit of the pear in one orchard in Delta county. Now, another food-plant is to be added. While passing near some white-ash shade trees in Denver last August my attention was attracted by the peculiar appearance of the foliage. The leaves were densely spotted with yellowish white along the mid-veins, which gave them a bleached appearance at a little distance. An examination showed that the light spots were caused by scales upon the under surface. The scales were found rather abundant, though not in great numbers, upon the tender bark near the tips of the twigs. Specimens of the scale were sent to Professor Cockerell, who determined them to be *Aspidiotus howardi.*

So far, this species has manifested a tendency to attack fruit, leaves and tender twigs almost exclusively. It has demonstrated its ability to increase rapidly, so as to appear in decidedly injurious numbers, and also to subsist upon a variety of food-plants. This pest is a close relative of the San José scale, and special efforts should be made to subdue it wherever it may be found to occur.

PLANT LICE.

Plant lice were rather more than usually troublesome in Colorado the past summer, the lice upon apple trees and snowball bushes being particularly abundant.

The apple plant louse (*Aphis pomi*) usually does not appear in numbers to attract attention before August, but this year serious complaints of the injuries of this insect were made to the Station before the end of June. They were particularly abundant upon young or newly set trees.

The snowball louse (*Aphis viburni*) was so numerous that, in Fort Collins, at least, there were almost no snowballs upon any of the many bushes that are usually loaded with them, and the leaves were tightly curled, as shown in Plate III, Figure 1.

REMEDIES.

Both of these species of plant lice lay their eggs upon the twigs in the fall, where they may be seen at any time during the winter as small shining black specks. The young lice hatch before the buds open, and may then be destroyed by a free use of kerosene emulsion or whale oil soap of the ordinary strengths.

THE SUGAR BEET LEAF BEETLE (*Monoxia puncticollis* Say).

This insect was first mentioned as being injurious to cultivated crops by Dr. W. P. Headden in Bulletin 46, page 11, of this station. Dr. Headden was growing sugar beets experimentally upon a patch of alkali ground upon the college farm. A number of the beetles were brought to this department for determination and remedies were experimented with for their destruction.

Later, in the same year, this beetle was reported in Bulletin 18, N. S., of the United States department of agriculture, division of entomology, page 95, by Mr. F. H. Chittenden as injurious to sugar beets at Hagerman, New Mexico, the previous year.

In the Thirteenth Report of this Station (1900) the writer reported this beetle as injuring sugar beets in the vicinity of Rocky Ford, Colo. On the 29th of last May Mr. Officer, manager of the Loveland Sugar Company, telephoned to the Station, asking that someone be sent to investigate the injuries of some insect to young sugar beets in that vicinity. On the following morning I went to Loveland and, in company with Mr. A. J. Houts, field superintendent, I visited the farm of Mr. W. S. Warner, about four miles north of town. Mr. Warner had sown a fourteen-acre field of beets, along the north side of which was an alkali pond. The beets had come up well and then suddenly disappeared over a large portion of the field. At the time of my visit, it was estimated that fully one-half of the field had the beets all eaten to the ground, the portions escaping, or showing least injury, being most distant from the low ground. Eggs, larvæ and beetles of the above

PLATE III. 1, leaves of snow-ball curled by lice; 2, eggs of beet leaf-beetle; 3, eggs and larvæ of beet-beetle; 4, eggs of beet-beetle greatly enlarged; 5, beet-beetle and leaves injured by it. All natural size except 1 and 4. Original.

species were found in abundance. Some of the beet plants were just breaking the ground and the largest were two or three inches high.

A few days later, June 3, I visited a field just outside of Fort Collins, where beets were growing upon low alkali ground and found the beetles plentiful in places, but no large areas where the plants were suffering severely. Eggs were also common, but very few larvæ could be seen. Eggs and beetles were most abundant upon scattering volunteer or "mother" beets that had stood in the ground since the previous crop. The beetles were common in this field throughout the summer, but during the latter part of July eggs and larvæ were hard to find, becoming more abundant later. The insect is double-brooded, the broods overlapping. On the 7th of June I requested Mr. Ball, of this department, to determine, if possible, the native food-plants of this beetle. Before night he reported finding eggs, larvæ and beetles common upon *Dondia depressa, Atriplex argentea* and *Salsala tragus* (Russian thistle), all growing upon a small piece of virgin alkali soil upon the college farm. The eggs were also common upon spears of grass (*Atriplex*), growing among the other plants. Mr. Chittenden reported *Suæda linearis* (*Dondia americana*) as the native food-plant in New Mexico. As these food-plants are all closely related to the sugar beet, being members of the goose-foot family, it is easy to understand why this insect should have taken readily to the tender and succulent leaves of the cultivated sugar beet as a pleasant and abundant food supply.

The eggs are deposited in irregular clusters, often piled upon one another, and nearly always upon the under surface in cases of beet and *Atriplex*. See Plate III, Figures 2, 3 and 4. When first laid the eggs are light orange yellow, but soon change to a darker shade, which will vary between a light yellowish brown to a dark yellowish brown. An irregular blotch or dash of darker color is common upon one side of the egg. They are about .8 mm. by .6 mm. broad, oval in form, and densely and minutely reticulated or pitted, as shown in Plate III, Figure 4. The number of eggs in a cluster varies between two or three and forty or fifty.

The larvæ, like the beetles, drop to the ground when disturbed. They are black in general color, with head and cervical shield dark brown; the anal segment is white and the body is marked above with rows of rather small sordid white

spots, each of which is upon a slightly raised tubercle bearing one or more short stout spines at the center; a double row of these tubercles numbers about twenty pairs, occurring both upon the coarser wrinkles of the body segments proper and upon the smaller wrinkles between the segments; two lateral rows have one spot to a segment after the first three segments. When fully grown, the larvæ measure about eleven millimeters—a little less than half of an inch.

The beetles vary little from .3 of an inch (8 mm.) in length. In color, many are of a uniform dull yellowish-brown above, others have the same ground color, but with one or two more or less distinct dark longitudinal vittæ upon either wing cover; not uncommonly the elytra are entirely black or blackish, except a narrow yellow margin all the way around; and occasionally a specimen is seen that is entirely black above and below except the lower portion of the face, the proximal joints of the antennæ and the joints of the legs. Most of the specimens are black or blackish beneath with the middle portions of the femora, the terminal portions of the tibiæ and the tarsi black also, but some of the specimens are yellowish brown on thorax and abdomen beneath. This is particularly true of those that are lightest in color above. The four varieties described by Dr. Horn* have occurred at Fort Collins the past season along with others that were intermediate. Examples sent from Rocky Ford by Mr. H. H. Griffin happen all to be light yellowish-brown above and below. The head is rather densely and coarsely punctured; the pronotum is rather coarsely and irregularly wrinkled and pitted, and the elytra are rather finely and densely punctured. Nearly everywhere the exposed portions of the body and appendages are covered with a short yellowish gray pubescence.

Plate III, Figure 5, shows the beetle life-size and also its injuries to beet leaves.

So far as I have been able to determine this insect confines its injuries to plants growing in alkali ground or in close proximity to it.

REMEDIES.

Paris green, London purple and paragrene were all used with apparent good results by mixing with flour in the pro-

*Trans-American Entomological Society, Vol. XX., page 83.

portion of one pound of the poison to twenty pounds of the dilutent and lightly dusting the plants early in the morning.

As the insects accumulated quite largely upon mother beets early in the spring, it is possible that a few beets left in the ground over winter where this insect is likely to occur might serve as a trap crop to protect younger plants.

One of the best preventives would seem to be to avoid alkali ground for beets.

THE PEAR AND CHERRY TREE SLUG (*Eriocampa cerasi* Peck).

The pear and cherry tree slug was unusually abundant in the northern portion of Colorado the past summer. Some of the orchards looked as if fire had been through them after the appearance of the second brood of the slugs. In fact the first brood almost completely defoliated many of the cherry trees in the vicinity of Ft. Collins. I have never known this brood so abundant before.

On June 23 the slugs of the first brood were hatching very rapidly upon the trees in the College orchard. The largest of the slugs were from half to two-thirds grown, and probably had been hatched for a week or ten days. Plum foliage suffered some from this slug, but not seriously.

The female saw-flies deposit their eggs singly, just beneath the epidermis of the upper surface of the leaf, causing a slight pimple, as shown in Plate IV, Figure 1. The eggs soon hatch and the slugs escape upon the surface of the leaves, where they begin to eat by gnawing small holes into the leaf, as shown at Figure 2, of the same plate. As the slugs become larger they eat away large patches from the upper surface, and when very abundant will leave nothing but the veins, and epidermis of the under side. During a rain the slugs go to the under side of the leaves for shelter, but do not seem to feed there.

When fully grown the slugs drop to the ground, crawl into any crevice in the soil or among leaves or other rubbish and spin their cocoons. It was found that sheets of sticky fly paper placed beneath the trees in the evening, when the slugs were fully grown, would catch a number of them before morning. So it was concluded that their method of descent

was to drop from the leaves. This insect seems to be very definitely two-brooded in Colorado.

REMEDIES.

This is one of the easiest orchard pests to control. During the last two summers the Station has tested several different substances to determine their comparative value for the destruction of the slugs.

Paris green, London purple and paragrene sprayed upon the foliage in the proportion of a pound to 160 gallons of water was, in every instance, very successful, destroying the slugs almost completely within three or four days. *Arsenate of lead* in the proportion of a pound to 25 gallons of water was equally efficient, but one-half this strength killed slowly.

White hellebore in the proportion of an ounce to three gallons of water was as successful as the arsenical poisons and as quick in its results.

Buhach (Pyrethrum) was perfectly efficient in destroying all the slugs that were treated with it. It is too expensive to use upon a large scale.

Lime, freshly slaked and dusted freely over the trees was very successful in removing the slugs, but in some instances a considerable number escaped. When air-slaked lime was used the results were not as good. In some instances less than one-half were destroyed, and the slugs would be seen the next day quietly feeding with masses of lime upon their backs. In other cases, when an abundance was applied, the slugs nearly all disappeared. An examination beneath the trees treated with lime showed that a great many of the slugs were not killed outright, as they could be found crawling about. But few of these seemed to get back upon the trees again. The trees were in well cultivated soil. Freshly slaked lime applied in water was very successful in strengths as low as one pound to four gallons of water, but weaker than this the applications were not wholly satisfactory.

Zenoleum in the proportion of one pound to fifty gallons of water and in one-half this strength was used. The stronger application killed fairly well, but was too strong for the foliage. The weaker strength did but little good.

Road dust was used repeatedly upon a considerable number of trees (about forty) by Mr. E. P. Taylor, during the

FIG. 1. Strawberry leaves with slugs of *Emphytus gillettei* upon them, and also the adult female saw-fly. The fly is enlarged two diameters. Original.

summer of 1901, and with very little beneficial results. He concluded that the remedy was practically worthless. Some farmers with whom I have talked are certain that they get good results by shoveling dirt into the trees. It is quite possible that by this method they may knock many of the slugs from the leaves that never find their way back again. Mr. Taylor used finely pulverized road dust. The sure remedies are so cheaply and easily applied it seems unwise to waste time or take chances with doubtful remedies.

I am much indebted to the careful work of both Mr. Taylor and Mr. F. C. Bishopp for assistance in carrying on the above experiments with this insect.

THE WESTERN STRAWBERRY SAW-FLY.

BY S. ARTHUR JOHNSON.

This enemy of the strawberries appears in early summer, doing some damage where it has an opportunity to become abundant. It has been examined by Prof. A. D. MacGillivray, who pronounces it a new species of *Emphytus,* near *E. cinctus,* and has furnished the following name and description:

"Emphytus gillettei n. sp. MacG.—Black, with the following parts rufous: The apex of the anterior femora, the anterior tibiae and tarsi beneath, the apex of the middle femora, the middle tibiae and tarsi beneath, the posterior femora and tibiae, and the basal segment of the posterior tarsi; with the following parts white: The tegulae, the cenchri, the anterior trochanters at apex, the middle and posterior trochanters, and a transverse band on the base of the fifth abdominal terga, slightly attenuated at middle; the stigma and wing veins dark brownish; the first submarginal cell more than twice the length of the second; the third segment of the antennae slightly longer than the fourth; the clypeus roundly and deeply emarginate, the labrum filling the emargination and angulate at apex; the saw-guides obtusely pointed at apex. Length, 8 millimeters."

In the latter part of May and early June, the adult insects appear and lay the eggs between the upper and lower epidermis of the leaves. In this act the female rests on the upper side of the leaf, thrusts her ovipositor through the epidermis, usually near the leaf margin, and between the large veins, and lays a single egg in a cell which is invisible from above, but appears on the lower side as a bulge in the epidermis. The egg is elongated and oval in shape, and whitish

in color with a pearly lustre. It hatches in a few days, and the young larva lives for a week or more on the lower epidermis of the leaf. For this reason it is apt for a time to remain unnoticed. As the larva grows, it eats round or elongated holes, preferring the tissues between the larger veins. The feeding is done chiefly in the morning or late evening. When the sunshine becomes bright, the caterpillar curls itself up and rolls into the hollow of a leaf or to the ground, where it remains during the heat of the day. When touched or otherwise disturbed it has the habit of quickly releasing its hold and rolling out of the way of danger. In from four to six weeks the larvæ are full fed and crawl into the ground, where they make a rough earthen cocoon and pupate. There is but one brood each year.

The insect resembles the currant saw-fly, to which it is allied. The larva is provided with seven pairs of abdominal legs, and has the saw-fly habit of curling up the posterior extremity of the body. When full fed it is nearly an inch in length. The back is green, almost the shade of the strawberry leaf, and covered with a slight bloom. The green extends to the middle of the side, but below that line the body and feet are creamy in color and nearly transparent. The head is yellowish, with a brown patch on the dorsal portion, which extends some distance down the face.

The insect appeared in Denver on small garden patches, where, in some instances, it devoured twenty-five per cent. of the early foliage. Curiously enough, it was not found on large beds from which strawberries were marketed. One specimen was taken in Gregory canon, near Boulder. (See Figure 1.)

REMEDY.

Dusting the plants with white hellebore should be a sufficient remedy for this pest.

CORN ROOT-LOUSE.

(*Tychea brevicornis* Hart.)

During the fall of 1901 Mr. H. H. Griffin, of Rocky Ford station, sent me specimens of a plant-louse that he thought had done considerable injury to a few patches of beets in his

locality. There were no winged individuals sent, and it was then supposed that this insect was the root-louse* that Professor Doane reported attacking beet roots in Washington state in Bulletin No. 42 of the Washington experiment station. From additional material sent by Mr. Griffin last spring it was decided that this louse is the species described by Mr. Hart in the eighteenth report of the state entomologist of Illinois, page 97, as occurring upon corn roots. Specimens recently sent to Mr. Hart were so determined.

Plate IV, Figure 4, shows a photograph of a clod of earth, sent by Mr. Griffin early last spring. The clod is broken apart, exposing the whitened galleries in which the lice lived during the winter. Some of the lice can also be seen crawling about over the dirt. The white lining to the galleries is a secretion from the bodies of the lice. Mr. Griffin also reported the lice upon the roots of "salt-grass" and weeds. Mr. Griffin was asked to study the insect as much as possible the past season, for the purpose of determining its habits and extent of injury. He reports that the louse has largely disappeared, and seems to have done no special harm the past year. In one lot of lousy beet roots which he sent there were numerous puparia of some dipterous insect, probably a Syrphus fly. They were found among the fibrous roots, four or five inches, at least, beneath the surface of the ground. It seems probable that some Syrphus fly has been the means of keeping the lice in check the past summer.

The remedial measures would seem to be to avoid putting beets in ground that bore corn or "salt-grass" the previous year and to practice clean culture.

OBSERVATIONS UPON BARK-BORING BEETLES.

(*Scolytidæ.*)

Last July a letter came to the Station from an officer of the Colorado & Southern railroad, requesting that an investigation be made of insect injuries to pine trees in Platte canon, in the vicinity of Shawnee and Bailey's. At these places the railroad had erected a number of very handsome rustic hotels, covering them with slabs that had been shipped from New Mexico. A considerable number of pine (*Pinus ponderosa*)

*Pemphigus betae.

trees in the neighborhood of the hotels were dying, and it was discovered that they were very badly infested with bark-borers. As these pests had not been noticed in the vicinity before, it was believed by some that they had been brought to the locality in the imported slabs, and complaint was made to the railroad company.

I reached Bailey's on August 1, and spent the greater portion of that day and the day following examining dead and dying pines in the vicinity of the very beautiful slab-covered hotel known as "Kiowa Lodge." (See Plate V.) A half dozen thrifty young pines, measuring from six to eight inches through at the base, and standing fifteen to twenty feet high, and within forty rods of Kiowa Lodge, had suddenly died. In two or three cases the leaves were still partially green. I was told that all these trees were perfectly green in foliage at the beginning of July. An examination showed that the inner bark of trunk and limbs, even to the smallest twig, was completely riddled by bark-borers. Four large pines, measuring fully eighteen inches in diameter, near the hotel (within forty rods), were either dead or dying, and were similarly infested. Three or four trees were also found having a considerable number of pitchy exudations upon the bark, as the result of the attacks of the "pine-destroying *beetle" of the Black hills, but these trees did not appear to be in a dying condition, and the extent of injury being done by the borers over the territory visited certainly was not large.

A week later I drove sixteen miles into the foothills west of Fort Collins, going up Rist canon. Four small examples of *Pinus ponderosa*, and one tree, measuring somewhat more than a foot through near the ground, were found infested with bark borers, and all of the trees were dead. The last one mentioned was struck by lightning the previous summer.

OBSERVATIONS UPON BARK-BORERS IN THE COLLECTION.*

Tomicus calligraphus Germ.—This large species was found very numerous under the bark of a pine tree in Rist canon that had been struck by lightning the previous summer, but not one was taken beneath the bark of trees at

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*Dendroctenus ponderosa.

*The species here mentioned were all determined by Dr. A. D. Hopkins.

PLATE IV. 1, cherry leaf showing egg-punctures of cherry slug (*Eriocampa cerasi*); 2, leaf showing holes eaten by newly-hatched slug; 3, leaf showing extensive injuries from larger slugs; 4, clod of earth showing white winter galleries of corn root-louse (*Tychea brevicornis*); 5, section of trunk of small pine with outer bark removed to show tunnels of bark-beetle (*Tomicus oregoni*). Original.

Bailey's. It was found beneath the bark of the trunk and large limbs only. Each beetle bores a hole one-tenth of an inch in diameter through the thick bark. It is probable that the tree was in a dying condition before the beetles attacked it.

Tomicus integer Eich.—This species took the place of the preceding species beneath the bark of large dead pines at Bailey's, but was not near as abundant as *calligraphus*. It was not found attacking green bark and was only taken beneath the thick bark of the trunks.

Tomicus oregoni Eich.—This insect occurred in such abundance beneath the bark of young and dying pines where no other assignable cause could be given for their death, that it seemed very suspicious that the parent beetles must have bored into the bark and deposited their eggs when the trees were green. But if this is true, it is then difficult to understand why in the twigs of the same trees other small bark borers** should have occurred at the same time. It occurred beneath the bark of both trunk and limbs.

On August 2, when the visit was made, this insect had almost completely changed to the adult condition, only an occasional larva or pupa being found. A young *Pinus ponderosa* in Rist canon, visited August 8, that had recently died, the leaves still being on, was similarly infested by this beetle. See Plate IV, Figure 5.

This species seems not to remain in its burrows over winter, at least sections of the trunks brought to the station from Bailey's have only an occasional dead beetle in the burrows at this date, December 12.

Tomicus pini Say.—A single specimen of this species was taken by the writer in Rist canon, Colo., in general collecting, May 29, 1891.

Tomicus plastographus Lec.—A single specimen was taken by the writer at Silverton, Colo., in general collecting, June 20, 1892.

Pityogenes ponderosa Hopkins, MSS.—Taken August 2 at Bailey's, Colo., beneath the bark of both the trunks and small branches of both large and small trees of *Pinus ponderosa* that had recently died. They were chiefly taken in small limbs of large trees that died the previous year and

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**Pityopthorus sp.

in both trunk and limbs of the trees that had just died, in which *T. oregoni* were abundant. Also taken August 8 in Rist canon in similar situations. The large tree that was struck by lightning the previous summer had many of them in its small branches.

All the specimens taken on the dates mentioned, with two exceptions, were light yellowish brown in color. To-day, December 12, a good number of these beetles were cut from sections of trees and limbs that were brought from Bailey's and Rist canon last August and every one is of a dark mahogany brown color. As the beetles have not yet left their burrows, it is evident that this species remains in its summer burrows over winter.

Pityogenes coloradensis Hopkins, MSS.—A few specimens taken August 8 from small limbs of the large dead pine in Rist canon that had been stricken with lightning.

Pityogenes wickhami Hopkins, MSS.—Two specimens taken August 2 at Bailey's in the bark of small limbs of one of the large pines that had died, apparently the previous year.

Pityogenes gillettei Hopkins, MSS.—Two specimens taken August 1 at Bailey's, Colo., from a small limb of one of the small pines that had died, apparently, since the first of July. This was one of the trees in which *T. oregoni* was so abundant.

Pityopthorus nitidulus Mann.—This species was noticed flying in great numbers just at dusk in the evening of June 18 at Dolores, Colo., so that I easily caught a good number in my hand. All seemed to be going in one direction.

Dendroctenus ponderosa Hopkins.—This is the bark-borer that was reported by Dr. A. D. Hopkins as doing extensive injuries to pine timber in the Black hills and which was designated by him as "the pine-destroying beetle of the Black hills," because of its propensity to attack living, healthy trees as well as dead and dying ones, and because of its great numbers. A few specimens of this beetle were taken at Bailey's August 2, some from a living but sickly appearing *Pinus ponderosa* and some from a pine that had been dead for probably a year. Both were large trees. No specimens were found in the small dead or dying pines.

Dendroctenus valens Say.—A single speciment of this large *Dendroctenus* was taken by Mr. Fred C. Bishopp at Virginia Dale, Colo., June 19, 1902, in general collecting.

REMEDIES FOR BARK-BORERS.

When trees, either dead or dying, are found to be badly infested by bark-borers, the insects may be destroyed by cutting and burning the timber; simply charring the surface will be sufficient.

In the cutting of timber, those trees should be first taken that show signs of weakening and all unused portions should be burned. With these precautions promptly carried out, there is little danger that bark-borers will become seriously troublesome to our pine forests.

BEE PLANTS.

A PRELIMINARY LIST OF THE MORE IMPORTANT FLOWERING PLANTS IN COLORADO FROM WHICH HONEY-BEES GATHER POLLEN OR NECTAR.

The following notes are condensed from notes taken in a desultory way in the field, chiefly by the writer, but partially by those who have been assistants in the department, viz.: C. F. Baker, E. D. Ball and E. S. G. Titus.

All the notes were made from plants in the vicinity of Fort Collins, unless it is otherwise stated.

The plants are given in the order in which they have been noted. As I do not have exact or even approximate dates for the earliest blossiming of many of the species, later records will doubtless change the order very much.

Soft Maple (*Acer dasycarpum*)* has attracted the bees as early as March 11 (1900), and they have continued to collect pollen from the flowers as late as April 15 (1898). The bees seem to obtain pollen only. The tree is important as a stimulant to early breeding in the hives. The trees almost never fail to be in full bloom the last week in March.

The American Elm (*Ulmus Americana*) follows close after the soft maples, and furnishes considerable pollen. We have noticed the trees in bloom as early as March 27 (1900),

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*I am under obligations to Prof. W. Paddock and Mr. F. M. Rolfs, of the Department of Botany and Horticulture of the Colorado Agricultural College, for many of the determinations of plants here mentioned.

and as late as April 20 (1901). They are usually in full bloom by the middle of April.

Willows (*Salix sp.*) begin blossoming early, but some species come into flower rather late. We have recorded species in full bloom on April 2 (1893), while we have found others in the foothills near Fort Collins in bloom as late as July 9 (1897). *Salix amygdaloides,* one of our common species, was in full bloom June 6, 1893.

Wind-flower (*Anemone patens,* var. *Nuttalliana*) occurs abundantly in many places among the lower foothills, and has been noticed in bloom between April 2 (1893) and May 11 (1899).

Lombardy Poplar (*Populus dilatata*) is very little behind the elm in its blooming, and perhaps is not at all behind when in full bloom, which is generally about April 15. The earliest date we have recorded for it is April 5 (1900), and the latest April 21 (1899). The catkins discharge large quantities of pollen and the bees are very fierce after it.

Townsendia sericea—The bees were working quite freely upon the flowers of this plant April 10 (1896) for pollen, and apparently for honey also.

White Ash (*Fraxinus Americanus*) is also a good producer of pollen, and has been noted as being in blossom as early as April 18 (1895), and as late as May 23 (1899). It has been most commonly in full bloom during the last week in April and the first week in May.

Cottonwood (*Populus balsamifera*) blossoms with the ash, but the blossoms are retained longer, and furnish a very large supply of pollen. Trees have been noticed in bloom as early as April 18 (1895), and still in full bloom as late as May 16 (1894).

Box Elder (*Negundo aceroides*) is but very little later than the cottonwoods in its period of blooming, and also furnishes a very liberal supply of pollen from its pendant stamens, and the bees literally swarm in the trees when they are in bloom. We have recorded the trees in bloom as early as April 20 (1902), and as late as May 23 (1892 and 1902).

Spring Beauty (*Claytonia sp.*) blooms along the foothills about the 20th of April and is visited by honey-bees.

Buttercups (*Ranunculus sp.*) were also in full bloom April 20 (1901), and were furnishing nectar for the bees.

PLATE V. A portion of slab-covered hotel, "Kiowa Lodge," with one of the dead pines infested by bark-borers. Original.

Oregon Grape (*Berberis repens*) blooms abundantly upon the dry slopes in the foothills, from April 20 to the 10th of May, but honey-bees seem to avoid the flowers.

Plum (*Prunus Americana*) furnishes both pollen and nectar, and is the first nectar-producing plant of much importance to report. Our earliest dates are May 1 (1902), May 2 (1901), May 3 (1891), and May 4 (1897 and 1900). The latest date is May 25 (1899). The European varieties bloom at about the same time.

The following plants were found in bloom in Spring canon, near Fort Collins, May 1, 1902, and the flowers were being visited by honey-bees: Bushy Clematis (*Clematis Douglasii*), Johny Jump-up (*Viola Nuttallii*), Larkspur (*Delphinum sp.*), and Quaking Asp (*Populus tremuloides*). The aspen was visited for pollen; the violets for pollen and honey.

Dandelion, eastern (*Taraxacum Dens-leonis*)—This very troublesome weed grows in lawns and along roadsides, and particularly in shaded spots. It does not thrive in the bright sunshine in Colorado. It has become a forage plant of no mean importance for the honey-bee, furnishing both pollen and nectar, chiefly the former. We noticed it coming into bloom as early as May 3 (1901), and there was a profusion of bloom ten days later. The flowers are generally at their best about the second or third week of May. The flowers are well open about 8 o'clock in the morning, and are closed by 1 p. m.

Garden Cherry (*Prunus cerasus*) is a very few days behind the plums in its time of blooming. We have recorded it as early as May 3 (1901), and as late as May 23 (1899). It is usually in full bloom during the second week in May. It furnishes both nectar and pollen.

Apple (*Pyrus malus*) will average but two or three days later than cherry in blooming. Some of the very early blooming varieties are out in flower as soon as the cherry trees. We have noticed early blooming crabs and yellow transparent and Dutchess apples in bloom as early as May 3 (1902), but as a rule apple orchards are not in full bloom at Ft. Collins until about May 20. The flowers furnish moderate quantities of both pollen and nectar.

The Blazing Star (*Mentzelia multiflora*) is a fairly common native plant in this portion of the state and bees were noticed visiting its flowers May 3, 1898.

Cultivated Currant (*Ribes rubrum*) bushes were in full bloom May 7, 1902, and bees were visiting the flowers for nectar.

Garden Gooseberry (*Ribes Grossularia*) has been noted in bloom as early as May 7 (1902), and as late as May 23 (1892). The plant furnishes both pollen and honey, but is chiefly valuable for the latter.

The Squaw Currant (*Ribes cereum*) grows rather abundantly in the foothills and was noted as being in full bloom May 8, 1897. The flowers furnish nectar.

The Yellow Pea (*Thermopsis rhombifolia*) occurs in small patches in the first foothills, in rather moist places, and is visited by bees for nectar. It was in full bloom May 8, 1897.

Mountain Maple (*Acer glabrum*). This small maple, which is hardly more than a bush, occurs commonly in the foothills and has been noted in full bloom May 8 to 15, 1897. Honey-bees were collecting pollen from the flower.

Rattleweeds or Loco (*Astragalus* and *Oxytropis,* etc.) of various species occur abundantly upon the plains and in the foothills in northern Colorado, and are freely visited by bees for nectar. Several species are in bloom by May 10, and some continue to bloom until late in June. We have recorded *Astragalus caryocarpus* and *A. Canadensis* as being in full bloom June 13 (1893).

Native Dandelion (*Taraxicum officinale*) was seen in full bloom in the foothills May 11, 1899, bees gathering pollen. Plant rather scarce and unimportant.

Wild Gooseberry (*Ribes irriguum*) grows in moist places along the streams in the foothills and has been noticed in full bloom between May 11 (1899) and May 23 (1892). Furnishes nectar.

Choke Cherries (*Prunus virginiana*) were in full bloom in the foothills May 16, 1891.

Honey-bees were seen visiting flowers of the following plants at Magnolia, Colo. (about seven miles east of Denver), May 22, 1897: *Corydalis aurea* var. *occidentalis* (Dutchman's Breeches), *Nasturtium sinuatum* (Water Cress), *Sophora sericea* (Lupine), *Lupinus parviflorus* (Lupine), *Oxytropis Lambertii* (Rattle-weed), *Oenothera pinnatifida* (Primrose), *Aster tanacetifolius* (Aster), *Antennaria* Sp.

(Everlasting), *Gilia pungens* (Prickly Gilia), *Gilia pinnatifida, Pentstemon acuminatus* (Beard-tongue), *Abronia fragrans* (Snowball), *Zygadenus* sp. (Star-lily).

Mountain Ash (*Pyrus sambucifolia*) was in full bloom on the College campus May 25, 1901, and May 30, 1899. The bees are very active at the flowers.

Figwort (*Scrophularia nodosa*) occurs in small amount along streams in the foothills and is a great honey producer. We found it nicely in bloom May 28, 1897.

Primrose (*Oenothera pinnatifida*) was in full bloom about Ft. Collins May 31, 1897. Bees were actively gathering pollen from the flowers in the morning.

White Clover (*Trifolium repens*) has been noted as beginning to bloom as early as June 3 (1899), and to be past its prime July 18 (1893). Upon lawns that are frequently mowed it continues to bloom later. It furnishes both pollen and nectar.

Red Clover (*Trifolium pratense*) does not occur in large amount about Ft. Collins, but it has been seen in bloom as early as June 3 (1902), and to be in quite full bloom by June 15 (1893), Furnishes honey and pollen.

Alfalfa (*Medicago sativa*) which is the chief honey plant in Colorado, will begin to bloom on rather dry ground, some years (1902) as early as June 2, but it is seldom in good condition for bees on well irrigated ground before June 10 or 15. In 1894 we recorded it in full bloom June 14, and in 1896 on June 20; in 1893, June 6.

Yellow Melilotus, or Yellow Sweet-Clover (*Melilotus officinalis*) comes in bloom along with alfalfa and the clovers, and is very attractive to the bees for both pollen and nectar. I know no plant that the bees are more active upon than this. We have recorded it in good bloom from June 3 (1902) to July 15 (1896.)

Wild Raspberry (*Rubus deliciosus*) was in full bloom in the foothills June 3, 1893, and honey-bees were active gathering pollen, at least, from the large white flowers.

Black Locust (*Robinia pseudacacia*) has been noted as being in full bloom about Fort Collins, June 4 (1901). June 6 (1902), and June 12 (1899.) It is one of our best honey plants.

Sedge (*Carex* sp.)—A species of Carex was furnishing a considerable supply of pollen for honey-bees June 6, 1893.

Gaura coccinea.—Bees are very active about the flowers of this plant early in the mornings and in the evenings. The flowers begin to open from the 5th to the 10th of June, and continue for two or three weeks or more.

Willow (*Salix longifolia*).—This is a late blooming species. The honey-bees were active about the catkins June 9, 1897, collecting pollen.

Monolepis nuttalliana.—Bees were collecting pollen freely from this weed on the college grounds June 10, 1897.

Milkweed (*Asclepias* sp.) was recorded as coming well into bloom June 6, 1893, and June 11, 1902. Bees were at the blossoms for nectar.

Honey Locust (*Gleditschia triacanthos*) was in full bloom June 11, 1902, and June 20, 1899, and bees were very active for several days collecting nectar from the blossoms.

Chicory (*Cichorium Intybus*) was in bloom along the road-sides in Fort Collins June 11, 1902, and bees were visiting the flowers in the morning.

Asparagus (*Asparagus officinalis*) furnishes considerable pollen and has been recorded in full bloom as early as June 11 (1902), and as late as July 4 (1893).

Hedge Mustard (*Sophia incisa*) was in full bloom June 13, 1893.

Deer's Tongue (*Frasera speciosa*) was in full bloom in the foothills on the evening of June 14, 1896, and the bees were very abundant at the flowers until it was quite dark.

Western Ragweed (*Ambrosia psilostachya*) furnishes large quantities of pollen, beginning about June 15.

Lamb's Quarter, or, Pigweed (*Chenopodium album*) furnishes considerable pollen and was in bloom at Fort Collins June 20, 1897. It was also in full bloom July 1, 1901, and the bees were very active collecting pollen.

Catalpa, or Indian Bean (*Catalpa bignonioides*) was just nicely in bloom June 20, 1902. Bees were very active at the flowers, which hang on but a very few days.

Rocky Mountain Bee-Plant, or Skunk-Weed (*Cleome integrifolia*) is second to no other plant in northern Colorado, unless it be white sweet-clover, in the production of a supply of late nectar for honey. We have noted it as coming in bloom as early as June 23 (1901), and as being still in its prime as late as July 18 (1893). It continues to bloom much

later than the last date mentioned. It seems to be increasing in abundance, and grows in waste places, so as to be of no importance as a noxious weed.

Sunflowers (*Helianthus* sp.) begin coming into bloom June 23 (1901) to July 1 (1897), and continue for a long time to furnish pollen for the bees.

White Sweet-Clover (*Melilotus alba*) we have found coming well into bloom as early as June 23 (1901), and continuing in full bloom as late as August 19 (1898). It furnishes both nectar and pollen.

Water Hemlock (*Cicuta maculata*) has been recorded as being in full bloom June 25 (1893) and June 27 (1896). Bees visit the flowers, but the plants are not numerous enough to be of much importance.

Evening Primrose (*Oenothera biennis*) comes into bloom about July 1, and continues to bloom for a considerable time. Bees visit the flowers late in the afternoon to some extent.

Mint.—Several species begin coming into bloom about July 1, and the flowers are eagerly sought by honey-bees for the nectar they contain. Confined mostly to the foothills and along streams.

Red Mallow (*Malvastrum coccineum*) is quite generally distributed on the plains, and is visited freely by the bees. It was noted as being in full bloom on the college grounds July 1, 1898.

On July 3, 1897, Mr. Titus observed honey-bees visiting flowers of the following plants in Rist canon, eight or ten miles northwest of Fort Collins: Long-fruited Anemone (*Anemone cylindricus*); Five-finger (*Potentilla effusa*); *Franseria discolor* (for pollen); Arnica (*Arnica cordifolia*), for pollen; Painted cup (*Castilleia linariaefolia*); Tiger-lilly (*Lilium Philadelphicum*).

Poppy (*Argemone platyceras*).—This plant is quite extensively distributed over the plains, particularly upon ground that has been broken and allowed to lie unused. Was in full bloom July 6, 1893, and bees were gathering pollen from the flowers.

Canada Thistle (*Cirsium arvense*), in full bloom July 8, 1893, and bees collecting pollen, and apparently nector, also, from the flowers.

European Linden, or Basswood (*Tilia Europaea*).—Has been noted as being in full bloom on the college campus from

July 10 to July 14. This tree deserves to be more extensively planted in Colorado as it is a beautiful shade tree, very free from insect attacks, hardy and a great producer of nectar for the honey bees, and it comes in bloom just after the first crop of alfalfa is out of the way.

Mentzelia multiflora is a rather common species near Fort Collins and has been recorded in full bloom with honey-bees at the flowers August 3, 1898.

Virginia Creeper (*Ampelopsis quinquefolia*) was in full bloom August 5, 1898, and honey-bees were very active at the flowers for nectar.

DATES AT WHICH COLONIES OF BEES MAKE THEIR FIRST GAINS IN WEIGHT.

For several years it has been our custom to keep one or two of the strongest colonies in the college apiary upon a set of scales, to be weighed each morning and evening to determine the first date that there should be a gain in weight. These dates correspond well with the dates at which alfalfa comes well into bloom and are as follows for the years mentioned:

YEAR.	FIRST GAIN.
1893	June 25
1894	June 11
1895	June 19
1896	June 12
1897	June 12
1899	June 16
1901	June 8

C. P. GILLETTE.

REPORT OF THE CHEMIST.

Since my last report the record of my study of the ground water of the plat had under observation for the past four years has been presented as Bulletin No. 72.

I am now studying the compositions and changes in the irrigation waters of this portion of the state, more especially of the Poudre, the storage reservoirs tributary thereto and to the return waters, including those of the Platte. I shall include the waters of the Big Thompson, St. Vrain and Clear creek, but not any reservoirs tributary thereto or their return waters, as I believe that the Poudre will faithfully represent the others, especially in those large features which it will be possible for us to consider in such a general study. The samples of water have been secured and a large amount of work has already been done on this subject. It may, however, prove to be advisable to take still other samples; this will develop as the work proceeds and takes definite form.

The work on our digestion experiments is not completed, but is being pushed along as opportunity and time permits.

The question of the composition of the alkalis of the state will be presented in the near future. It will necessarily be in a somewhat incomplete form, for it will be practically impossible to obtain representative samples from all sections of the state where these salts occur. This fact, the incompleteness of the representation, will not be a serious matter, for it has already been demonstrated that our alkalization is so largely a matter of drainage that a sufficient number of samples from widely separated localities to show the general composition of these salts will, I think, be quite sufficient. We already have samples from near the Kansas line in the Arkansas valley, from the San Luis valley, Delta, Grand Junction and this section.

Respectfully submitted,

WM. P. HEADDEN,
Chemist.

Fort Collins, Colo., December 6, 1902.

REPORT OF THE HORTICULTURIST AND BOTANIST.

The work of this section has followed closely the schedule presented at the beginning of the year. Special attention has been given to potato diseases, while plant diseases in general have received much study. A general survey of the conditions of the horticultural crops of the state have been undertaken. It is the intention to publish this information as soon as sufficient data has been received. Two bulletins on special crops are already in preparation.

POTATO DISEASES.

The results of our investigations with potato diseases for the year 1901 were published in bulletin No. 70, which was distributed last spring. The experiments there recorded established the fact that a great deal of our trouble in growing this crop is due to a fungus disease which attacks the underground portions of the potato plant. The work has been continued through the season just passed. Extensive experiments were tried to determine whether a practical remedy for the disease could not be secured. While the results of the experiments are conflicting, some progress has been made. The results of the experiments of the past season are to be published in bulletin form during the present winter.

WHEAT SMUT.

The practice of treating seed wheat for the prevention of smut is quite universal in many sections of the state. The treatment is usually successful. However, an occasional grower is found who has not had satisfactory results. For this reason it was thought desirable to test the different methods of treatment and publish the results of the experiments in bulletin form. One of the seniors in the agricultural course of the College undertook the work. Wheat was secured for the experiment which was so badly smutted that it had been sold for hog feed. Some of the treatments were so successful that plats of wheat practically free from smut were grown from this seed.

PLATE VI. College apiary in walnut grove. Original.

PLANT DISEASES IN GENERAL.

A bulletin on the general subject of plant diseases was published last spring. This bulletin set forth the observations of the previous year on plant diseases that had been observed in various portions of the state, and also gave suggestions for their treatment. One of the principal objects of the bulletin is to attract attention to and arouse interest in this subject. The increase in the amount of correspondence and in the number of specimens sent for examination has been very gratifying. Records are kept of the occurrence of all plant diseases that are observed or reported. In this way much valuable data is being accumulated.

ONION GROWING.

Many localities in Colorado are unique in that a special crop has been developed and made an important feature. The Cache la Poudre valley has become noted in this way as an onion growing district. Many inquiries come to the Experiment Station about this industry, and therefore it was thought desirable to collect information from the growers which would form the basis of a bulletin on the subject. One of the seniors in the agricultural course was detailed to collect such data during the spring of 1901. This has been added to during the present season and the subject is now being prepared for publication.

WINTER PROTECTION OF PEACHES.

Canon City has become noted in a similar way for crops of peaches produced by trees that are given winter protection. Peach growing by this means is, to a limited extent, a paying industry. A knowledge of the methods there employed would probably make the production of peaches, at least for home consumption, possible much farther north. A knowledge of the methods used, together with data and a series of photographs, have been secured, which will be embodied in a bulletin now in preparation.

OTHER CROPS.

Data on the condition of other crops is being secured as rapidly as time will permit; special attention being given to

the apple. It is the intention to continue this work until all of the leading horticultural crops of the state have been written up.

FUTURE INVESTIGATION.

The work for the coming season will follow the same general lines as before. We hope to undertake additional work, however, in plant breeding, if time will permit.

ACKNOWLEDGMENTS.

I desire to express my appreciation of the conscientious work of my assistant, Mr. Rolfs. The character of his work is well shown in Bulletin No. 70 of this Station. This bulletin has received much favorable comment from other experiment station workers.

I am also indebted to the director for his continued support.

W. PADDOCK,
Horticulturist and Botanist.

Fort Collins, Colo., November 25, 1902.

REPORT OF THE AGRICULTURIST.

The following is a brief outline of the various items of Experiment Station work which has been accomplished (or is in progress) during the past year:

We have been conducting five separate co-operative experiments with the United States department of agriculture in Washington, which have consumed a great deal of time and work; unless otherwise directed they will be continued until the work is accomplished. Detailed reports of each of the various experiments conducted by the farm section will be furnished as rapidly as possible.

1. Sugar Beets for Seed. By A. J. Pieters.

This is an experiment which was inaugurated this season, which is for the purpose of growing a stock of sugar beets for which experiments in growing seed on a commercial scale will be begun. Over a dozen varieties of sugar beets were planted on a suitable piece of ground of 1.4 acres area, from which a total of thirty-two tons of clean beets were harvested.

2. Experiments with Grasses and Forage Plants. By A. S. Hitchcock.

This is the second year of this co-operative experiment, during which more promising results have been obtained than in the first year. We have under observation the grasses in our grass garden, in which we are trying to obtain a stand of as many varieties as possible. This grass garden has also proven very useful for class instruction. On a larger scale in the field we have over three acres of various species planted, mostly species of rye grasses and Brome grasses. From our experience last year we do not expect these to make a very great growth until the second season. What has attracted more attention than anything else in this field is the mixture of *Bromus marginatus* and *B. secalinus,* or common cheat, which made a very thick stand, and was eaten very greedily by the cattle and sheep. If this mixture will live over winter it will be a very useful crop under some conditions. We have

also sown a mixture of various grasses in low bottom land, a few species of which grew well the past summer, and gives promise of covering this waste place with grass.

3. Sugar Beets—Influence of Environment. By H. W. Wiley, chemist of the United States Department of Agriculture, Washington, D. C.

This season we grew a small area of a variety of sugar beets selected by Dr. Wiley for some of his investigations. We have taken samples of the soil upon which the beets were grown and have samples of the beets every week since the harvesting season began. From the results of his analyses of the beets so far received, it seems that, although the late rains this fall caused a new growth of the sugar beets, with, of course, a lessening per cent. of sugar, that the beets have since increased greatly in sugar content much more than they were before the heavy rains came.

4. Experiment with Grains—Available Plant Food. By H. W. Wiley.

Four varieties of small grains were grown on a small area from which a sample of the soil was sent to Washington, and a part of the crop harvested and also sent to Washington. We have not received any report of this experiment as yet.

5. The Growing of Winter Wheats. By H. W. Wiley.

Dr. Wiley has been making attempts to have this Station grow a few varieties of winter wheats for him during the past two years, but for various causes this has never been done until the fall when the varieties that Dr. Wiley sent us were planted. As this section is greatly interested in the growing of winter wheats, we may achieve something along with our other experiments in winter wheat growing.

6. Trial of Macaroni Wheats.

This season we grew some four acres of the Macaroni wheats, planting both home-grown and outside seed, on the highest, driest and poorest land on the farm. It made an exceedingly good growth and heavy yield of grain, showing its value for such situations.

7. Emmer or Speltz on Low Alkaline Land.

This year we grew a considerable area of the Emmer or Speltz on the low alkaline ground on the farm, which is almost unfit for growing any kind of a crop, chiefly to destroy

and smother the weeds. Considering the situation, it made very good growth and we obtained a considerable crop from it.

8. Nitrate of Soda as Fertilizer of Wheat and Oats.

A quantity of nitrate of soda supplied for experimental purposes by the nitrate of soda propaganda was used on wheat and oats to see whether the application of this material would pay or not. Chiefly because the soda was applied in too great an amount, the crop on the fertilized ground was not nearly as good as that which was not fertilized. We have received an additional quantity of the nitrate of soda this year from the same source, which will be tried again in smaller quantity, not only on grains, but also for an experiment on fertilizing sugar beets.

9. Varieties of Grain in Field Culture.

Over twenty-eight varieties of common grains were grown under field conditions from seed grown last year in our nursery plots where each plant is grown separately and the seed carefully selected.

10. Varieties of Winter Wheats.

Over ninety-five varieties of winter wheats were grown in rows two feet apart, and four inches apart in the row; or, as we have termed it, a nursery system for the grains. A good many of the varieties are very promising, and as nearly all lived through the winter, we may find a very hardy variety among these.

11. Crossing or Hybridizing Wheats.

A number of successful crosses of winter wheats and spring wheats were made during the last season. This work is very tedious and takes a long time, but it is the only scientific method to originate new varieties, and we hope something may come from it. The few kernels which we obtained from the crossing of winter wheats have been planted this fall, and the crosses which we obtained from the spring wheats will of course be planted in the spring.

12. New Grains. Emmers and Einkorns.

A number of foreign varieties of grains were received from Prof. E. E. Elliott, of Washington state, for use in our crossing experiments. These grains are very rare, and have not been seen before at this Station. We hope that when they become acclimated we may use them successfully for

crosses; but during the last season, being their first year here, they rusted very badly. The system of growing a number of varieties of grains under our nursery system will be continued next year. As it is pretty well established that our grains, especially the wheats, decrease in gluten and increase in starch content after they have been grown in the arid region for a number of years, it is especially important that we have some idea of their gluten content. It would, therefore, be advisable to have the most important of our varieties of wheat analyzed for nitrogen, as it is the most certain way of determining whether they are rich enough in gluten to warrant growing them the succeeding year.

13. Grain Experiments at Monte Vista.

The growing of duplicate varieties of wheat and oats at Monte Vista was continued this year, the same as has been done the previous two years. We made two trips to the San Luis valley last season for the purpose of planting and harvesting. As the greater part of the San Luis valley suffered from the severe drouth the past season, our experiments suffered severely, and the grain did not grow or produce one-third what they had done the previous years. However, a couple of the varieties of wheat grew much better than any of the others, in spite of the extreme drouth, and we may find a variety which will do well under such conditions; so that we can not consider the experiment at Monte Vista a total failure this year.

14. Australian Wheats.

A number of varieties of wheat were received from Australia a couple of years ago, crossed by the noted wheat specialist, Wm. Farrar. These wheats have been grown now for two years under our nursery system for small grains, and two of them show an earliness of at least two weeks ahead of our acclimated varieties. Besides the quality of earliness, they have an exceedingly great weight per bushel, and on examination by an expert miller, two or three were pronounced to be a good flouring variety.

15. Light and Heavy Seed.

An experiment was begun this season in testing the value of planting light and heavy seed, using common Defiance wheat for the purpose. In selecting the light from the heavy seed we used a newly invented machine called the Eu-

reka Grain Grader, with a vertical blast. The heavy grain falls through this blast while the lighter grain is thrown out. A certain quantity of the seed was taken and by the use of this machine divided into three lots according to the weight of the seed. Careful notes were taken; four plots were used, one for the original weight wheat and the other three for the light, medium and heavy seed respectively. This experiment will be continued for three years, when we can say something definite as to whether it will pay the farmers to select good, heavy seed or not.

16. Alfalfa Sowing in Spring and Fall.

About two acres were devoted to an experiment for determining the result of sowing alfalfa in the spring and fall. An acre was sown in the spring and the adjoining plot was sown in the fall. Part of each of these plots were fertilized with nitrate of soda, so we can also get a fairly good idea of the value of nitrate of soda in giving young alfalfa a start in life.

17. A New Stock Beet from France.

In searching for seed of the original Lane stock beet, which proved to be so very successful at the Wyoming Experiment Station, we were informed through Vilmorin, of France, that he had a new variety of stock beet, a cross between the mangle wortzel and the sugar beet. At some expense we obtained fifty pounds of this seed, a quantity of which was planted on well prepared ground. This year we harvested a good tonnage of this new stock beet. The difference between these beets and mangle wurtzels is clearly shown in the way they protrude above the ground and in the way their leaves grow. The beets grown by us last season averaged very small, not much over a pound in weight, but there was a good number of them. We will conduct some feeding experiments this winter to determine their actual value for stock.

18. Large Trials of Winter Wheat.

A large acreage on the farm has been seeded to winter wheat this fall. A part has been seeded on freshly plowed alfalfa sod, but the greater part has been seeded on ground on which the spring wheat and barley were grown the past year. It is claimed by some practical farmers in this locality that a crop of winter wheat following a crop of spring wheat on the

same ground will produce as much or even a heavier yield than the spring wheat. As this land will be seeded to alfalfa next year it is believed that the winter wheat can be harvested early enough so as not to interfere with giving the young alfalfa a good start next year. In this way our winter wheat is really an extra crop from the land. It will be very interesting to note the result of this practical experiment.

19. Brome Grass Sod.

A field of Brome Grass, which has been grown chiefly for an object lesson, shows signs of being very much sod bound; the roots are really crowding each other to death. We have relied on getting a good crop of Brome Grass seed from these two plats, but the past season the yield was very light on this ground. It is believed that if a sub-soil plow is run across the field at a distance apart of a foot or so, this sod bound condition will be much improved.

20. Other Field Crops.

Besides the experimental crops enumerated we have a number of field crops which are not considered to be of an experimental nature, as Kafir corn, sorghums, flax, artichokes, Turkestan alfalfa, Lamona wheat, Selisian oats, Hanna barley on a large scale, and rye.

Full reports of the most important of these experiments will be furnished as soon as possible.

A. H. Danielson,
Agriculturist.

REPORT OF THE IRRIGATION ENGINEER AND METEOROLOGIST.

I have the honor to submit the following report as Irrigation Engineer and Meteorologist of the Experiment Station for the past year:

The work of investigation has followed along essentially the same lines as in previous years. The lack of help and the fact that records of investigations in progress have accumulated faster than we have been able to work them up, has made it undesirable to start many new lines of investigation. We have, however, extended some of our former lines as far as we were able to without better equipment. The extent of the state is so great that the mere physical difficulty of visiting different parts of the state is time-consuming and, without more help available for working up results, it will be difficult to keep the records up with the possibilities of our field work. Some help has been received through the Department of Agriculture in co-operation in some lines which we had already undertaken.

It has been the desire of this section to carry on a complete irrigation survey of the whole state. Such a plan was made and incorporated as a part of the schedule of work of this section as long as twelve years ago, and the purpose of that plan has been steadily kept in view throughout these years. The time and means at our disposal have, however, prevented as marked progress along these lines as had been hoped. At the same time a good deal of work has been done in sections of the eastern part of the state. One particular phase included in the investigations has been the amount of water required in irrigation and the amount of water available for irrigation, with the various questions incidental thereto.

DUTY OF WATER.

For the past ten years the section has continued measurements to determine the amount of water actually used in irrigation. This has been done by measurements on in-

dividual farms, and at the heads of canals, so as to measure all the water taken in by them. The lack of instruments has prevented as extensive measurements of this character as is desirable. New additions to our instruments during the past year by purchase and by construction have given a larger outfit. During the present year we have had self-recording instruments on the main canals, which serve to irrigate the land on the south side of the Poudre river, at and adjacent to Fort Collins. This includes the Pleasant Valley & Lake canal, the New Mercer, the Larimer County No. 2, and the Arthur, or Town ditch. While this tract of land has not been as good in some respects as others that were available, it has had the advantage of being close by and constantly under inspection, and more than that, these canals include all the sources of supply. There were then no complications due to seepage water coming from other canals or other watersheds. We could have used a much larger tract of land, as such was offered us, but the magnitude was such that it was realized that we could not carry on the investigation to a successful issue.

In addition records have been kept on canals on the Big Thompson, on the Arkansas, and, for most of the year, on the Rio Grande river. Some records were also kept on the individual tracts of land. These records are, at present, in progress of reduction, and it will take considerable time to complete them.

During the season the study of an irrigation stream typified by the Cache la Poudre has been continued. This has involved frequent measurement of the stream for the purpose of ascertaining the amount of water corresponding to different heights in the stream. This was necessary to determine its rating. A continuous record was kept throughout the season. This record has been kept by self-recording instruments, and the record has been kept continuously night and day. The results of these records have been issued in a form of press bulletins. At the gaging station all of the water which supplies the Poudre valley passes, with the exception of such as may come in a form of rain. In the case of a few storms during the past season an additional supply of water has been received, and a considerable amount has also run off. This is especially true of the storm of September 20, when 6.84 inches of water fell in the course of two days.

RETURN OR SEEPAGE WATERS.

The determination of the amount of water returning from irrigation has been continued during the year, though it has been extended but little this season. This measurement was first undertaken to ascertain the increase in water of our irrigation streams from invisible sources. The records, as shown in Bulletin No. 33, indicated that there was a material gain, and it was pointed out that this would materially increase and would be of much value in some valleys of the state like the Platte. The developments of the past few years have been fully in accord with our anticipations. The measurements have led to other important reasons for the investigation. They have been continued for a series of years, and it is evident now that the seepage water is still increasing in quantity. All of the tributaries of the Platte have now been measured for several years in succession. These measurements were made in connection with the State Engineer, and are a complete record of the Platte valley. The streams which we have measured consist of the Cache la Poudre river, from the foothills to its mouth, below Greeley; the Big Thompson and its tributaries, the Little Thompson, the St. Vrain and its tributaries, Left Hand, Boulder creek, South Boulder and Bear creeks. These measurements were made by passing over the length of the streams and required hundreds of miles of driving. For some years such measurements have also been made on the Arkansas river. These were taken from the Royal gorge, above Canon City, to the state line, a distance of about two hundred miles. Most of the trip was made with a light wagon and with the aid of the water commissioners or canal superintendents, who were familiar with the situation of the ditches. A portion of the distance had to be traversed on foot. During the present season a beginning has been made on the measurements of the upper Arkansas. Some forty miles have been measured, and the inflow from invisible sources has been found to be great.

Measurements have continued, the present season, to the Rio Grande. For the past three years they have started from a point known as the South Fork, some thirty miles above Del Norte, and continued down the river to the New Mexico line, or to the canon, which starts a short distance above. The distance is about 100 miles. Likewise, the measure-

ments on the Conejos, practically the only tributary of the Rio Grande in Colorado after it enters the San Luis valley. Measurements have also been made on the Uncompahgre river from a point above Ouray, from its mouth to the distance also of over 100 miles.

SEEPAGE FROM CANALS.

In order to determine what becomes of water used in irrigation, measurements have been continued to study the losses of water in distribution by canals. It has been found that in many cases the losses are very large. In some canals the losses are small. In many canals where the losses are great it has been found that in the measured part, the loss is in relatively short portions of the canals. It is, therefore, practicable for steps to be taken to lessen them. In numerous cases steps have already been taken as indicated by our investigations for improving the worst places. In one canal a section where it was found a large part of the canal's loss occurred within a short distance, has since been flumed. The measurements made this year have included quite a number of miles of canal. Similar measurements, though on a different scale, were made during the present season on the Arkansas river. A heavy storm had occurred on some of the tributaries of the Arkansas. It washed out bridges, raised the river to a considerable height and overflowed the low land. It was found that this storm was confined to the region of the mountains, and that eastern Colorado and Kansas were free from the storm. There was, therefore, the condition of a flood wave passing down the Arkansas river. It seemed an unusually favorable opportunity to determine the characteristics of such a wave and to determine the loss of such a wave from seepage. Preparations were at once made to follow and catch up with the wave and make measurements at different stages of its progress. The flood at Pueblo had been estimated to be over twenty thousand cubic feet per second. At Lamar, after several tributaries had entered, it was estimated to be nearer forty thousand cubic feet per second. The flood was overtaken at Dodge City, and there the flood wave was found to measure less than six thousand cubic feet per second. At Kinsley, 3,500; at Great Bend, 2,600; at Hutchinson, 1,600; at Wichita, 1,200, and at Arkansas City, 1,200 cubic feet per second.

A register was kept of the character of the flood for several days in order to determine that the flood did not become longer in time and thus make up for diminution in quantity. It, however, was plainly evident that the flood actually diminished almost in a ratio as indicated by the measurements.

METEOROLOGY.

The meteorological records have been maintained as in previous years. The observations, especially their reductions, require considerable time and becomes burdensome in its demands. There are, however, many reasons why it is desirable to maintain a series of observations for various purposes of the Experiment Station. In so doing it is possible to carry on a much larger series of observations than it is convenient to reduce. It has, therefore, been our desire to make these observations of such character that they furnish data for reduction at some subsequent time. It is considered that at least twenty-five years of observations are necessary in order to form a basis for any full conclusion regarding the climate. We now have fifteen years of continuous record, and observations scattered through some dozen of years, although the record is not continuous. The observations are becoming of considerable value. We have not only maintained the records of the temperature, of the air pressure, but have had in mind more especially the preservation of records of the elements important to agriculture. We thus have given more attention to questions of sunshine, of moisture, soil temperatures, etc. As far as possible records are kept by means of self-recording instruments, although these are checked by eye readings. A self-recording thermograph is located at an elevation of nine thousand feet at the camp where an observer has been located during the year. We also have records from another location at nine thousand feet, and at several other volunteer stations. We have distributed rain gages to various observers at different times, though in many cases the observers, while reporting to the weather bureau, have ceased to report to us.

Evaporation records, to determine the loss of water from water surfaces, have been maintained. For some years demands have been made to obtain records from high elevations, and such records have been difficult to obtain, indeed

it is difficult to find places where the conditions were favorable for making them. During several months of the year daily measurements have been made at an elevation of nine thousand feet, and it is expected that similar measurements will be continued during the coming season.

Acknowledgments are made especially to Mr. R. E. Trimble, assistant in this section, whose careful work and continued interest has made him an invaluable assistant. He has taken direct charge of many of the measurements, as well as of the meteorological observations. Mr. Amos Jones has assisted in the measurements in the San Luis valley. Mr. Oro McDermith has assisted in the measurements made on the Poudre and the Big Thompson.

L. G. Carpenter,
Director.

REPORT OF THE ARKANSAS VALLEY FIELD AGENT.

I hereby report the field operations of the experiment station in the Arkansas valley for the season of 1902.

The operations have differed from those of previous seasons in that no work has been done by what was formerly known as the sub-station. The time of the field agent has been occupied in four different ways:

1. Observing specific operations on various farms.
2. Noting insect troubles and fungus diseases, and remedies for the same.
3. Some cooperative work with farmers testing fertilizers.
4. The study of some questions (as hereafter specified) at the expense and under the supervision of the field agent on land controlled by the Experiment Station.

Under the first heading may be mentioned the following: The results secured from the practice of fall plowing for beets; the growth of beets on strong alkali land; the use of nitrate of soda as a fertilizer for beets; methods employed in securing a stand of beets; the behavior of certain varieties of fruits; the behavior of certain legumes for cover crops and fertilizers; methods employed in growing the tomato and the success obtained in canning the product; the forcing of cantaloupes in hotbeds.

The second heading comprises the following: The use of trap crops in protecting mother beets from the ravages of the false chinch bug (*Nysia pungeus*); the extent and character of the injury done to beets and other crops by the beet louse; studying the extent of injury from the melon louse and noting methods used for its control; the success obtained from the use of various sprays for the codling moth; noting the results obtained from the use of Bordeaux mixture to prevent apple twig blight; noting the development of the cantaloupe blight and the results of some work combating it.

The following comprises the principal work under the third heading: The use of nitrate of soda on beets and cantaloupes; testing the growing of field peas and oats, followed by cow peas as a soil improver; testing the growth of hairy vetch, cow peas and soy beans.

The fourth heading comprises the following: Some comparative work with the tomato in the propagation of the plants and the use of fertilizers; comparing nitrate of soda with other fertilizers for beets; testing what effect late September irrigation may have upon the sugar content of beets; the use of trap crops (on a small scale) to protect mother beets from the bug (*Nysia*); the further use of Bordeaux mixture for control of the cantaloupe blight; testing spraying and mechanical means to destroy or control the melon louse; the screening of trees to study to what extent twig blight of apple is propagated by flies visiting the blossoms. In addition to the above we have had the care of the experimental orchard that has been planted for some time.

More time has been devoted to the study of the tomato industry than to any other line of work—it has been the principal line of work. Next to this, the subjects that have received the most attention, are as follows: The use of trap crops to protect mother beets; a continuation of the work of former years with the cantaloupe blight and a study of the various means for control of the melon louse.

In each of the last mentioned lines of work, sufficient data has been secured to warrant its publication in bulletin form. We now have, the results of three years work of study, the various aspects of the tomato industry.

Each year adds importance to the beet sugar industry, and it seems only a question of a short time until Colorado will produce the beet seed as well as the beet, and perhaps by so doing will increase the per cent. of sugar which the beet contains. The work of the past year indicates that the insect ravage that at one time threatened to prevent the growing of seed, can be controlled.

Some additional information of importance has been secured in regard to cantaloupe blight. In some places the injury to melons by the louse was serious. An important industry is affected. I would respectfully recommend that a

press bulletin be issued giving information in regard to the life history of the insect, together with the means of combating it, and in order to make the distribution general it should be done through the various melon associations.

Respectfully submitted,

H. H. Griffin,
Field Agent.

REPORT OF THE PLAINS FIELD AGENT.

As field agent in charge of the Plains investigation, I present the following report for 1902.

I moved from Cheyenne Wells to Fort Collins in October, 1901, arriving at Fort Collins October 16. Following this removal came sickness in my family, which crippled me for vigorous work all winter.

The winter was spent in routine office work, some in connection with the Plains work, but more was in the line of arranging bulletins for binding. About seventy-five volumes were made ready for binding and sent to a bindery. Nearly as many more are stored awaiting missing parts.

During May I made a trip to the Colorado Springs divide with a team, visiting the principal farming districts on that divide, noting the condition of the country, methods of farming, crop raised, and the general industries of the country. A detailed account of that trip is filed in your office as my monthly report for May, 1902. Stock raising in combination with dairying, is the chief business all over the territory. The country is too hilly for farming on broad united acres. In the districts where grain growing is the most extensively practiced, probably not more than twenty per cent. of the land is cultivated. The hills are nearly all covered with pine timber. The best trees have all been cut, leaving those from three to ten inches in diameter standing.

The altitude is so great that the growing season is quite short. Potatoes, oats and wheat are the main crops produced. These, combined with dairy products, are the main sources of revenue. The hills which can not be farmed furnish a small amount of pasturage for milch cows. Nearly all people sell milk to creameries or cheese factories, but many use hand separators and ship their cream to Colorado Springs or Denver.

Very few orchards are seen. Mr. Wheatley has about two acres in cherry and apple trees two miles east of Elizabeth. This orchard is near the top of a hill and is not irri-

gated. The trees were watered a few times, but the main dependence has been placed upon thorough cultivation. The trees are now just beginning to bear. Mr. E. R. Parsons, who lives six miles west of Parker, has twelve acres in apple, plum, cherry and pear trees. These have never been irrigated, but have been kept thoroughly cultivated. Another orchard worthy of note is that of W. T. Lambert, near Sedalia. This consists of 250 acres, mostly apple trees. The trees are all young. Some are just beginning to bear. They were watered from hydrants during the first and second years from setting. The water was injected into the ground near the trees by means of a pointed iron tube attached to a hose. The plan is to water the trees two years from setting and then not water them again until they begin bearing fruit freely. Careful cultivation is kept up with disc harrows throughout the summer.

The soil on most of the divide is a sandy soil or sandy loam, underlaid by a clay subsoil, but there are considerable areas of clay soil. The Lambert orchard is on clay land, as is also much of the Parsons orchard. As I had failed to get good pictures during my travels in May, I spent most of the time during June in studying photography.

When I went to the eastern part of the state in July, I took with me a New Century camera. I also changed my mode of traveling, going by railroad, mail wagons and on foot, or by hired conveyance, as convenience suggested.

I went first to Washington county. People there make stock raising the main business. Some try to raise forage for winter feed and some do not. There is a considerable area of sand hills in the county. These produce hay in quite large quantities, when not grazed too much during the summer. The black polled cattle are seen on every hand in this country.

Yuma county was next visited. Yuma county, west of the sand hills, is just like Washington county. Yuma county, east of the sand hills and south of the north fork of the Republican, is quite thickly settled. It must be considered with the neighborhood near Vernon postoffice, in eastern Arapahoe county. The territory between the north fork of the Republican and the Arickaree, lying east of the sand hills, is still quite thickly settled. Grain raising is the main business, but nearly all the settlers there own cattle, which are kept in the sand hills during the summer and fed at home in the winter. These sand hills furnish a natural outlet for the cattle of this settlement. On the Vernon divide there are three times as

many cattle owned as there were when I was there in 1900. Also, more land is fenced on every hand. They are now beginning to fence to keep the cattle away from the crops.

I also visited the Idalia neighborhood on this trip. There I found practically the same changes as in the Vernon district. They are still raising grain, but are fencing their land, building wooden houses and getting into cattle raising as rapidly as their means will permit.

When I was over this country first the farmers told me that taking wheat crops from the land several years in succession did not seem to injure the land for future crops of wheat. This year the testimony and evidence favors one year in corn and the next in wheat. Wheat after sorghum and on fall-plowed land was no better this year than wheat after wheat.

In eastern Arapahoe county, stock raising is growing in importance. In nearly all the territory crop raising is now considered as a help to stock raising. Small herds are held by settlers, and where the settlement is too thick to furnish pasture the young stock is taken to a more thinly settled region for the summer. Corn was looking well when I was there in July, but later hail and drought destroyed much of the crop.

The next trip taken was to Cheyenne Wells. The substation farm was visited and found to be well cared for. The crop of forage was light on account of dry weather. The fruit trees were still looking thrifty. Many varieties had set apples, which must have been good, as rains came in August sufficient to bring the fruit to maturity. The eastern part of Cheyenne county is settling slowly. There are usually two well drills at work prospecting for water. The early settlers think that too many settlers are coming in, but the settlement will probably be much increased before the full capacity of the country is reached.

Forage crops around Cheyenne Wells are showing poor yields on account of continued drought. Many men in Cheyenne county try to winter stock without any extra feed (except what the cattle can get on the prairie). The result is that most of the cattle are poor—very poor—and weak in the spring. This causes a great deal of work during March, April and May, but those ranchers do very little during the remainder of the year.

The next trip took me to the northern part of Lincoln county, and along the Rock Island railroad, as far east as Burlington, also to Yale, Tuttle, Kirk and Cope. All points showed the effect of continued drought. Some late planted sod-corn, near Flagler, was so small that a passing darky remarked of it: "Dey'd betta kiver up dat co'n, or it mought git frost bit."

I interviewed several stockmen and settlers. The large cattlemen feel that they can not afford to raise feed for stock, and that if settlers continue to crowd in they must go out of business soon. Those holding small bunches of cattle (less than one hundred) can easily raise plenty of feed to winter them in corrals, when necessary, but those who have large numbers must put feed production on a commercial basis and handle cattle accordingly. If they can not produce feed cheap enough to winter their cattle, they must cease wintering and use their ranges in summer only.

In Kit Carson county the forage raising, or farming, is limited to the needs of cattle for winter feed. In other words, farming is made subsidiary to stock raising. The country about Kirk and Cope is given up to stock raising, the same as in Kit Carson county. At Cope I attended a meeting of the old settlers. There were about three hundred people there. They came from thirty miles away on every side, and many camped over night.

Most of the ranchmen hold herds of less than two hundred. There are five ranchmen on the North Fork, about the same number on the Arickaree, and ten on the South Fork, and about ten in the sandhills who hold from four hundred to two thousand head of cattle. These are small holdings when compared with the outfits who once held the country with from five thousand to twenty thousand cattle each.

At Burlington there is a skimming station, which does a small business. There are also a few hand separators in use about there. Burlington is constantly improving. There are now twenty-two windmills in the town. All but five of these are on residence properties, where they are used for irrigating home gardens and trees. The country near Burlington is settled quite thickly, so that only a few cattle are kept close to town, and these are mostly in pastures.

Detailed accounts of these trips are on file in the director's office. The fact that I took photographs of many places and things is mentioned in the trip reports. Since then the

negatives have been developed by Mr. Mulder. I have made prints from the negatives which were good and filed them in a book furnished for the purpose.

The distribution of macaroni wheat, which I have had partly in my charge, has given fairly satisfactory returns. Four are yet to be heard from. One of these has a good crop, and will report as soon as it is threshed. I would recommend that all who have raised seed be requested to keep the seed due the Station and plant next year, on condition that they furnish a report of the crops grown on large areas planted to macaroni wheat for the next four years, in case they continue to plant the variety so long as that.

In connection with some trials of macaroni wheat we planted a sample of the wheat produced by Robert Gauss, of Denver. Unfortunately circumstances having nothing to do with their merits rendered the test valueless. Mr. Gauss for a series of years has been trying to develop a variety of wheat which would be so drought resistant that it would grow upon our arid plains without irrigation. The results encourage to further trials.

J. E. Payne,
Field Agent.

SUMMARY OF WORK DONE AT THE PLAINS SUB-STATION IN THE YEAR 1902.

Began work April 15 (as soon as contract was made).

Got possession of the house and moved June 1.

PREPARATION OF THE LAND—MANNER OF PLANTING AND CULTIVATION.

All land was disced before planting, and planted with a lister drill.

All crops were harrowed three times and cultivated once. It was necessary to have the entire crop hoed in order to clean it. This work cost one dollar per acre.

One half of the land was disced by May 3. Began planting May 5. Finished first half May 9.

Five acres White African cane planted May 5. Damaged badly by hot wind; cut August 5. On August 20 we had a severe rain and hail storm; damaged crop so that it was worthless, washing much of it away. All other crops were severely damaged.

Ten acres Early Orange cane planted May 6 and 7. Cut September 16 and 17. Yield, five tons. .

Five acres corn planted May 9; three acres Pride of the North, two acres White Australian. Yield, no grain; very small crop of fodder on account of hot wind. Cut August 14. (All of which was worth cutting.)

The remainder of the field was disced May 16 and 17. Seven acres Early Orange cane planted May 19 and 20. Cut September 16. Yield, three tons.

Three acres Kafir corn planted May 20; failed to germinate. This was planted in cane June 24. Cut September 17. Yield, one ton.

Three acres corn planted May 21. Cut August 15. Yield too small to estimate.

One acre Early Amber cane planted May 22. Matured seed quite early. Cut September 20. Yield, one ton.

Six acres mixed cane seed planted May 23. Good crop of fodder. Cut September 20. Yield, four tons.

Trees.—All trees would have done well had it not been for the hail on August 20, damaging them so that they were about the same as at the beginning of the year.

Apples.—Nearly all varieties set some fruit. Drouth, hot wind, and the hail of August 20 caused all the apples to be damaged so that practically not a perfect specimen was gathered.

Cherries.—All killed by frost.

Plums.—All killed by the frost.

Gooseberries.—None fruited.

Grapes.—A few bunches of fine fruit.

Mulberries.—Good crop of fine fruit.

About two acres were used as a garden and truck patch. Fine results were obtained, but finally destroyed by hail in August.

COST OF CROPS.

Discing forty acres, at fifty cents	$ 20 00	
Listing forty acres, at seventy-five cents	30 00	
Harrowing three times, at seventy-five cents	30 00	
Cultivation once, at fifty cents	20 00	
Hoeing forty acres, at one dollar	40 00	
Cutting feed	15 00	
Caring for trees	25 00	
Total		$180 00

RESULTS.

Fourteen tons feed, at $8.00	$112 00	
Rent of house and barn nine months, at $8.00	72 00	
Total		$184 00

J. B. Robertson.

METEOROLOGICAL OBSERVATIONS FOR 1902.

The following tables, prepared by Mr. R. E. Trimble, give a record of the principal observations made during 1902, and more especially the elements of the climate most often inquired about. Records have been maintained at Fort Collins regularly since 1887, with observations extending for most of the time to 1884, and also during the years of 1873 and 1874. The record since the organization of the Experiment Station has been maintained to give not only the elements ordinarily included in weather observations, but a number of those important in agricultural meteorology, but less often recorded. Among these special attention has been given to the sunshine, measuring both its duration and its intensity—an automatic-photographic record for the amount, and the Arago-Davy conjugate thermometers for the intensity. Considerable trouble has been had with maximum registering solar thermometers, as the range of those on the market has not been sufficient to withstand the great radiation here experienced.

The present year completes eighteen years in which we have a record of the precipitation of the year for the full twelve months. It is interesting that the precipitation from and including 1895, excepting one year, has been above the normal. The record for 1900 gave 19.21 inches; for 1901, 21.17 inches, and for the present year, 18.00 inches. There have thus been three succesive years of exceptional rainfall. For the early part of the year there was a market deficiency in the rainfall, and, in fact, except in June, the rainfall was below the normal to the month of September. In this month came a fall which exceeded any other previously recorded in any one storm, and greater than recorded in any single month except in April, 1900. This storm began September 20, at 5 p. m., and continued without cessation until noon of the 22d. A total of 6.84 inches fell in forty-three hours. This and other storms have deposited an unusual body of snow in the mountains early in the season.

EXPLANATION OF THE TABLES.

The tables give summaries of the observations by months for Fort Collins, the Arkansas Valley sub-station at Rocky

Ford, the Plains sub-station at Cheyenne Wells, and at several volunteer stations, with other observations of soil temperatures, evaporations, etc., at Fort Collins.

The daily mean dew point and relative humidity is the mean of the two observations at 7 a. m. and 7 p. m.

The maximum and minimum temperatures are determined by the ordinary type of recording thermometers, both being read at 7 a. m. and 7 p. m. Usually the highest temperature occurs during the daylight hours, but in exceptional cases during the winter it may occur outside of these times. In such cases the time of maximum temperature is found by the sheets from the thermograph, and the highest and lowest temperatures of the twenty-four hours are recorded in these columns. The mean temperature for the day is the mean of the highest and the lowest temperatures. The range is the difference between the maximum and the minimum temperatures of the day.

The readings of the barometer are taken from an ordinary mercurial thermometer in the office. The readings as given are corrected for temperature and instrumental error but not for elevation of the basin, which is 4,994 feet above a level.

The terrestrial radiation is determined by a minimum thermometer placed in the instrument plat, with its bulb a few inches above sod, and the column headed "Radiation" is the difference between the reading of this instrument and the minimum thermometer. It will be noted that it is less than the minimum thermometer, and that the radiation is often considerable. The precipitation is measured in inches. The movement of the wind is determined by means of anemometers placed on the tower of the college building, about sixty feet above the ground, and is measured in miles.

The actinometer records are those taken from a set of Arago-Davy conjugate thermometers, the one being a black bulb and the other a bright bulb thermometer, enclosed in an envelop of glass, and with the bulbs freely exposed to the sky. The reading is taken at noon. As other duties often interfere with presence at the office at this hour, there are numerous blanks. The radiation is expressed in calories, as determined from a table which was made by comparing the observations throughout a cloudless day at short intervals.

It thus includes the constant of these particular instruments, and is thus given in absolute measurements.

The soil temperatures are taken by means of long thermometers, with bulbs set in the ground at the depths indicated. Set "A" is in an irrigated tract of ground, with a small lateral running near the side of the enclosure. The surface is covered with grass. The readings are taken at 7 a. m. and 7 p. m. Set "C" is located in a tract of unirrigated ground above ditches, and as it is some distance from the office the readings are taken weekly at 4 p. m. The extreme temperature is given in the next table, which shows the highest temperatures as found by the readings at 7 a. m. and 7 p. m. In some cases the maximum readings have been disturbed by irrigation water, which has brought the maximum temperature at a different time than would be the case under ordinary conditions.

TABLE I.

METEOROLOGICAL RECORD FOR JANUARY, 1902.

	Temperature, Dew Point and Relative Humidity								
	7 A. M.				7 P. M.				
	Dry Bulb	Wet Bulb	Dew Point	Relative Humidity	Dry Bulb	Wet Bulb	Dew Point	Relative Humidity	Daily Mean Dew Point
1	19.0	18.8	18.4	97.4	33.2	29.2	23.0	65.5	20.7
2	29.0	27.0	23.8	80.3	31.0	28.9	25.8	80.4	24.8
3	18.2	17.8	16.9	94.7	29.2	26.2	20.9	71.2	18.9
4	17.0	16.7	16.0	95.9	30.0	26.2	19.4	64.3	17.7
5	25.8	24.2	21.3	82.8	23.8	22.6	20.3	86.4	20.8
6	25.2	22.8	18.2	74.0	37.0	30.0	18.3	46.2	18.2
7	23.9	22.0	18.3	78.6	34.0	29.8	23.4	64.6	20.9
8	26.7	25.0	22.0	82.2	35.0	29.8	19.9	53.5	20.9
9	24.9	23.8	21.8	87.9	28.9	25.7	20.0	69.0	21.0
10	17.0	16.8	16.3	97.3	22.8	20.8	16.8	76.8	16.5
11	18.0	16.8	13.8	84.2	36.3	28.0	11.6	35.7	12.7
12	17.7	17.2	16.1	93.3	24.4	22.0	17.3	73.4	16.7
13	21.8	20.0	16.3	78.4	27.4	26.0	23.6	85.5	20.0
14	26.3	23.0	16.5	65.8	33.0	24.8	5.6	30.9	11.0
15	19.0	17.9	15.3	85.9	21.0	19.0	14.5	75.6	14.9
16	10.3	9.9	8.7	93.2	30.8	24.8	12.3	45.5	11.0
17	28.8	25.2	18.6	65.1	31.2	28.4	24.0	74.3	21.3
18	27.6	26.1	23.6	84.7	25.0	23.6	21.0	84.6	22.3
19	16.2	15.8	14.8	94.4	37.2	29.2	14.8	39.3	14.8
20	34.8	26.5	8.8	33.2	29.0	23.0	9.3	43.2	9.1
21	9.0	8.8	8.2	96.5	19.2	17.2	12.2	74.4	10.2
22	9.1	8.6	7.0	91.1	23.8	22.8	20.9	88.6	13.9
23	0.2	0.2	0.2	100.0	1.4	1.4	1.4	100.0	0.8
24	−4.2	−4.2	−4.2	100.0	16.8	16.8	16.8	100.0	6.3
25	0.0	0.0	0.0	100.0	−10.0	−10.0	−10.0	100.0	−5.0
26	−31.6	−31.6	31.6	100.0	−7.0	−7.8	−13.5	73.0	−22.6
27	14.2	−15.2	−26.6	53.4	−12.2	−12.4	−13.5	91.4	−20.0
28	−13.4	−14.0	−19.7	73.0	−2.7	−3.0	−4.3	91.4	−12.0
29	−8.8	−9.4	−13.6	77.9	−11.0	−11.4	−14.2	83.7	13.9
30	−9.8	−10.3	−14.0	80.8	3.0	2.6	1.0	91.1	−6.6
31	−5.8	−6.1	−7.4	90.2	16.0	14.1	8.8	73.4	0.7
Means	12.18	10.97	7.86	84.26	20.56	17.69	11.85	72.03	9.86
Normal	15.6	13.6	------	------	24.8	20.7	------	------	10.5

TABLE I—Continued.

METEOROLOGICAL RECORD FOR JANUARY, 1902.

	Daily Mean Relative Humidity	Maximum Temperature	Minimum Temperature	Daily Mean Temperature	Range	Barometer, Corrected for Temperature and Instrumental Error			Terrestrial Radiation	
						7 A. M.	7 P. M.	Mean	Instrument Reading	Radiation
1	81.5	55.2	18.7	36.9	36.5	25.138	25.175	25.156	15.1°	3.6
2	80.3	35.7	27.0	31.4	8.7	25.256	25.224	25.240	22.0	5.0
3	83.0	49.6	15.0	32.3	34.6	25.201	25.260	25.231	13.5	1.5
4	80.1	51.4	15.0	33.2	36.4	25.264	25.122	25.193	11.1	3.9
5	84.6	46.1	22.6	34.3	23.5	25.232	25.169	25.200	22.6	0.0
6	60.1	59.0	19.2	39.1	39.8	24.966	25.050	25.008	15.0	4.2
7	71.6	58.0	23.8	40.9	34.2	25.051	25.022	25.037	18.9	4.9
8	67.8	62.2	24.3	43.3	37.9	25.033	25.019	25.026	20.0	4.3
9	78.5	49.0	26.6	37.8	22.4	25.053	25.148	25.100	21.3	5.3
10	87.9	44.4	19.0	31.7	25.4	25.424	25.321	25.373	15.7	3.3
11	60.0	56.7	14.3	35.5	42.4	25.326	25.212	25.269	10.0	4.3
12	83.3	57.0	17.0	37.0	40.0	25.152	25.117	25.134	13.0	4.0
13	82.0	57.0	17.8	37.4	39.2	25.066	25.041	25.054	13.0	4.8
14	48.3	58.2	18.8	38.5	39.4	25.033	25.005	25.019	13.2	5.6
15	80.8	48.3	17.0	32.6	31.3	25.230	25.228	25.229	12.0	5.0
16	69.3	52.0	8.4	30.2	43.6	25.036	24.773	24.904	14.2	4.2
17	69.7	39.9	20.1	30.0	19.8	24.685	24.919	24.802	15.3	4.8
18	84.7	34.8	24.4	29.6	10.4	25.021	24.990	25.006	19.0	5.4
19	66.8	46.6	16.8	31.7	29.8	24.857	24.744	24.800	14.0	2.8
20	38.2	38.7	28.0	33.4	10.7	24.897	25.201	25.049	26.0	2.0
21	85.5	34.9	5.6	20.2	29.3	25.134	24.814	24.974	1.3	4.3
22	89.8	33.9	7.2	20.6	26.7	24.899	24.930	24.915	2.8	4.4
23	100.0	24.4	1.8	13.1	22.6	24.850	24.872	24.861	−1.8	3.6
24	100.0	22.8	−5.0	8.9	27.8	24.944	24.751	24.847	−8.1	3.1
25	100.0	0.0	−10.8	−5.4	10.8	24.634	24.814	24.724	−12.0	1.2
26	86.5	6.7	−31.4	−12.3	38.1	24.907	24.965	24.936	−34.6	3.2
27	72.4	14.0	−18.6	−2.3	32.6	25.070	25.093	25.082	−22.2	3.6
28	82.2	10.9	−19.7	−4.4	30.6	25.002	25.094	25.048	−22.6	2.9
29	80.8	8.8	−17.7	−4.5	26.5	25.086	24.939	25.012	−20.3	2.6
30	86.0	25.8	−14.8	5.5	40.6	24.836	24.821	24.829	−17.7	2.9
31	81.8	33.0	−7.0	13.0	40.0	24.758	24.708	24.733	−20.0	5.0
Means.	78.15	39.19	9.14	24.17	30.05	25.094	25.017	25.026	5.41	3.73
Normal	71.4	40.6	11.0	25.8	27.9	.....	.....	24.927	.....	5.2

TABLE I—Concluded.

METEOROLOGICAL RECORD FOR JANUARY, 1902.

Precipitation				Direction of Wind		Total Movement 24 Hours Following 7 A. M.	Actinometer at Noon				Frost or Dew
Time of Beginning	Time of Ending	Total Amount Rain and Melted Snow	Average Depth of Snow	7 A. M.	7 P. M.		Black Bulb	Bright Bulb	Difference	Radiation	
.....	.....	.....	.....	E	W	105.2	.....	.....	.....	.....	Fr
.....	.....	.....	.....	0	NW	83.1	.....	.....	.....	.....	.....
.....	.....	.....	.....	NW	E	133.6	.....	.....	.....	.....	Fr
.....	.....	.....	.....	.....	W	78.9	.....	.....	.....	.....	.....
.....	.....	.....	.....	SW	SW	146.6	.....	.....	.....	.....	Fr
.....	.....	.....	.....	N	S	124.4	40.4	22.4	18.0	12.00	Fr
.....	.....	.....	.....	N	NE	97.0	.....	.....	.....	.....	.....
.....	.....	.....	.....	W	NW	75.2	42.7	24.0	18.7	12.65	Fr
.....	.....	.....	.....	0	W	102.9	.....	.....	.....	.....	Fr
.....	.....	.....	.....	0	W	101.4	.....	.....	.....	.....	Fr
.....	.....	.....	.....	N	NW	76.1	.....	.....	.....	.....	Hv Fr
.....	.....	.....	.....	0	S	80.7	.....	.....	.....	.....	Fr
.....	.....	.....	.....	N	W	118.3	40.2	22.5	17.7	11.79	Fr
.....	.....	.....	.....	NW	NW	153.0	39.9	22.2	17.7	11.77	.....
.....	.....	.....	.....	NW	S	88.8	36.4	18.2	18.2	11.76	Fr
.....	.....	.....	.....	S	S	58.0	37.7	19.0	18.7	12.18	Fr
4 P. M.	.....	T	.....	NW	W	122.4	.....	.....	.....	.....	.....
.....	.....	.....	.....	0	S	65.2	10.6	3.7	6.9	3.82	.....
.....	.....	.....	.....	N	NW	177.6	.....	.....	.....	.....	Fr
.....	.....	.....	.....	NW	N	264.2	20.0	8.3	11.7	6.83	.....
.....	.....	.....	.....	NE	NE	67.5	10.3	1.5	8.8	4.82	Fr
4.30 P	Nt	.02	.....	S	0	92.1	29.5	10.5	19.0	11.61	Fr
.....	.....	.10	2.5	NW	W	89.5	36.3	10.8	25.5	16.02	Sn
4.15 P	.....	.02	¼	NW	NW	145.0	.....	.....	.....	.....	Fr
.....	.....	.18	4.0	N	N	159.5	.....	.....	.....	.....	Sn
.....	.....	.....	.....	N	N	94.5	.....	.....	.....	.....	Fr
.....	.....	.....	.....	NW	W	77.2	34.1	5.8	28.3	17.30	.....
.....	.....	.....	.....	NE	W	76.8	33.2	4.5	28.7	17.40	Fr
.....	.....	.....	.....	0	W	81.3	.....	.....	.....	.....	Fr
.....	.....	.....	.....	0	0	80.5	37.2	10.0	27.2	17.10	.....
.....	.....	.....	.....	W	W	108.5	38.2	12.0	26.2	16.66	.....
.....	.....	.32	6.75	----	----	107.3	32.45	13.03	19.42	12.25	.....
.....	.....	0.57	.....	----	----	189.0	.....	.....	.....	.....	.....

TABLE II.

METEOROLOGICAL RECORD FOR FEBRUARY, 1902.

	Temperature, Dew Point and Relative Humidity								Daily Mean Dew Point
	7 A. M.				7 P. M.				
	Dry Bulb	Wet Bulb	Dew Point	Relative Humidity	Dry Bulb	Wet Bulb	Dew Point	Relative Humidity	
1	7.8	7.8	7.8	**100.0**	—9.2	—9.4	—10.2	92.5	—1.20
2	—12.8	—13.2	—16.4	82.5	9.6	8.8	6.0	86.1	—5.20
3	4.0	3.6	2.0	91.5	14.0	13.0	10.1	85.0	6.05
4	12.0	12.0	12.0	**100.0**	23.3	22.0	19.5	85.1	75.8
5	33.2	26.2	12.0	40.9	29.7	26.8	21.9	72.4	16.9
6	23.2	22.0	19.7	86.3	25.8	24.2	21.3	82.8	20.5
7	18.9	18.2	16.7	90.9	31.3	28.5	24.2	74.5	20.5
8	14.8	14.8	14.8	**100.0**	22.2	21.2	19.1	88.2	16.9
9	19.8	19.2	18.0	92.5	29.0	28.2	27.0	92.1	22.5
10	20.0	19.6	18.8	95.0	48.0	37.9	24.9	40.3	21.9
11	29.0	26.2	21.4	72.7	37.3	33.8	29.2	72.9	25.3
12	22.0	21.6	20.8	95.2	37.7	32.0	23.7	56.6	22.2
13	31.0	28.9	25.8	80.4	28.8	26.1	21.5	73.5	23.7
14	14.6	14.0	12.4	91.1	29.2	27.8	25.6	86.2	19.0
15	22.2	21.0	18.6	85.9	29.8	26.2	19.8	65.5	19.2
16	28.9	27.8	26.1	89.1	44.0	36.9	28.0	53.5	27.1
17	28.0	26.6	24.3	85.7	36.7	33.0	28.0	71.0	26.1
18	42.5	32.5	15.9	33.7	39.7	32.9	23.0	51.0	19.5
19	30.8	28.0	23.6	74.1	34.8	27.8	14.8	43.2	19.2
20	15.3	14.8	13.4	92.9	32.9	25.0	7.1	33.1	10.2
21	32.7	26.7	15.5	48.1	36.8	27.9	9.8	32.2	12.7
22	30.2	25.1	15.1	52.6	41.9	35.2	26.4	54.0	20.7
23	18.1	18.2	17.6	97.4	31.2	26.6	10.2	40.9	13.9
24	12.2	11.9	11.0	95.2	40.2	29.8	9.3	27.7	10.2
25	33.7	28.7	20.4	57.5	37.5	30.2	17.6	43.4	19.0
26	30.4	27.8	23.7	75.6	41.9	30.9	10.0	26.6	16.9
27	35.8	29.9	20.3	53.0	38.0	28.0	6.6	26.4	13.4
28	29.4	25.0	16.7	58.3	30.0	28.8	27.0	88.4	21.9
Means	22.43	20.18	16.00	79.22	31.15	26.43	17.91	62.33	16.95
Normal	15.9	14.1	.....	.....	25.2	21.43	.....	.....	11.9

TABLE II—Continued.

METEOROLOGICAL RECORD FOR FEBRUARY, 1902.

Daily Mean Relative Humidity	Maximum Temperature	Minimum Temperature	Daily Mean Temperature	Range	Barometer, Corrected for Temperature and Instrumental Error			Terrestrial Radiation	
					7 A. M.	7 P. M.	Mean	Instrument Reading	Radiation
96.2	8.1	—9.2	—0.55	17.3	24.844	25.044	24.944	—16.0	6.8
84.3	24.7	—23.0	0.85	47.7	25.025	24.928	24.976	—28.2	5.2
88.3	32.2	0.2	16.2	32.0	24.996	25.105	25.051	—4.3	4.5
92.5	38.0	9.8	23.9	28.2	24.981	24.741	24.861	8.0	1.8
56.7	43.0	18.0	30.5	25.0	24.719	24.721	24.720	8.0	10.0
84.5	34.8	22.0	28.40	12.8	24.945	24.961	24.953	21.9	0.1
82.7	51.0	16.0	33.5	35.0	24.922	25.011	24.966	14.0	2.0
94.1	32.2	13.8	23.0	18.4	25.133	25.110	25.122	15.0	—1.2
92.3	32.3	18.0	25.2	14.3	25.088	25.115	25.101	14.9	3.1
67.6	56.1	18.1	37.1	38.0	24.995	24.962	24.979	15.2	2.9
72.8	58.0	28.0	43.0	30.0	24.950	25.006	24.978	24.2	3.8
75.9	57.2	22.0	39.6	35.2	24.899	24.849	24.874	19.7	2.3
77.0	37.0	28.0	32.5	9.9	24.954	25.067	25.010	23.0	5.0
88.6	34.2	5.8	20.0	28.4	25.173	25.032	25.103	0.9	4.9
75.7	47.7	19.1	33.4	28.6	25.069	25.097	25.083	16.0	3.1
71.3	63.0	27.0	4.5	36.0	25.032	24.963	24.997	23.7	3.3
78.4	55.6	25.3	40.5	30.3	24.873	24.583	24.728	------	------
42.3	49.1	30.3	39.7	18.8	24.578	24.810	24.694	------	------
58.7	44.2	30.0	37.1	14.2	25.054	25.170	25.113	------	------
63.0	62.2	14.0	38.1	48.2	25.118	24.976	25.047	------	------
40.1	50.9	22.8	36.9	28.1	25.020	24.880	24.950	------	------
53.3	50.9	25.4	38.2	25.5	24.828	24.800	24.814	------	------
69.2	51.2	20.0	35.6	31.2	24.923	25.009	24.966	------	------
61.4	57.0	12.3	34.7	44.7	24.967	24.765	24.865	------	------
50.5	60.0	30.7	45.4	29.3	24.631	24.486	24.558	------	------
51.1	54.0	28.3	41.1	25.7	24.320	24.409	24.365	------	------
39.7	47.1	35.2	41.2	11.9	24.550	24.511	24.530	------	------
73.4	42.2	28.9	35.5	13.3	24.476	24.571	24.524	------	------
70.77	45.5	18.46	27.04	------	24.895	24.881	24.888	9.75	3.60
72.9	40.5	12.1	25.4	28.43	----------	----------	24.92	------	4.1

TABLE II—Concluded.

METEOROLOGICAL RECORD FOR FEBRUARY, 1902.

	Precipitation				Direction of Wind		Total Movement 24 Hours Following 7 A. M.	Actinometer at Noon				Frost or Dew
	Time of Beginning	Time of Ending	Total Am'nt Rain and Melted Snow	Average Depth of Snow	7 A. M.	7 P. M.		Black Bulb	Bright Bulb	Difference	Radiation	
1	Nt	A M	.07	1.25	NE	S	136.7	35.6	7.3	28.3	17.50	Sn
2	----	----	----	----	NW	W	117.7	----	----	----	----	Fr
3	----	----	----	----	E	W	139.1	42.0	16.8	25.2	16.56	Fr
4	----	----	----	----	0	NW	217.2	31.2	8.5	22.7	13.85	Hv Fr
5	----	----	----	----	NW	N	155.9	41.9	19.2	22.7	15.04	----
6	----	----	----	----	S	S	180.4	31.5	15.5	16.0	10.04	----
7	----	----	----	----	W	N	128.7	26.7	18.0	18.7	12.09	Fr
8	6.40 A	----	T	----	SE	E	50.2	2.5	0.0	2.5	1.32	Hv Fr
9	P M	----	T	----	N	S	87.3	----	----	----	----	----
10	----	----	----	----	SE	W	151.7	8.6	4.1	4.5	2.47	Fr
11	----	----	----	----	NW	NE	70.6	29.0	13.1	15.9	9.79	----
12	----	----	----	----	W	N	128.4	----	----	----	----	Fr
13	12.10 P	2.10 P	.08	1.0	SE	NE	121.9	----	----	----	----	----
14	----	----	----	----	N	SE	61.9	40.0	16.0	24.0	15.60	----
15	----	----	----	----	N	NW	118.5	36.5	18.5	18.0	11.65	Fr
16	----	----	----	----	0	W	117.6	----	----	----	----	----
17	----	----	----	----	SE	NW	166.2	32.2	18.3	13.9	8.84	----
18	----	----	----	----	NW	N	375.7	35.7	19.1	16.6	10.73	----
19	----	----	----	----	NW	N	254.5	39.7	18.8	20.9	13.71	----
20	----	----	----	----	NW	N	96.9	40.2	23.2	17.0	11.36	Fr
21	----	----	----	----	N	NW	101.9	16.8	8.7	8.1	4.68	----
22	----	----	----	----	NW	N	110.9	36.0	20.2	15.8	10.27	----
23	----	----	----	----	W	W	107.4	----	----	----	----	Fr
24	----	----	----	----	0	W	77.6	38.9	20.8	18.1	11.92	Fr
25	----	----	----	----	0	NW	100.6	40.1	18.8	21.3	13.99	----
26	----	----	----	----	W	W	277.2	----	----	----	----	----
27	----	----	----	----	NW	NW	508.8	----	----	----	----	----
28	7.00 P	----	T	----	NW	N	416.8	36.8	17.5	19.3	12.45	----
Means	----	----	0.15	2.25	----	----	163.5	32.60	15.12	17.48	11.19	----
Normal	----	----	0.59	----	----	----	193.0	----	----	----	----	----

TABLE III.

METEOROLOGICAL RECORD FOR MARCH, 1902.

	Temperature, Dew Point and Relative Humidity								
	7 A. M.				7 P. M.				
	Dry Bulb	Wet Bulb	Dew Point	Relative Humidity	Dry Bulb	Wet Bulb	Dew Point	Relative Humidity	Daily Mean Dew Point
1	30.6	26.3	18.6	60.4	34.0	26.7	12.0	39.6	15.3
2	24.9	21.8	15.4	66.4	39.1	32.8	23.7	53.8	19.5
3	30.9	27.1	20.6	65.1	33.3	26.0	10.8	38.5	15.7
4	24.0	20.9	14.2	65.5	27.2	21.0	5.0	38.7	9.6
5	14.3	12.9	8.9	79.3	32.4	24.2	4.2	29.8	6.6
6	32.1	24.0	4.2	30.1	40.9	34.8	26.8	55.0	15.5
7	37.7	28.2	9.1	29.5	41.9	29.2	—1.0	16.1	4.0
8	24.7	22.0	16.6	70.4	32.4	24.2	3.6	29.8	10.1
9	26.9	23.0	15.1	60.4	38.0	28.0	6.6	26.4	10.9
10	39.2	32.9	23.9	54.0	37.4	35.8	33.9	87.4	28.9
11	26.2	25.0	22.9	87.3	35.2	29.1	18.8	50.7	20.8
12	20.3	18.9	15.9	82.6	34.7	23.7	**—10.9**	13.1	2.6
13	25.7	20.9	9.6	50.0	47.8	32.0	—6.0	**10.3**	1.8
14	32.7	31.0	28.6	84.8	29.7	27.7	24.6	80.6	26.6
15	25.6	19.4	1.5	35.8	23.0	19.7	12.2	62.2	6.7
16	24.2	20.0	10.0	54.0	23.2	20.3	13.9	66.8	12.0
17	9.8	9.8	9.8	**100.0**	36.8	29.0	14.9	40.1	12.3
18	29.8	27.8	24.6	80.7	42.8	32.0	12.8	29.2	18.8
19	32.2	26.8	17.0	52.5	48.8	38.3	24.9	39.1	20.9
20	35.9	34.4	32.6	87.7	42.8	38.1	32.7	68.3	3.27
21	34.0	33.1	31.9	92.2	39.7	33.9	26.1	57.3	29.0
22	29.2	29.2	29.2	**100.0**	45.9	40.9	35.8	68.2	32.5
23	35.0	34.0	32.8	91.6	46.7	38.6	**37.1**	89.7	34.9
24	36.0	35.2	34.2	93.4	35.7	35.0	34.2	94.2	34.2
25	34.9	34.1	33.1	93.2	35.0	31.0	25.2	67.2	29.2
26	38.7	31.0	18.4	43.4	40.2	30.4	12.1	31.5	15.2
27	31.2	31.2	31.2	**100.0**	37.3	33.0	27.2	66.9	29.2
28	30.9	26.9	20.0	63.4	24.2	23.2	21.3	88.8	20.7
29	21.1	18.9	13.9	73.3	24.0	20.0	10.6	55.8	12.2
30	23.0	20.7	16.0	73.5	27.0	25.0	21.4	79.2	18.7
31	25.0	22.8	18.6	76.0	33.1	28.7	21.5	62.0	20.1
Means	28.60	25.49	19.31	70.85	35.60	29.43	17.28	52.79	18.30
Normal	27.1	24.3	------	------	35.1	29.1	------	------	19.6

TABLE III—Continued.

METEOROLOGICAL RECORD FOR MARCH, 1902.

	Daily Mean Relative Humidity	Maximum Temperature	Minimum Temperature	Daily Mean Temperature	Range	Barometer, Corrected for Temperature and Instrumental Error			Terrestrial Radiation	
						7 A. M.	7 P. M.	Mean	Instrument Reading	Radiation
1	50.5	44.0	28.7	36.3	15.3	24.744	24.926	24.835	------	----
2	60.1	46.9	16.6	31.8	30.3	24.781	24.575	24.678	------	----
3	51.8	44.0	26.8	35.4	17.2	24.698	24.982	24.840	------	----
4	52.1	42.7	23.8	33.2	18.9	25.248	25.223	25.235	------	----
5	54.5	49.0	8.0	28.5	41.0	25.142	24.880	25.011	4.1	3.9
6	42.6	51.0	23.2	37.1	28.8	24.679	24.616	24.648	18.9	4.3
7	22.9	49.8	26.8	38.3	23.0	24.865	25.000	24.932	18.0	8.8
8	50.1	56.2	20.1	38.2	36.1	25.066	24.919	24.993	14.3	5.8
9	43.4	63.9	23.8	43.8	40.1	24.844	24.755	24.798	16.8	1.0
10	70.7	43.0	33.4	38.2	9.6	24.835	24.848	24.841	25.9	7.5
11	69.0	47.1	18.0	32.5	29.1	24.912	25.032	24.972	13.8	4.2
12	47.9	53.6	16.7	35.2	36.9	25.103	24.907	25.005	9.7	7.0
13	30.1	57.8	14.0	35.9	23.8	24.777	24.460	24.619	6.9	7.1
14	82.7	41.8	20.3	31.0	21.5	24.267	24.515	24.391	15.0	5.3
15	49.0	36.9	20.5	28.7	16.4	24.540	24.796	24.668	17.2	3.3
16	60.4	40.8	12.0	26.4	28.8	24.981	25.118	25.049	6.3	5.7
17	70.1	53.9	2.0	28.0	51.9	25.193	25.040	25.117	—0.4	2.4
18	54.9	63.1	18.1	40.6	45.0	24.900	24.717	24.808	13.2	4.9
19	45.8	60.3	24.0	42.1	36.0	24.727	24.673	24.700	18.1	5.9
20	78.0	51.0	33.0	42.0	18.0	24.810	24.876	24.843	32.1	0.9
21	74.8	46.2	32.3	39.3	13.9	24.874	29.819	24.847	32.0	0.3
22	84.1	52.0	28.8	40.4	23.2	24.872	24.713	24.792	23.7	5.1
23	90.6	50.1	31.7	40.9	18.4	24.691	24.667	24.679	27.4	4.3
24	93.8	50.9	32.2	41.5	18.7	24.748	24.671	24.710	27.7	4.5
25	80.2	39.7	31.2	35.5	8.5	24.560	24.393	24.476	29.9	1.3
26	37.5	50.2	33.7	41.9	16.5	24.684	24.770	24.727	29.0	4.7
27	83.4	51.0	26.3	38.7	24.7	24.841	24.697	24.773	22.7	3.6
28	76.1	36.2	33.0	29.6	13.7	24.801	24.856	24.822	23.0	0.0
29	64.6	32.5	19.0	25.8	13.4	24.977	24.992	24.984	17.2	1.9
30	76.4	37.0	16.1	26.5	20.9	25.147	24.669	24.908	12.0	4.1
31	69.0	45.8	14.0	29.9	31.8	25.246	25.154	25.200	9.8	4.2
Means	61.82	48.01	22.52	35.27	25.49	24.857	24.815	24.836	17.94	4.37
Normal	------	------	------	------	------	--------	------	------	------	----

TABLE III—Concluded.

METEOROLOGICAL RECORD FOR MARCH, 1902.

Precipitation				Direction of Wind		Total Movement 24 Hours following 7 A. M.	Actinometer at Noon				Frost or Dew
Time of Beginning	Time of Ending	Total Amount Rain and Melted Snow	Average Depth of Snow	7 A. M.	7 P. M.		Black Bulb	Bright Bulb	Difference	Radiation	
------	------	------	------	NW	W	285.0	------	------	------	------	----
8.20 P	------	------	------	0	W	204.7	------	------	------	------	----
------	------	T	------	W	NW	392.2	32.2	15.6	16.6	10.49	Sn
------	------	------	------	NW	S	224.3	21.6	10.7	10.9	6.46	----
------	------	------	------	0	N	74.4	22.2	11.7	10.5	6.26	Fr
------	------	------	------	SE	E	202.1	20.5	12.0	8.5	5.04	----
------	------	------	------	NW	NW	306.3	------	------	------	------	----
------	------	------	------	N	N	105.6	29.4	15.4	15.0	8.71	----
------	------	------	------	W	W	202.2	------	------	------	------	----
9.00 A	Int da	.03	T	N	N	99.8	30.0	15.5	14.5	9.04	----
------	------	------	------	N	N	230.4	35.4	17.8	17.6	11.31	Hv Fr
------	------	------	------	SE	S	152.8	41.3	22.5	18.8	12.58	Fr
------	------	------	------	NW	NW	92.3	24.8	15.2	9.6	5.86	----
------	------	------	------	NW	N	443.7	------	------	------	------	----
------	------	------	------	W	NW	360.8	23.0	16.0	7.0	4.62	----
------	------	------	------	W	E	298.0	------	------	------	------	----
Nt	------	T	------	E	W	104.9	35.0	16.5	18.5	11.81	Hv Fr
------	------	------	------	NW	W	105.7	27.9	17.0	10.9	6.78	----
8.15 P	Nt	------	------	S	N	179.1	43.5	26.0	17.5	11.97	----
8.30 P	Nt	.45	T	NW	NW	92.6	------	------	------	------	Sn
------	------	.20	T	SE	NW	133.9	Cloudy	------	------	------	Sn
------	------	------	------	0	NW	168.4	40.3	26.2	14.1	9.53	Fog
3.00 P	6.00 P	.17	------	NW	N	116.6	------	------	------	------	Fr
3.00 P	------	.23	------	0	N	150.0	43.7	23.0	20.7	14.01	Fr
6.50 A	6.00 P	.21	------	NW	NW	474.6	1.94	9.7	9.7	5.67	Rn
------	------	------	------	N	NW	218.7	------	------	------	------	----
------	------	------	------	0	W	148.1	------	------	------	------	Fr
10.30 A	8.00 P	.20	2.5	N	N	242.5	------	------	------	------	----
------	------	.01	------	N	W	310.0	------	------	------	------	----
------	------	------	------	S	W	133.0	------	------	------	------	----
------	------	------	------	NW	NW	96.1	35.1	16.5	18.6	11.88	Fr
------	------	1.50	2.50	----	----	204.8	30.90	16.90	14.00	8.92	----
------	------	------	------	----	----	233.0	------	------	------	------	----

TABLE IV.

METEOROLOGICAL RECORD FOR APRIL, 1902

	Temperature, Dew Point and Relative Humidity								Daily Mean Dew Point
	7 A. M.				7 P. M.				
	Dry Bulb	Wet Bulb	Dew Point	Relative Humidity	Dry Bulb	Wet Bulb	Dew Point	Relative Humidity	
1	28.0	26.0	22.6	79.8	40.3	34.9	27.9	61.4	25.2
2	31.7	29.7	26.8	81.7	42.3	37.0	30.7	63.8	28.8
3	31.7	30.2	28.1	86.3	49.3	36.0	15.0	25.2	21.5
4	38.9	33.3	25.6	58.6	43.8	32.0	**10.0**	24.9	17.8
5	42.9	37.8	31.9	65.7	53.0	40.1	23.7	32.0	27.8
6	39.4	38.9	**38.4**	96.2	45.0	38.8	31.8	60.1	35.1
7	36.8	35.1	32.9	85.7	51.6	43.0	34.3	51.7	33.6
8	51.4	39.8	25.5	36.5	53.2	38.0	14.7	**21.7**	20.1
9	43.0	39.9	36.7	79.0	48.9	37.6	22.2	35.0	29.5
10	36.1	32.0	26.3	67.4	43.6	33.6	17.9	35.2	22.1
11	34.2	28.7	19.5	54.1	52.9	42.7	31.8	45.0	25.6
12	35.0	35.0	35.0	**100.0**	41.9	39.6	37.2	84.0	36.1
13	40.2	36.6	32.4	74.1	34.7	33.0	30.8	85.6	31.6
14	26.2	25.2	23.5	89.3	33.2	32.2	30.9	91.2	27.2
15	25.8	25.8	25.8	**100.0**	45.0	36.4	25.1	45.2	25.2
16	37.2	35.2	32.8	84.3	44.2	37.6	29.7	56.9	31.2
17	50.2	42.0	33.4	52.6	44.7	41.2	37.7	77.2	35.6
18	46.1	40.6	34.8	65.3	56.6	42.2	25.0	29.5	29.9
19	51.9	43.2	34.4	51.5	60.5	47.0	34.3	37.5	34.3
20	52.5	43.2	33.7	49.0	60.0	47.1	35.1	39.4	34.4
21	43.0	39.2	35.1	74.3	41.0	37.0	32.3	71.8	33.7
22	33.7	28.7	20.4	57.5	40.0	34.8	28.1	62.6	24.3
23	37.8	35.2	32.0	80.0	45.3	39.0	31.9	59.7	31.9
24	41.1	3.80	34.6	78.1	49.3	40.9	31.7	50.7	33.2
25	49.1	38.0	23.2	36.3	47.7	37.9	25.3	41.5	24.2
26	41.0	37.8	34.2	77.4	54.6	42.0	28.1	36.2	31.2
27	46.2	41.2	36.1	68.4	50.9	37.9	19.5	28.9	27.8
28	53.4	43.9	34.5	48.9	56.0	42.2	25.9	31.5	30.2
29	47.3	39.3	30.0	51.2	53.7	42.9	31.4	42.9	30.7
30	53.7	42.1	29.0	39.0	62.0	47.0	32.4	32.9	30.7
Means	40.82	36.05	30.31	68.94	48.17	39.06	27.75	48.71	29.03
Normal	41.3	36.0	------	------	48.0	38.7	------	------	28.2

TABLE IV—Continued.

METEOROLOGICAL RECORD FOR APRIL, 1902.

Daily Mean Relative Humidity	Maximum Temperature	Minimum Temperature	Daily Mean Temperature	Range	Barometer, Corrected for Temperature and Instrumental Error			Terrestrial Radiation	
					7 A. M.	7 P. M.	Mean	Instrument Reading	Radiation
70.6	47.8	20.0	33.9	27.8	25.134	24.865	24.999	13.6	6.4
72.7	53.3	25.2	39.2	28.1	24.830	24.903	24.867	21.0	4.2
55.8	60.9	21.0	41.0	39.9	24.986	24.978	24.982	18.0	3.0
41.7	66.8	24.0	45.4	42.8	25.073	24.932	25.002	19.4	4.6
48.9	66.9	32.8	49.8	34.1	24.908	24.873	24.891	24.4	8.4
78.1	60.1	38.0	50.0	22.1	25.042	25.063	25.052	36.0	2.0
68.7	63.0	34.8	48.9	28.2	25.068	24.725	24.897	33.6	1.2
29.1	65.0	46.2	55.6	18.8	24.778	24.885	24.831	41.2	5.0
57.0	60.3	37.3	48.8	23.0	25.039	24.921	24.980	35.6	1.7
51.3	54.9	23.2	39.0	31.7	25.150	25.102	25.126	16.2	7.0
49.6	59.2	26.2	42.7	33.0	25.157	24.972	25.065	18.8	7.4
92.0	46.9	34.3	40.6	12.6	25.087	24.994	25.040	34.1	0.2
79.8	45.2	31.7	38.5	13.5	24.981	24.977	24.979	25.2	6.5
90.3	37.1	18.0	27.5	19.1	25.035	25.017	25.026	13.0	5.0
72.6	49.8	23.8	36.8	26.0	25.034	24.934	24.984	25.0	−1.2
70.6	56.0	28.9	42.5	27.1	25.124	24.971	25.098	24.7	4.2
64.9	69.3	30.0	49.6	39.3	24.971	24.913	24.942	25.0	5.0
47.4	72.0	29.9	51.0	42.1	25.027	24.935	24.981	23.7	6.2
44.5	79.2	34.0	56.6	45.2	24.923	24.748	24.835	30.2	3.8
44.2	79.8	35.1	57.4	44.7	24.736	24.546	24.641	28.9	6.2
73.1	47.0	37.7	42.4	9.3	24.618	24.536	24.577	------	------
60.0	52.7	30.2	41.4	22.5	24.789	24.981	24.885	------	------
69.9	57.8	23.0	40.4	34.8	25.074	24.970	25.022	------	------
64.4	67.0	28.3	47.7	38.7	24.921	24.663	24.792	24.0	4.3
38.9	56.4	40.9	48.6	15.5	24.795	25.000	24.898	37.5	3.4
56.8	62.2	29.6	45.9	32.6	25.030	24.871	24.950	24.6	5.0
48.7	73.4	29.1	51.3	44.3	24.838	24.743	24.796	23.2	5.9
40.2	67.0	32.7	49.8	34.3	24.909	24.880	24.894	25.9	6.8
47.0	73.6	33.0	53.3	40.6	24.960	24.938	24.949	23.4	9.6
36.0	79.3	34.1	56.7	45.2	24.949	24.582	24.766	27.5	6.6
58.82	61.00	30.43	45.71	30.56	24.966	24.881	24.923	25.69	4.76
57.7	61.6	31.9	46.1	29.5	----------	----------	24.941	------	4.5

TABLE IV—Concluded.

METEOROLOGICAL RECORD FOR APRIL, 1902.

	Precipitation				Direction of Wind		Total Movement 24 Hours following 7 A. M.	Actinometer at Noon				Frost or Dew
	Time of Beginning	Time of Ending	Total Amount Rain and Melted Snow	Average Depth of Snow	7 A. M.	7 P. M.		Black Bulb	Bright Bulb	Difference	Radiation	
1	----	----	----	----	N	0	87.6	38.1	18.7	19.4	12.64	Fr
2	----	----	----	----	NE	W	128.2	33.3	17.5	15.8	10.06	Fr
3	----	----	----	----	S	NW	262.6	----	----	----	----	Fr
4	----	----	----	----	0	W	266.5	35.5	18.4	17.1	11.02	-----
5	----	Nt	----	----	E	NW	353.2	----	----	----	----	-----
6	----	----	.08	----	SE	SW	134.8	----	----	----	----	Rn
7	----	----	----	----	N	N	204.9	42.1	22.0	20.1	13.47	-----
8	----	----	----	----	NE	NW	376.6	----	----	----	----	-----
9	----	----	----	----	S	N	240.1	32.5	21.1	11.4	7.33	-----
10	----	----	----	----	0	NW	131.2	39.0	21.5	17.5	11.56	Fr
11	Nt	----	----	----	N	E	120.7	39.5	21.6	17.9	11.86	Fr
12	A M	----	.02	----	NE	E	107.2	9.5	4.8	4.7	2.60	Rn
13	2.50 P	7.30 P	.25	Mel'd	W	E	129.8	----	----	----	----	-----
14	12.30P	6.15 P	.11	----	NW	N	62.1	19.5	9.0	10.5	6.13	Sn
15	----	----	----	----	0	S	160.7	----	----	----	----	-----
16	----	----	----	----	S	S	176.4	36.2	21.7	14.5	9.48	Fr
17	----	----	----	----	W	S	202.0	40.5	27.7	12.8	8.71	-----
18	----	----	----	----	NE	W	202.4	46.5	31.0	15.5	10.93	Fr
19	----	----	----	----	NW	W	117.5	42.7	21.8	20.9	14.03	-----
20	----	----	----	----	0	W	81.6	----	----	----	----	-----
21	11 A	12.20P	.15	----	S	N	266.3	----	----	----	----	-----
22	----	----	----	----	NW	S	133.2	----	----	----	----	-----
23	----	----	----	----	NW	0	61.9	27.3	16.5	10.8	6.69	Fr
24	----	----	----	----	N	NW	218.9	41.1	25.6	15.5	10.49	-----
25	8.10 A	----	T	----	N	S	271.6	38.6	21.7	16.9	11.16	-----
26	----	----	----	----	NW	NW	81.2	33.0	20.5	12.5	8.04	-----
27	----	----	----	----	0	W	265.2	----	----	----	----	Fr
28	----	----	----	----	S	S	191.0	39.0	26.8	12.2	8.22	-----
29	----	----	----	----	W	W	110.6	----	----	----	----	-----
30	----	----	----	----	0	N	268.3	----	----	----	----	-----
Means	----	----	0.61	----	----	----	180.5	35.22	20.44	14.78	9.69	-----
Normal	----	----	2.12	----	----	----	231.0	----	----	----	----	-----

TABLE V.

METEOROLOGICAL RECORD FOR MAY, 1902.

	Temperature, Dew Point and Relative Humidity								Daily Mean Dew Point
	7 A. M.				7 P. M.				
	Dry Bulb	Wet Bulb	Dew Point	Relative Humidity	Dry Bulb	Wet Bulb	Dew Point	Relative Humidity	
1	59.5	43.1	23.2	24.8	60.4	43.2	22.0	22.8	22.6
2	50.8	42.1	32.9	50.5	61.0	44.9	27.2	27.7	38.1
3	51.1	39.1	23.6	34.1	59.6	44.0	26.3	28.0	25.0
4	48.3	45.8	43.8	84.6	51.1	48.7	47.0	85.9	45.4
5	48.2	46.7	45.5	90.7	54.9	40.9	23.2	29.3	34.3
6	46.4	41.4	36.4	68.6	55.2	43.2	30.2	38.7	33.3
7	49.0	43.6	38.5	67.9	57.7	46.2	35.4	43.4	37.0
8	54.1	45.9	38.6	55.8	68.3	50.9	35.9	30.5	37.2
9	54.3	48.4	43.8	67.6	59.6	49.1	40.4	49.3	42.1
10	55.4	48.1	42.2	61.1	64.2	51.0	40.5	42.0	41.4
11	57.0	51.3	47.2	69.8	58.8	54.2	51.3	76.1	49.2
12	56.0	49.1	43.7	63.4	60.0	51.1	44.4	56.5	44.1
13	57.2	53.2	50.6	78.7	55.1	52.0	49.9	82.9	50.2
14	51.2	49.9	49.0	92.3	54.8	51.7	49.6	82.8	49.3
15	55.9	53.9	51.6	85.7	62.7	53.6	47.4	57.5	49.5
16	50.1	50.9	45.6	63.2	64.4	57.8	54.0	68.9	49.8
17	50.0	53.2	50.0	74.8	65.7	48.7	32.7	29.4	41.4
18	49.7	42.9	36.2	60.1	45.0	43.1	41.4	87.6	38.8
19	46.8	43.6	40.7	79.9	46.2	42.0	37.9	73.4	39.3
20	43.1	41.1	39.2	86.4	54.0	38.9	17.7	23.2	28.1
21	46.1	39.7	32.7	59.7	57.9	45.0	31.8	37.4	32.3
22	51.0	42.9	34.7	53.9	59.7	47.4	36.2	41.6	35.4
23	55.2	45.3	35.8	48.5	62.3	51.5	43.3	50.0	39.6
24	57.3	48.8	42.0	56.6	64.9	48.3	32.7	30.0	37.3
25	60.8	49.3	39.8	45.9	72.8	56.6	45.8	38.3	42.8
26	53.8	52.2	51.1	90.9	56.9	55.9	55.3	94.5	53.2
27	53.0	51.6	50.7	91.9	47.5	47.1	46.8	97.4	48.8
28	43.2	42.6	42.0	95.9	52.3	49.8	48.0	85.6	45.0
29	46.1	46.1	46.1	100.0	61.4	54.7	50.4	67.2	48.2
30	61.3	53.9	49.0	64.0	70.3	55.9	46.3	42.4	47.7
31	61.0	53.0	47.5	61.2	69.2	56.0	47.3	45.8	47.4
Means	52.87	47.04	41.73	68.66	59.16	49.14	39.93	53.75	40.83
Normal	51.6	45.5	------	------	57.0	47.4	------	------	39.1

TABLE V—Continued.

METEOROLOGICAL RECORD FOR MAY, 1902.

	Daily Mean Relative Humidity	Maximum Temperature	Minimum Temperature	Daily Mean Temperature	Range	Barometer, Corrected for Temperature and Instrumental Error			Terrestrial Radiation	
						7 A. M.	7 P. M.	Mean	Instrument Reading	Radiation
1	23.8	74.7	51.5	63.1	23.2	24.801	24.789	24.795	44.9	6.6
2	39.1	81.8	34.0	57.9	47.8	24.739	24.793	24.766	28.2	5.8
3	31.0	67.8	37.7	52.7	30.1	24.962	24.872	24.917	26.8	10.9
4	85.3	55.8	46.0	50.9	9.8	25.004	24.936	24.970	38.9	7.1
5	60.0	63.3	44.9	55.6	21.4	25.006	25.049	25.027	44.3	0.6
6	53.6	69.0	29.6	49.3	39.4	25.181	25.062	25.122	23.0	6.6
7	55.7	77.7	33.0	55.4	44.7	25.075	24.986	25.030	26.0	7.0
8	43.1	78.3	42.0	60.1	36.3	25.043	24.965	25.004	33.1	8.9
9	58.5	77.9	41.3	59.6	36.6	25.050	25.007	25.029	36.0	5.3
10	57.5	78.3	37.0	57.7	41.3	25.103	24.957	25.030	31.4	5.6
11	73.0	80.6	44.0	62.3	36.6	24.952	24.947	24.949	37.9	6.1
12	59.9	72.6	39.8	56.2	32.8	25.041	25.039	25.040	34.0	5.8
13	80.8	72.0	48.0	60.0	24.0	25.131	25.113	25.122	40.0	8.0
14	87.6	69.0	39.2	54.1	29.8	25.057	24.920	24.989	35.0	4.2
15	71.6	73.0	43.7	58.3	29.3	24.914	24.837	24.875	39.6	4.1
16	66.0	73.1	48.0	60.6	25.1	24.950	24.827	24.889	42.5	5.5
17	52.1	79.0	48.0	63.5	31.0	24.682	24.413	24.547	42.0	6.0
18	73.9	57.0	44.2	50.6	12.8	24.515	24.430	24.473	42.5	1.7
19	76.6	56.1	41.2	48.6	14.9	24.378	24.524	24.451	39.0	2.2
20	54.8	60.2	37.3	48.8	22.9	24.648	24.792	24.720	35.0	2.3
21	48.6	62.9	37.2	50.0	25.7	24.963	24.860	24.911	24.6	12.6
22	47.7	70.0	34.8	52.4	35.2	24.954	24.887	24.921	28.0	6.8
23	49.3	72.0	36.9	54.5	35.1	24.939	24.960	24.949	30.8	6.1
24	43.3	77.2	45.0	61.1	32.2	24.993	24.993	24.993	37.8	7.2
25	42.1	81.4	42.8	62.1	38.6	25.143	25.094	25.119	35.2	7.6
26	92.7	56.9	52.0	54.4	4.9	25.288	25.165	26.226	51.9	0.1
27	94.6	52.7	47.2	50.0	5.5	25.090	25.097	25.093	47.2	0.0
28	90.8	55.9	42.0	48.9	13.9	25.098	25.006	25.052	42.0	0.0
29	83.6	67.2	37.2	52.0	30.0	24.953	24.830	24.891	32.5	4.7
30	53.2	83.2	42.0	62.0	41.2	24.854	24.821	24.838	37.7	4.3
31	53.5	85.9	44.4	51.2	41.5	24.874	24.687	24.780	37.2	7.2
Means	61.20	70.50	41.67	56.09	28.83	24.948	24.892	24.920	36.29	5.38
Normal	60.9	69.2	40.9	55.1	28.2	------	------	24.946	------	60.0

TABLE V—Concluded.

METEOROLOGICAL RECORD FOR MAY, 1902

Precipitation				Direction of Wind		Total Movement 24 Hours following 7 A. M.	Actinometer at Noon				Frost or Dew
Time of Beginning	Time of Ending	Total Amount Rain and Melted Snow	Average Depth of Snow	7 A. M.	7 P. M.		Black Bulb	Bright Bulb	Difference	Radiation	
------	------	------	------	NW	W	238.7	------	------	------	------	-----
------	------	------	------	E	W	218.2	------	------	------	------	-----
------	------	------	------	NE	NW	114.2	------	------	------	------	-----
2.00 P	Nt	.05	------	0	E	148.8	------	------	------	------	-----
------	------	.18	------	N	N	205.1	46.9	29.0	17.9	12.55	Rn
------	------	------	------	0	S	111.7	------	------	------	------	-----
------	------	------	------	NW	S	88.4	49.6	34.3	15.3	11.06	Fr
------	------	------	------	0	S	111.0	------	------	------	------	-----
12.00 P	------	T	------	E	0	114.1	31.0	25.6	5.4	3.51	Fr
------	------	------	------	E	S	178.4	59.5	34.3	25.2	18.91	L F
Abt. 2 P	------	.06	------	S	W	107.6	------	------	------	------	-----
Abt. 3 P	------	T	------	0	SW	97.7	51.7	34.7	17.0	12.41	-----
5.15 P	6.45 P	.06	------	0	NE	122.7	----	------	------	------	-----
4.30 P	------	.46	Hail	E	E	99.6	------	------	------	------	Rn
------	------	------	------	E	0	123.6	49.9	32.6	17.3	12.43	-----
Nt	Nt	.18	------	0	S	108.7	48.1	32.2	15.9	11.33	Rn
4.30 P	------	T		0	W	164.5	51.4	34.3	17.1	12.44	D
Int. P M	------	.05	------	S	N	138.0	------	------	------	------	-----
12.00	12.15 P	.35	------	SW	NE	179.9	------	------	------	------	Rn
Nt	Nt	.18	------	S	SW	201.6	------	------	------	------	Rn
------	------	------	------	0	W	98.0	47.0	28.8	18.2	17.75	Fr
P M	------	T	------	0	E	83.5	41.2	27.8	13.4	9.14	Fr
1.00 P	------	T	------	0	NW	84.8	------	------	------	------	-----
------	------	------	------	S	W	158.7	------	------	------	------	-----
Nt	------	------	------	N	NW	74.3	------	------	------	------	D
Int. da		.14	------	E	E	157.6	17.0	15.0	2.0	1.18	Rn
All day	------	.34	------	E	E	143.7	------	------	------	-----	Rn
------	------	.08	------	0	E	55.7	------	------	------	------	Rn
------	------	------	------	0	0	91.9	------	------	------	------	-----
------	------	------	------	NW	S	110.0	------	------	------	------	D
------	------	------	------	0	NW	90.0	------	------	------	------	-----
------	------	2.13	------	----	----	129.7	44.85	29.87	14.97	11.16	-----
------	------	2.93	------	----	----	188.0	------	------	------	------	-----

TABLE VI.

METEOROLOGICAL RECORD FOR JUNE, 1902.

	Temperature, Dew Point and Relative Humidity								Daily Mean Dew Point
	7 A. M.				7 P. M.				
	Dry Bulb	Wet Bulb	Dew Point	Relative Humidity	Dry Bulb	Wet Bulb	Dew Point	Relative Humidity	
1	59.8	57.8	56.8	89.5	69.4	47.0	**21.0**	**15.9**	38.9
2	53.8	43.1	31.8	43.2	62.2	49.9	39.8	43.8	35.8
3	58.0	46.5	35.8	43.7	71.2	56.8	47.5	43.0	41.6
4	62.0	55.7	51.8	69.2	69.8	53.5	41.2	35.5	46.5
5	62.0	52.3	45.3	54.5	64.9	55.3	49.1	56.7	47.2
6	65.5	55.2	48.5	54.2	73.4	57.5	47.3	39.7	47.9
7	52.0	51.0	50.3	94.1	54.4	52.0	50.4	86.5	50.4
8	58.4	54.5	52.1	79.5	72 4	59.3	51.7	48.3	51.9
9	66.8	59.4	55.4	66.5	79.5	56.0	38.0	22.8	46.7
10	69.2	59.0	53.2	56.7	73.8	57.1	46.1	37.4	49.6
11	69.9	60.9	56.2	61.7	68.8	55.2	45.9	44.1	51.1
12	60.2	55.4	52.4	75.6	64.9	59.3	56.3	73.5	54.3
13	60.2	56.1	53.7	79.1	62.0	57.5	55.0	77.7	54.4
14	68.3	58.9	53.6	59.3	68.2	57.8	51.6	55.4	52.6
15	49.0	48.1	47.4	93.2	57.8	51.4	46.8	66.8	47.1
16	57.0	53.9	52.0	83.3	68.2	57.0	50.0	52.5	51.0
17	61.2	55.7	52.3	72.7	60.0	48.4	38.4	44.9	45.3
18	49.2	45.0	**41.3**	74.8	65.0	54.2	46.8	52.0	44.1
19	57.8	53.7	51.1	78.3	67.5	55.2	47.0	48.0	49.0
20	42.9	42.9	42.9	**100.0**	51.5	47.1	43.5	74.6	43.2
21	52.0	48.5	45.9	79.9	69.1	54.5	44.1	40.7	45.0
22	62.0	55.1	50.8	66.5	71.0	60.8	55.4	57.8	53.1
23	64.0	58.1	54.8	71.9	77.3	56.1	40.5	27.0	47.7
24	66.2	57.0	51.4	59.0	83.1	55.8	33.3	16.7	42.3
25	64.2	56.3	51.5	63.3	75.1	57.8	46.6	36.5	49.1
26	63.2	57.9	54.9	74.3	72.0	57.6	48.6	43.5	51.7
27	58.6	58.0	**57.7**	96.7	57.2	55.0	53.7	88.0	55.7
28	57.1	55.8	55.1	92.9	54.6	50.9	48.3	79.9	51.7
29	55.4	48.9	43.9	65.1	60.9	55.1	51.4	71.1	47.7
30	58.0	54.2	51.8	79.9	67.2	57.9	52.4	59.2	52.1
Means	59.46	53.83	50.06	72.62	67.08	54.97	46.26	51.32	48.16
Normal	60.3	53.5	------	------	66.0	55.2	------	------	48.3

TABLE VI—Continued.

METEOROLOGICAL RECORD FOR JUNE, 1902.

Daily Mean Relative Humidity	Maximum Temperature	Minimum Temperature	Daily Mean Temperature	Range	Barometer Corrected for Temperature and Instrumental Error			Terrestrial Radiation	
					7 A. M.	7 P. M.	Mean	Instrument Reading	Radiation
52.7	83.0	48.8	65.9	34.2	24.772	**24.684**	24.728	41.6	7.2
43.5	74.3	41.9	58.1	32.4	24.966	25.009	24.987	33.9	8.0
43.3	79.1	**37.0**	58.0	42.1	25.134	24.948	25.041	**29.4**	7.6
52.4	85.0	44.0	64.5	41.0	25.000	24.880	24.990	36.3	7.7
55.6	84.2	47.7	66.0	36.5	24.928	24.865	24.897	39.7	8.0
46.9	86.1	44.5	65.3	41.6	24.938	24.966	24.952	36.6	7.9
90.3	55.4	52.0	53.7	**3.4**	25.146	25.171	25.158	51.2	0.8
63.9	79.5	53.5	66.5	26.0	25.149	25.028	25.089	52.0	1.5
44.7	94.1	46.0	70.1	**48.1**	25.057	24.971	25.014	39.5	6.5
47.0	93.7	52.0	72.9	41.7	24.986	24.893	24.939	44.2	7.8
52.9	76.8	57.7	67.2	19.1	24.960	24.786	24.873	48.0	**9.7**
74.6	79.0	54.0	66.5	25.0	24.815	24.848	24.832	50.0	4.0
78.4	85.3	49.0	67.2	36.3	24.875	24.728	24.801	42.3	6.7
57.3	88.1	45.2	66.6	42.9	24.819	24.875	24.847	41.0	4.2
80.0	61.9	49.8	55.9	12.1	25.224	25.078	25.151	48.8	1.0
67.9	80.0	48.8	64.4	31.2	25.028	24.772	24.900	44.0	4.8
58.8	77.0	46.0	61.5	31.0	24.816	24.979	24.898	38.8	7.2
63.4	73.9	39.8	56.8	34.1	25.082	24.975	25.028	33.0	6.8
63.2	76.9	53.4	65.2	23.5	25.004	24.950	24.977	48.0	5.4
87.3	54.3	42.7	48.5	11.6	**25.280**	25.230	25.255	42.8	**—0.1**
60.3	76.7	38.8	57.7	37.9	25.190	25.059	25.129	35.0	3.8
62.2	87.2	43.3	65.3	43.9	25.038	24.965	25.001	39.1	4.2
49.5	90.5	49.1	69.8	41.4	25.093	24.946	25.020	44.0	5.1
37.8	**96.0**	50.7	73.4	45.3	24.933	24.746	24.839	44.6	6.1
49.9	82.9	53.0	67.9	29.9	24.968	24.749	24.859	45.7	7.3
58.9	92.0	52.7	72.4	39.3	24.760	24.738	24.749	43.2	9.5
92.4	71.8	54.0	62.9	17.8	24.915	24.841	24.878	**54.0**	0.0
86.4	61.0	50.7	55.8	10.3	24.891	24.868	24.880	46.9	3.8
68.1	67.6	50.2	58.9	17.4	25.023	24.978	25.005	46.0	4.2
69.5	75.3	48.6	62.0	26.7	24.952	24.883	24.9175	44.0	4.6
61.97	78.95	48.16	63.56	30.79	24.992	24.913	24.952	42.79	5.38
61.4	79.2	48.1	63.4	31.2	----------	----------	24.970	------	6.2

TABLE VI—Concluded.

METEOROLOGICAL RECORD FOR JUNE, 1902.

	Precipitation				Direction of wind		Total Movement 24 Hours following 7 A. M.	Actinometer at Noon				Frost or Dew
	Time of Beginning	Time of Ending	Total Amount Rain and Melted Snow	Average Depth of Snow	7 A. M.	7 P. M.		Black Bulb	Bright Bulb	Difference	Radiation	
1	----	----	----	----	0	W	179.8	----	----	----	----	-----
2	----	----	----	----	0	0	82.5	49.0	33.7	15.3	11.00	-----
3	----	----	----	----	N	S	129.1	----	----	----	----	L, F
4	----	----	----	----	N	SW	116.3	52.0	36.0	16.0	11.15	D
5	----	----	----	----	N	0	126.3	----	----	----	----	D
6	----	----	----	----	0	NE	112.3	----	----	----	----	-----
7	----	----	.01	----	E	N	78.0	----	----	----	----	-----
8	----	----	----	----	N	E	64.8	----	----	----	----	-----
9	----	----	----	----	E	NW	109.5	----	----	----	----	-----
10	----	----	----	----	0	S	109.4	----	----	----	----	-----
11	----	----	----	----	N	N	98.5	----	----	----	----	-----
12	----	----	T	----	0	0	82.5	25.7	22.8	2.9	1.83	-----
13	4.40 P	5.10 P	.28	----	N	0	111.2	52.8	38.1	14.7	10.91	D
14	6.30 P	----	T	----	N	E	147.0	----	----	----	----	-----
15	6.40 A	----	.01	----	E	E	119.2	----	----	----	----	Rn
16	----	----	----	----	S	SE	142.5	----	----	----	----	-----
17	----	----	T	----	0	N	91.5	----	----	----	----	D
18	----	----	----	----	N	S	92.0	45.5	29.7	15.8	10.91	D
19	2 00 P	8.00 P	.01	----	0	NW	121.5	----	----	----	----	-----
20	----	11AM	.48	----	NE	S	101.6	----	----	----	----	Rn
21	----	----	----	----	NE	S	101.9	----	----	----	----	-----
22	----	----	----	----	S	0	89.8	----	----	----	----	D
23	----	----	----	----	SE	NW	107.3	----	----	----	----	D
24	----	----	----	----	SE	W	238.5	----	----	----	----	-----
25	----	----	----	----	SE	S	148.6	----	----	----	----	-----
26	6.55 P	----	T	----	N	NW	114.6	57.6	42.5	15.1	11.61	D
27	----	----	.57	----	S	S	133.1	----	----	----	----	Rn
28	Ntint	in d'y	1.02	----	SE	N	178.3	----	----	----	----	Rn
29	----	----	----	----	NW	SE	86.7	----	----	----	----	-----
30	12.15 P	----	.05	----	E	N	107.5	----	----	----	----	D
Means	----	----	2.43	----	----	----	117.5	47.10	33.80	13.30	9.57	-----
Normal	----	----	1.65	----	----	----	152.0	----	----	----	----	-----

TABLE VII.

METEOROLOGICAL RECORD FOR JULY, 1902

	Temperature, Dew Point and Relative Humidity								
	7 A. M.				7 P. M.				
	Dry Bulb	Wet Bulb	Dew Point	Relative Humidity	Dry Bulb	Wet Bulb	Dew Point	Relative Humidity	Daily Mean Dew Point
1	59.9	55.0	51.9	75.0	63.8	55.0	49.3	59.3	50.6
2	60.6	57.1	55.1	82.1	73.8	62.9	57.5	56.7	56.3
3	66.2	60.9	58.2	75.3	66.7	55.1	47.4	50.0	52.8
4	56.7	50.2	45.4	65.8	57.6	51.9	47.9	70.1	46.6
5	57.0	52.7	49.8	77.0	59.6	53.2	48.9	67.7	49.4
6	56.7	50.9	46.7	69.2	64.9	49.9	37.0	**35.6**	41.8
7	63.0	55.2	50.3	63.1	68.9	56.5	48.6	48.6	49.5
8	63.2	54.6	49.0	59.8	70.7	60.1	54.3	56.2	51.6
9	54.1	50.8	48.5	81.5	58.2	56.1	54.9	88.7	51.7
10	55.2	54.1	53.4	**93.8**	67.0	60.8	57.6	71.7	55.5
11	61.7	57.2	54.6	77.6	66.5	56.1	49.5	54.4	52.1
12	61.3	55.2	51.4	69.9	70.1	60.2	54.9	58.3	53.1
13	62.5	54.8	49.8	63.3	72.5	57.8	48.6	42.9	49.2
14	70.8	56.5	47.2	43.0	74.1	61.1	54.1	49.7	50.7
15	65.3	56.1	50.4	58.6	76.4	63.4	56.9	51.0	53.6
16	68.1	61.1	57.5	68.7	72.6	58.1	49.2	43.6	53.4
17	66.0	60.0	56.8	72.0	62.0	56.9	53.9	74.8	55.4
18	55.6	53.1	51.5	86.2	56.7	54.0	52.3	85.3	51.9
19	57.2	53.2	50.6	78.6	62.2	57.2	54.3	76.0	52.5
20	56.7	52.0	48.8	74.8	69.3	59.1	53.3	56.8	51.0
21	62.2	57.0	54.0	74.4	65.1	57.0	52.1	62.9	53.1
22	62.9	56.2	52.1	67.8	72.2	59.9	53.0	51.0	52.5
23	63.2	56.1	51.8	66.2	69.0	63.2	**60.4**	74.1	56.1
24	67.2	58.5	53.6	61.5	71.2	62.0	57.4	61.5	55.5
25	68.2	60.7	56.7	66.7	68.5	59.1	**33.8**	59.4	55.3
26	57.0	54.0	52.1	83.8	63.2	61.2	60.3	89.8	56.2
27	64.5	60.9	59.0	82.6	70.0	59.8	54.2	57.2	56.6
28	64.6	56.0	50.6	60.6	71.5	63.8	60.2	67.3	55.4
29	68.9	60.0	55.2	61.5	71.6	60.4	54.3	54.5	54.7
30	72.0	58.7	50.8	47.3	77.8	63.0	55.3	46.0	53.1
31	65.7	59.1	55.5	59.5	81.2	63.8	54.8	40.4	55.1
Means	62.39	56.06	52.20	70.24	68.22	58.66	53.10	60.05	52.65
Normal	64.5	58.1	------	------	70.0	59.8	------	------	53.9

TABLE VII—Continued.

METEOROLOGICAL RECORD FOR JULY, 1902.

	Daily Mean Relative Humidity	Maximum Temperature	Minimum Temperature	Daily Mean Temperature	Range	Barometer, Corrected for Temperature and Instrumental Error			Terrestrial Radiation	
						7 A. M.	7 P. M.	Mean	Instrument Reading	Radiation
1	67.1	76.3	54.0	65.1	22.3	24.966	24.873	24.919	50.3	3.7
2	69.4	85.7	51.2	68.5	34.5	24.874	24.709	24.792	47.0	4.2
3	62.7	78.7	51.6	65.1	27.1	24.757	24.737	24.747	46.4	5.2
4	67.9	71.8	50.0	60.9	21.8	24.866	24.816	24.841	45.3	4.7
5	72.4	70.7	46.7	58.7	24.0	24.834	26.883	24.858	41.4	5.6
6	52.4	78.3	38.8	58.6	39.5	24.980	24.967	24.974	33.4	5.4
7	55.8	82.3	40.0	61.1	32.3	25.096	24.974	25.035	34.5	5.5
8	58.0	78.6	54.1	66.4	24.5	25.021	25.052	25.036	50.1	4.0
9	85.1	63.0	52.5	57.7	10.5	25.363	25.343	25.354	52.2	0.4
10	82.8	76.5	48.8	62.7	27.7	25.282	25.185	25.233	44.9	3.9
11	66.0	85.5	45.6	65.5	39.9	25.219	25.156	25.188	41.8	3.8
12	64.1	88.0	49.8	68.9	38.2	25.118	25.009	25.063	44.5	5.3
13	53.1	85.0	44.0	64.5	41.0	25.026	24.970	24.998	39.6	4.4
14	46.3	94.3	47.4	70.9	46.9	25.125	25.096	25.110	41.9	5.5
15	54.8	98.0	48.8	73.4	49.2	25.102	24.965	25.033	41.4	7.4
16	56.2	88.9	53.5	71.2	35.4	24.957	24.964	24.961	46.0	7.5
17	73.4	69.3	59.3	64.3	10.0	25.016	24.043	25.029	55.8	3.5
18	85.7	68.7	51.4	60.0	17.3	25.084	25.116	25.100	50.7	0.7
19	77.4	73.6	43.0	58.3	30.6	25.223	25.208	25.216	39.1	3.9
20	65.8	78.9	43.2	61.1	35.7	25.288	25.132	25.210	39.0	4.2
21	68.6	85.1	45.2	65.1	39.9	25.099	25.030	25.064	41.0	4.2
22	59.4	86.1	43.2	64.7	42.9	25.032	25.015	25.024	41.3	1.9
23	70.2	86.9	48.8	67.8	38.1	25.102	25.049	25.075	42.9	5.9
24	61.5	92.0	47.2	69.6	44.8	25.102	25.008	25.056	41.9	5.3
25	63.0	81.1	53.7	67.4	47.4	25.009	25.026	25.018	46.0	7.7
26	86.8	74.6	56.7	65.3	18.6	25.110	24.997	25.053	------	----
27	69.9	88.9	53.0	71.0	35.9	25.001	24.938	24.970	47.0	6.0
28	64.0	93.9	46.1	70.0	47.8	24.995	24.912	24.953	39.2	6.9
29	58.0	94.2	52.9	73.5	41.3	24.959	24.914	24.937	44.0	8.9
30	46.6	87.6	59.4	73.5	28.2	25.113	25.156	25.134	47.8	11.6
31	55.0	95.1	56.0	75.6	39.1	25.230	25.037	25.134	49.2	6.8
Means	65.14	82.50	49.52	66.01	32.98	25.063	25.009	25.036	44.18	5.13
Normal	65.0	84.5	53.1	68.5	31.7	--------	--------	25.067	------	5.9

TABLE VII—Concluded.

METEOROLOGICAL RECORD FOR JULY, 1902

Precipitation				Direction of Wind		Total Movement 24 Hours following 7 A. M.	Actinometer at Noon				Frost or Dew
Time of Beginning	Time of Ending	Total Amount Rain and Melted Snow	Average Depth of Snow	7 A. M.	7 P. M.		Black Bulb	Bright Bulb	Difference	Radiation	
6.55 P	7.20 P	T	------	0	N	129.1	------	------	------	------	-----
------	------	.01	------	0	W	102.0	52.5	38.0	14.5	10.75	Rn
12.30 P	------	T	------	0	N	122.6	------	------	------	------	D
4.00 P	4.20 P	.04	------	0	N	123.2	------	------	------	------	Rn
11.50 A	12.00	.13	------	0	0	105.4	20.1	18.6	1.5	0.91	-----
------	------	------	------	N		133.9	------	------	------	------	D
------	------	------	------	0	E	198.9	50.6	35.2	15.4	11.21	D
9.00 P	------	------	------	NW	SW	156.3	------	------	------	------	D
------	------	.17	------	N	0	60.4	21.0	15.2	5.8	3.49	Rn
2.10 P	------	T	------	N	W	60.2	------	------	------	------	D
------	------	T	------	W	NW	101.0	56.7	37.2	19.5	14.35	D
------	------	------	------	W	N	81.5	57.1	39.8	17.3	13.14	D
------	------	T	------	0	W	120.8	------	------	------	------	D
------	------	------	------	W	SE	77.0	58.0	43.4	14.6	11.29	D
4.50 P	------	T	------	0	N	100.0	------	------	------	------	D
Nt	Nt	------	------	0	N	126.9	56.3	41.8	14.5	11.06	-----
PM	------	.05	------	NW	NW	80.5	------	------	------	------	Rn
Int. in day		.47	------	S	S	86.0	35.4	26.5	8.9	5.91	Rn
8.30 P	11.30 P	.43	------	SE	SE	56.4	47.4	30.5	16.9	11.94	R
------	------	------	------	0	SE	50.7	------	------	------	------	D
------	------	------	------	S	N	72.7	54.0	38.2	15.8	11.79	D
------	------	------	------	0	SW	111.6	------	------	------	------	D
------	------	------	------	NW	N	68.0	------	------	------	------	D
------	------	------	------	NW	NW	68.3	------	------	------	------	D
------	------	------	------	0	----	122.1	45.8	33.8	12.0	8.53	D
------	------	.01	------	S	NW	95.1	50.7	33.3	17.4	12.58	D
------	------	------	------	SE	E	72.7	53.6	38.5	11.26	11.26	-----
------	------	------	------	0	0	68.0	58.3	42.0	16.3	12.54	-----
------	------	------	------	0	0	124.8	------	------	------	------	-----
------	------	------	------	N	W	85.3	53.5	39.5	14.0	10.47	-----
------	------	------	------	0	S	95.9	54.5	40.5	14.0	10.55	D
------	------	1.31	------	----	----	99.0	48.56	34.82	13.73	10.10	-----
------	------	1.78	------	----	----	132.0	------	------	------	------	-----

TABLE VIII.

METEOROLOGICAL RECORD FOR AUGUST, 1902

	Temperature, Dew Point and Relative Humidity								
	7 A. M.				7 P. M.				Daily Mean Dew Point
	Dry Bulb	Wet Bulb	Dew Point	Relative Humidity	Dry Bulb	Wet Bulb	Dew Point	Relative Humidity	
1	76.3	56.3	42.0	29.4	78.9	61.5	51.7	38.8	46.8
2	66.9	58.8	54.3	63.8	75.0	66.1	62.2	64.4	58.3
3	69.8	64.4	61.9	76.1	72.6	60.0	52.9	50.1	57.4
4	70.8	63.8	60.5	69.8	79.8	56.5	38.4	23.6	49.4
5	63.8	56.9	52.8	67.3	60.7	58.8	57.8	90.1	55.3
6	59.6	57.6	56.6	89.4	71.6	59.9	53.4	52.8	55.0
7	65.7	59.1	55.5	69.5	61.1	55.1	51.3	70.2	53.4
8	61.0	55.0	51.2	70.2	68.2	56.0	48.1	48.8	49.7
9	60.3	53.7	49.4	67.1	61.1	52.0	45.4	56.4	47.4
10	58.1	47.0	37.0	45.5	61.9	50.2	40.9	46.0	38.9
11	56.6	49.6	44.3	63.3	64.7	59.1	56.1	73.5	50.2
12	64.0	56.9	52.7	66.6	74.5	57.8	47.2	37.9	50.0
13	67.0	57.0	50.9	56.3	72.0	58.8	51.0	47.7	50.9
14	66.7	58.3	53.5	62.5	69.3	60.0	54.9	60.2	54.2
15	67.6	58.8	53.9	61.3	70.6	59.2	52.7	53.2	53.3
16	65.0	56.6	50.6	59.6	70.1	56.3	47.3	44.3	49.0
17	67.0	58.7	54.1	63.0	71.9	58.7	50.9	47.6	52.5
18	65.2	50.0	36.9	35.2	67.0	55.0	46.9	48.7	41.9
19	61.9	53.3	47.4	59.1	73.8	54.2	39.0	28.5	43.2
20	61.9	52.6	46.0	56.1	70.1	61.9	57.8	64.8	51.9
21	60.6	56.1	53.4	77.2	68.2	56.2	48.5	49.4	50.9
22	61.8	56.2	52.8	72.4	69.2	58.2	51.7	53.9	52.3
23	62.2	59.4	57.9	85.9	61.2	60.0	59.4	93.8	58.6
24	63.2	59.0	56.7	79.4	64.6	55.2	49.1	57.3	52.9
25	62.8	57.0	53.6	71.8	67.1	58.5	53.6	61.8	53.6
26	60.7	58.3	57.0	87.5	67.2	60.2	56.2	68.4	56.8
27	60.2	57.2	55.5	84.5	67.2	58.8	54.1	62.7	54.8
28	65.3	59.1	55.7	71.0	66.1	53.2	43.9	44.7	49.8
29	68.5	55.4	46.6	45.6	64.7	57.5	53.3	66.4	49.9
30	59.7	52.5	47.5	64.0	64.2	50.8	40.0	41.2	43.8
31	55.8	50.8	47.2	72.9	61.5	47.1	33.4	34.6	40.3
Means	63.74	56.30	51.46	65.91	68.26	57.19	49.98	54.25	50.72
Normal	62.2	55.9	------	------	68.0	57.6	------	------	51.4

TABLE VIII—Continued.

METEOROLOGICAL RECORD FOR AUGUST, 1902.

Daily Mean Relative Humidity	Maximum Temperature	Minimum Temperature	Daily Mean Temperature	Range	Barometer, Corrected for Temperature and Instrumental Error			Terrestrial Radiation	
					7 A. M.	7 P. M.	Mean	Instrument Reading	Radiation
34.1	99.6	53.7	76.6	45.9	25.103	25.000	25.056	45.0	8.7
64.1	92.0	53.0	72.5	39.0	25.080	25.088	25.084	46.0	7.0
63.1	92.2	58.0	75.1	34.2	25.084	24.988	25.036	51.9	6.1
46.7	95.2	55.0	75.1	40.2	25.067	25.051	25.059	48.4	6.6
78.7	63.7	59.2	61.5	4.5	25.284	25.272	25.278	57.9	1.3
71.1	84.3	49.4	66.8	34.9	25.262	25.107	25.185	44.9	4.5
69.8	83.9	49.0	66.5	34.9	25.138	25.080	25.109	44.2	4.8
59.5	87.2	48.8	68.0	38.4	24.982	24.862	24.922	43.8	5.0
61.8	92.8	46.2	69.5	46.6	24.967	25.051	25.009	40.0	6.2
45.7	71.9	51.3	61.6	20.6	25.265	25.181	25.223	48.0	3.3
68.4	76.1	46.7	61.4	29.4	25.135	24.946	25.040	42.9	3.8
52.3	89.4	51.0	70.2	38.4	24.942	24.968	24.955	45.4	5.6
52.0	87.0	55.8	71.4	31.2	25.090	25.097	25.094	50.7	5.1
61.3	87.7	58.0	72.8	29.7	25.155	25.051	25.103	52.8	5.2
57.3	91.5	50.0	70.8	41.5	25.100	24.987	25.043	44.8	5.2
51.9	92.2	52.2	72.2	40.0	25.011	24.872	24.941	46.0	6.2
55.3	93.0	47.3	70.1	45.7	24.914	24.806	24.860	43.0	4.3
42.0	87.6	57.3	72.5	30.3	24.981	24.896	24.939	48.0	9.3
43.8	90.8	48.8	69.8	42.0	25.015	24.992	25.003	42.4	6.4
60.4	87.7	45.8	66.7	41.9	25.076	25.043	25.060	39.8	6.0
63.3	84.6	50.8	67.7	33.8	25.118	25.059	25.088	45.8	5.0
63.2	85.7	50.8	68.3	34.9	25.056	25.019	25.038	44.8	6.1
89.8	70.4	59.3	64.8	11.1	25.057	25.042	25.049	54.0	5.3
68.4	84.2	53.2	68.7	31.0	25.055	24.962	25.009	52.2	1.0
66.8	84.0	60.1	72.1	23.9	25.140	25.131	25.135	57.0	3.1
77.9	77.3	54.7	66.0	22.6	25.203	25.094	25.149	51.2	3.5
73.6	80.8	54.0	67.4	26.8	25.115	25.019	25.067	50.1	3.9
57.9	79.6	55.0	67.3	24.6	25.037	25.075	25.056	50.3	4.7
56.0	82.4	51.8	67.1	30.6	25.094	25.015	25.054	47.1	4.7
52.6	79.8	52.0	65.9	27.8	25.076	25.053	25.065	47.1	4.9
53.7	82.5	42.3	62.4	40.2	25.116	25.060	25.088	37.1	5.2
60.08	85.07	52.27	68.67	32.79	25.088	25.028	25.058	47.18	5.10
63.8	84.3	51.3	67.7	33.3	----------	----------	25.083	------	5.5

TABLE VIII—Concluded.

METEOROLOGICAL RECORD FOR AUGUST, 1902.

	Precipitation				Direction of Wind		Total Movement 24 Hours following 7 A. M.	Actinometer at Noon				Frost or Dew
	Time of Beginning	Time of Ending	Total Am't Rain and Melted Snow	Average Depth of Snow	7 A. M.	7 P. M.		Black Bulb	Bright Bulb	Difference	Radiation	
1	----	----	----	----	N	E	92.9	59.4	45.6	13.8	10.79	-----
2	----	----	----	----	SE	S	100.9	56.3	42.0	14.3	10.91	-----
3	12:00M	----	T	----	0	E	94.3	35.5	27.6	7.9	5.27	-----
4	----	----	----	----	E	S	158.2	58.3	43.2	15.1	11.67	-----
5	Int. in day		.04	----	NE	0	45.5	21.7	17.5	4.2	2.56	-----
6	----	----	----	----	NE	S	70.6	49.7	35.0	14.7	10.66	D
7	6:30 P	----	T	----	0	SE	98.0	34.0	28.3	5.7	3.79	-----
8	----	----	----	----	W	E	101.2	53.0	39.9	13.1	9.80	D
9	----	----	----	----	NE	NW	158.3	----	----	----	----	D
10	----	----	----	----	N	S	107.6	----	----	----	----	-----
11	6:30 P	----	T	----	NW	W	97.9	42.3	30.0	12.3	8.50	-----
12	----	----	----	----	W	E	181.9	----	----	----	----	-----
13	P M	----	T	----	NW	NW	114.5	----	----	----	----	-----
14	----	----	----	----	E	SW	97.0	----	----	----	----	-----
15	----	----	----	----	E	0	121.3	54.5	40.8	13.7	10.34	D
16	P M	----	T	----	0	W	101.7	55.9	41.4	14.5	11 02	D
17	----	----	----	----	0	SW	128.7	----	----	----	----	D
18	----	----	----	----	NW	S	92.9	54.7	39.7	15.0	11.28	-----
19	----	----	----	----	S	NW	85.8	----	----	----	----	-----
20	4:00 P	----	T	----	N	S	107.1	----	----	----	----	D
21	3:00 P	----	.02	----	S	S	97.8	----	----	----	----	D
22	P M	----	T	----	SE	S	76.1	50.1	36.0	14.1	10.28	D
23	3:00 P	----	T	----	0	S	31.7	29.5	23.3	6.2	3.98	-----
24	----	----	----	----	NW	N	112.8	----	----	----	----	-----
25	Nt.	----	----	----	SE	0	87.9	47.6	34.3	13.3	9.54	-----
26	----	----	.61	----	NW	SW	421.0	----	----	----	----	Rn
27	----	----	T	----	NW	NE	73.0	50.2	34.1	16.1	11.65	D
28	2:45 P	----	T	----	W	NW	112.3	----	----	----	----	Rn
29	----	----	T	----	W	NW	131.3	40.3	30.8	9.5	6.53	-----
30	6:45 P	----	T	----	NW	W	194.8	54.5	37.4	17.1	12.74	Rn
31	----	----	T	----	W	0	105.7	----	----	----	----	Rn
Means	----	----	0.67	----	----	----	116.2	47.08	34.83	12.26	8.96	-----
Normal	----	----	1.19	----	----	----	129.0	----	----	----	----	-----

TABLE IX.

METEOROLOGICAL RECORD FOR SEPTEMBER, 1902.

	Temperature, Dew Point and Relative Humidity								
	7 A. M.				7 P. M.				
	Dry Bulb	Wet Bulb	Dew Point	Relative Humidity	Dry Bulb	Wet Bulb	Dew Point	Relative Humidity	Daily Mean Dew Point
1	52.5	48.1	44.6	75.0	61.3	54.2	49.6	65.3	47.1
2	58.5	52.2	47.9	67.6	63.7	51.5	42.1	45.4	45.0
3	52.6	47.5	43.4	71.1	55.6	50.5	46.8	72.3	45.1
4	49.0	44 8	41.1	74.7	78.8	52.5	27.3	15.1	34.2
5	57.1	45.0	39.9	40.1	54.0	47.8	42.8	65.9	37.8
6	53.6	48.0	43.5	68.9	62.0	48.0	35.3	36.9	39.4
7	52.2	46.2	41.0	66.0	79.0	51.4	22.5	12.2	31.8
8	50.8	44.9	39.6	65.5	54.0	48.5	44.2	69.6	41.9
9	47.9	44.9	42.3	81.5	60.0	51.9	46.1	60.1	44.2
10	52.7	41.2	27.8	38.5	52.0	44.9	38.4	60.0	33.1
11	45.2	38.9	31.8	59.6	37.4	34.8	31.5	79.8	31.6
12	34.0	32.2	29.8	84.5	50.2	39.4	26.1	39.1	28.0
13	39.2	34.9	29.5	68.4	58.0	46.0	34.5	41.4	32.0
14	46.2	41.0	35.7	67.2	57.2	46.2	36.0	45.2	35.8
15	54.7	47.1	40.7	59.1	69.0	50.8	34.9	28.5	37.8
16	62.2	50.9	42.2	47.1	63.0	48.0	34.0	33.8	38.1
17	42.8	38.0	32.5	67.5	49.6	41.0	31.6	49.9	32.1
18	39.9	36.5	32.5	73.3	57.5	47.7	39.3	50.8	35.9
19	57.2	51.0	46.5	67.5	66.6	53.0	42.9	42.4	44.7
20	48.1	44.5	41.5	77.9	52.5	51.5	50.8	94.2	46.1
21	44.0	43.7	43.4	98.0	42.4	41.9	41.4	96.5	42.4
22	46.7	45.3	44.1	91.1	56.2	51.0	47.2	72.0	45.6
23	42.2	41.2	40.2	93.0	54.0	51.2	49.3	84.3	44.8
24	44.9	43.2	41.6	88.9	56.2	53.0	50.9	82.5	46.2
25	48.6	46.8	45.4	89.0	63.0	56.0	51.7	66.5	48.6
26	44.8	35.0	20.6	37.9	43.6	38.3	32.3	64.9	26.4
27	39.1	36.9	34.4	83.6	53.9	50.0	47.2	78.2	40.8
28	45.0	41.6	38.3	77.9	53.2	43.2	32.8	46.3	35.6
29	43.0	39.5	35.8	76.3	48.0	42.2	36.4	64.8	36.1
30	38.8	36.8	34.5	84.9	56.0	49.2	44.0	63.9	39.2
Means	47.78	42.93	38.17	71.48	56.93	47.85	39.66	57.59	38.92
Normal	51.4	45.9	.....	.....	59.3	49.0	.....	.....	41.1

TABLE IX—Continued.

METEOROLOGICAL RECORD FOR SEPTEMBER, 1902.

	Daily Mean Relative Humidity	Maximum Temperature	Minimum Temperature	Daily Mean Temperature	Range	Barometer, Corrected for Temperature and Instrumental Error			Terrestrial Radiation	
						7 A. M.	7 P. M.	Mean	Instrument Reading	Radiation
1	70.1	80.9	43.6	62.2	37.3	25.305	25.114	25.209	37.4	6.2
2	56.5	**89.8**	40.8	65.3	49.0	25.176	25.065	25.121	34.9	5.9
3	71.7	70.7	41.4	56.1	29.3	25.280	25.183	25.231	35.1	6.3
4	44.9	86.1	37.0	61.5	49.1	25.125	24.913	25.019	33.0	4.0
5	53.0	77.8	46.5	62.2	31.3	25.070	25.119	25.095	37.7	**8.8**
6	52.9	82.7	38.3	60.5	44.4	25.256	25.156	25.206	32.2	6.1
7	39.1	89.5	37.3	63.4	52.2	25.131	24.947	25.039	32.0	5.3
8	67.6	71.2	44.0	57.6	27.2	25.193	25.157	25.175	37.2	6.8
9	70.8	83.4	35.7	59.5	47.7	25.200	24.932	25.066	31.0	4.7
10	49.2	70.1	47.7	58.9	22.4	25.078	25.091	25.084	41.3	6.4
11	69.7	55.0	37.7	46.4	17.3	25.309	25.314	25.312	32.2	5.5
12	61.8	65.6	**22.0**	43.8	43.6	**25.354**	25.218	25.286	**17.1**	4.9
13	55.9	83.7	27.1	55.4	**56.6**	25.159	25.027	25.093	22.7	4.4
14	56.2	87.2	35.7	61.4	51.5	25.043	24.894	24.968	31.8	3.9
15	43.8	85.0	51.8	68.4	33.2	24.932	24.781	24.857	45.2	6.6
16	40.9	79.6	60.3	70.0	19.3	24.832	24.865	24.848	**56.6**	3.7
17	58.7	67.0	37.7	52.3	29.3	25.171	25.133	25.952	34.8	2.9
18	63.0	75.7	34.0	54.4	42.7	25.090	24.890	24.990	27.4	5.6
19	55.0	84.0	40.0	62.0	44.0	24.883	**24.700**	24.792	43.8	----
20	86.0	77.3	40.1	58.7	37.2	24.813	24.964	24.888	33.8	6.3
21	97.3	44.2	41.7	42.9	2.5	25.023	25.073	25.048	43.3	----
22	81.5	63.9	42.0	53.0	21.9	25.078	25.092	25.085	41.2	**0.8**
23	88.7	71.7	36.7	53.9	34.4	25.165	25.090	25.128	33.0	3.7
24	85.7	73.6	38.3	55.9	35.3	25.047	24.894	24.970	34.1	4.2
25	77.7	79.9	41.8	60.9	38.1	24.791	24.702	24.747	38.7	3.1
26	51.4	60.3	44.0	52.1	16.3	24.981	25.064	25.022	43.1	0.9
27	80.9	75.4	31.3	53.4	44.1	25.047	24.834	24.941	28.3	3.0
28	62.1	68.0	38.3	53.1	29.7	24.801	24.903	24.852	34.2	4.1
29	70.6	59.7	41.7	50.7	18.0	25.103	25.126	25.114	39.9	1.8
30	74.4	65.9	32.4	49.2	33.5	25.031	24.718	24.875	29.6	2.8
Means	64.54	74.14	39.53	56.84	34.61	25.082	24.999	25.040	35.42	4.60
Normal	61.2	77.6	42.5	59.5	35.2	.....	.....	25.051	.....	5.8

TABLE IX—Concluded.

METEOROLOGICAL RECORD FOR SEPTEMBER, 1902.

Precipitation				Direction of Wind		Total Movement 24 Hours following 7 A. M.	Actinometer at Noon				Frost or Dew
Time of Beginning	Time of Ending	Total Amount Rain and Melted Snow	Average Depth of Snow	7 A. M.	7 P. M.		Black Bulb	Bright Bulb	Difference	Radiation	
------	------	------	------	NW	NW	38.1	49.2	33.3	15.9	11.43	D
------	------	------	------	0	0	80.5	------	------	------	------	D
------	------	------	------	NW	0	108.7	46.2	30.0	16.2	11.37	D
------	------	------	------	0	W	144.7	------	------	------	------	D
------	------	------	------	S	SW	115.5	------	------	------	------	-----
------	------	------	------	0	0	114.0	52.7	36.9	15.8	11.68	D
------	------	------	------	N	W	164.7	------	------	------	------	D
------	------	------	------	SE	W	79.3	47.1	30.4	16.7	11.78	-----
------	------	------	------	0	N	172.0	------	------	------	------	L, F
------	------	------	------	NW	N	111.8	46.7	34.1	12.6	9.00	-----
12:00 M	------	T	------	NE	S	87.0	9.5	7.6	1.9	1.06	-----
------	------	------	------	NW	S	87.3	------	------	------	------	HvF
------	------	------	------	N	NW	101.2	50.5	34.6	15.9	11.55	HvF
------	------	------	------	NW	NW	98.0	------	------	------	------	F
------	------	------	------	N	NW	144.7	55.5	39.5	16.0	12.06	-----
3:50 P	------	T	------	NW	NW	168.9	------	------	------	------	-----
------	------	------	------	NW	S	132.8	40.5	23.5	17.0	11.38	-----
------	------	------	------	N	W	104.4	33.9	24.5	9.4	6.16	-----
------	------	------	------	E	E	107 3	36.8	29.3	7.5	5.06	-----
5:00 P	------	1.88	------	NE	W	193.5	50.8	35.4	15.4	11.23	-----
All day	-----	4.34	------	N	NW	181.4	------	------	------	------	Rn
------	12:00 M	.62	------	N	NW	129.2	30.9	18.7	12.2	7.73	Rn
------	------	------	------	E	NW	71.3	------	------	------	------	HD
------	------	------	------	0	S	68.5	46.5	30.2	16.3	11.46	HD
------	------	------	------	NW	N	201.0	48.5	32.8	15.7	11.23	-----
------	------	------	------	N	NW	201.0	41.5	23.0	18.5	12.41	-----
------	------	------	------	0	S	91.4	45.7	29.4	16.3	11.39	Fr
7:30 P	Nt.	------	------	N	NW	148.3	------	------	------	------	D
------	------	.28	------	N	N	174.3	------	------	------	------	Rn
------	------	------	------	0	N	160.8	------	------	------	------	HF
------	------	7.12	------	----	----	129.4	43.09	29.01	14.08	9.88	-----
------	------	1.20	------	----	----	137.0	------	------	------	------	-----

TABLE X.

METEOROLOGICAL RECORD FOR OCTOBER, 1902.

	Temperature, Dew Point and Relative Humidity								Daily Mean Dew Point
	7 A. M.				7 P. M.				
	Dry Bulb	Wet Bulb	Dew Point	Relative Humidity	Dry Bulb	Wet Bulb	Dew Point	Relative Humidity	
1	37.9	37.0	36.0	93.0	37.8	37.0	36.1	93.7	36.0
2	38.2	36.2	33.9	84.7	39.0	37.0	34.7	85.0	34.3
3	31.3	31.0	30.6	97.2	43.2	39.8	36.2	77.1	33.4
4	43.9	35.1	23.8	42.8	48.2	40.0	30.7	50.9	27.3
5	36.7	34.8	32.4	84.8	54.6	46.0	38.3	54.6	35.3
6	37.2	35.2	32.8	84.3	49.8	45.6	42.0	75.1	37.4
7	37.0	35.9	34.6	91.2	49.3	45.8	42.9	79.0	38.8
8	38.0	36.0	33.7	84.6	49.2	44.1	39.4	69.8	36.5
9	39.7	37.8	35.6	88.1	45.1	41.6	38.2	77.4	36.9
10	41.5	37.1	32.0	69.3	55.1	46.8	39.6	56.1	35.8
11	43.1	42.8	42.5	97.9	46.1	45.8	45.5	98.1	44.0
12	43.5	39.9	36.1	75.9	39.5	38.6	37.7	93.2	36.9
13	32.1	31.1	29.7	90.9	49.5	43.1	36.8	62.2	33.3
14	34.8	33.1	30.9	85.6	46.7	43.8	41.2	81.8	36.0
15	38.3	35.4	32.3	79.6	59.5	44.8	51.8	75.9	42.1
16	36.5	34.2	32.4	81.6	50.8	46.0	41.9	72.0	37.1
17	41.2	37.8	34.0	76.1	52.6	45.6	39.4	60.9	36.7
18	35.5	34.9	34.2	95.0	48.5	41.6	34.4	58.6	34.3
19	36.5	32.9	28.0	71.6	48.5	43.6	39.2	70.3	33.6
20	36.2	34.7	32.9	87.8	46.5	43.1	39.9	78.5	36.4
21	34.9	33.1	30.7	84.9	55.2	45.5	36.4	49.5	33.6
22	50.5	44.9	39.9	67.9	58.4	46.5	35.4	42.4	37.6
23	40.8	38.6	36.3	84.3	52.5	42.8	32.6	47.0	34.5
24	39.9	36.9	33.4	78.2	40.8	38.0	34.9	80.1	34.1
25	49.7	41.1	31.7	50.9	47.1	37.2	24.1	40.2	27.9
26	29.9	28.1	25.4	82.6	36.5	31.8	25.1	63.0	25.3
27	41.9	34.5	24.2	49.5	41.8	35.5	27.4	56.6	25.8
28	32.7	31.8	30.5	91.9	46.8	40.5	33.8	60.8	32.1
29	35.1	32.5	29.1	78.6	46.0	38.2	28.8	51.1	29.0
30	37.5	34.6	31.0	77.7	38.6	36.2	33.4	81.4	32.2
31	28.0	27.6	27.0	95.9	42.5	37.8	32.4	68.1	29.7
Means	38.06	35.37	32.18	80.79	47.28	41.60	36.46	68.08	34.32
Normal	38.4	34.2	------	------	46.7	38.9	--- --	------	28.9

TABLE X—Continued.

METEOROLOGICAL RECORD FOR OCTOBER, 1902.

Daily Mean Relative Humidity	Maximum Temperature	Minimum Temperature	Daily Mean Temperature	Range	Barometer, Corrected for Temperature and Instrumental Error			Terrestrial Radiation	
					7 A. M.	7 P. M.	Mean	Instrument Reading	Radiation
93.3	56.7	37.2	46.9	19.5	25.108	25.117	25.112	36.7	0.5
84.9	44.8	35.0	39.9	9.8	25.131	25.151	25.141	35.0	0.0
87.1	51.0	29.8	40.4	21.2	25.219	25.203	25.211	27.2	2.6
46.9	65.3	32.0	48.7	33.3	25.173	25.091	25.132	27.7	4.3
69.7	77.3	30.0	53.6	47.3	25.065	25.028	25.047	26.5	3.5
79.7	70.7	31.0	50.9	39.7	25.160	25.176	25.143	27.8	3.2
85.1	74.8	32.0	53.4	42.8	25.163	25.069	25.116	28.1	3.9
77.2	80.0	35.5	57.7	44.5	25.101	25.053	25.077	30.8	4.7
82.7	71.1	38.6	54.9	32.5	25.105	25.052	25.078	34.0	4.6
62.7	63.0	36.8	49.9	26.2	25.076	25.029	25.053	31.0	5.8
98.0	56.9	42.6	49.7	14.3	25.007	24.790	24.898	41.0	1.6
84.6	51.2	38.8	45.0	12.4	24.830	24.929	24.830	-- --	-- --
76.5	62.2	30.8	46.5	31.4	25.027	25.074	25.050	-- --	-- --
83.7	69.4	30.6	50.0	38.8	25.138	25.148	25.143	-- --	-- --
77.8	62.3	33.0	47.8	29.3	25.178	25.068	25.123	-- --	-- --
76.8	68.5	32.8	50.6	35.7	25.098	24.969	25.034	-- --	-- --
68.5	65.2	33.9	49.6	31.3	24.959	24.986	24.972	-- --	-- --
76.8	68.0	33.0	50.5	35.0	25.044	25.091	25.068	-- --	-- --
70.9	64.9	30.6	47.75	34.3	25.162	25.111	25.136	-- --	-- --
83.2	70.0	34.9	52.5	35.1	25.095	25.092	25.094	-- --	-- --
67.2	77.0	33.0	55.0	44.0	25.084	24.933	25.008	-- --	-- --
55.1	73.9	41.4	57.6	32.5	24.904	24.829	24.867	-- --	-- --
65.7	71.8	37.2	54.5	34.6	24.875	24.847	24.861	-- --	-- --
79.1	60.2	31.8	46.0	28.4	24.876	24.762	24.819	-- --	-- --
45.6	59.0	36.0	47.5	23.0	24.897	25.027	24.962	-- --	-- --
72.8	55.2	26.5	40.9	28.7	25.156	25.210	25.183	-- --	-- --
53.0	59.4	28.9	44.1	30.5	25.265	25.201	25.233	-- --	-- --
76.4	67.0	25.5	46.3	41.5	25.036	24.915	24.975	21.9	3.6
64.8	63.3	32.0	47.6	31.3	25.024	25.121	25.073	27.7	4.3
79.6	53.0	30.9	42.0	22.1	25.194	25.101	25.147	27.0	3.9
82.0	67.4	26.9	47.1	40.5	24.089	25.003	25.046	23.1	3.8
74.43	64.5	33.2	48.85	31.34	25.0722	25.0363	25.0543	29.7	3.35
64.9	64.8	32.4	48.0	32.6	----------	----------	25.035	------	5.9

Instrument Broken. Instrument Broken.

TABLE X—Concluded.

METEOROLOGICAL RECORD FOR OCTOBER, 1902.

	Precipitation				Direction of Wind		Total Movement 24 Hours following 7 A. M.	Actinometer at Noon				Frost or Dew
	Time of Beginning	Time of Ending	Total Am'nt Rain and Melted Snow	Average Depth of Snow	7 A. M.	7 P. M.		Black Bulb	Bright Bulb	Difference	Radiation	
1	Nt.	....	.18	....	N	NW	69.7	....	....	....	....	.....
2	5.00 P	....	.09	....	W	N	59.6	35.4	19.2	16.2	10.46	.....
3	....	....	....	....	N	N	77.3	....	....	....	....	HvFr
4	....	....	....	....	NW	NW	118.5	44.9	27.2	17.7	11.23	.....
5	....	....	....	....	W	W	78.6	....	....	....	....	HvFr
6	....	....	....	....	N	NW	67.9	47.4	30.0	17.4	12.27	Fr
7	....	....	....	....	NW	NW	59.0	49.0	31.8	17.2	12.28	Fr
8	....	....	....	....	0	0	81.5	51.5	34.6	16.9	12.32	Fr
9	....	....	....	....	N	W	106.1	49.0	31.2	17.8	12.69	Fr
10	6.50 P	....	.05	....	N	0	102.8	31.5	21.6	9.9	6.36	L, Fr
11	Nt.	....	.72	....	0	W	92.9	17.3	10.8	6.5	3.79	.....
12	6.00 A	....	.10	....	NW	0	129.5	....	....	....	....	.....
13	Nt.	....	.01	....	N	SE	108.7	41.9	24.0	17.9	12.08	.....
14	....	....	....	....	0	NW	42.4	....	....	....	....	Fr
15	....	....	....	....	SW	S	106.0	42.3	30.7	11.6	8.04	L, Fr
16	....	....	....	....	W	SE	74.1	....	....	....	....	Fr
17	....	....	....	....	E	W	110.9	45.7	30.1	15.6	10.93	Fr
18	....	....	....	....	0	NE	84.4	....	....	....	....	Fr
19	....	....	....	....	W	W	56.8	....	....	....	....	Dew
20	....	....	....	....	W	W	64.8	....	....	....	....	Fr
21	....	....	....	....	W	0	118.2	....	....	....	....	L, Fr
22	....	....	....	....	W	W	150.8	39.4	26.5	12.9	8.70	.....
23	....	....	....	....	SW	W	109.3	....	....	....	....	L, Fr
24	....	....	....	....	0	SW	101.0	....	....	....	....	.....
25	....	....	....	....	NW	NW	206.3	35.7	21.6	14.1	9.20	Dew
26	....	....	....	....	W	0	100.5	....	....	....	....	Fr
27	....	....	....	....	W	0	135.3	42.5	24.9	17.6	11.94	L, Fr
28	....	....	....	....	W	0	82.9	....	....	....	....	HvFr
29	....	....	....	....	SW	W	94.9	42.7	25.5	17.2	11.70	Fr
30	2.00 P	....	T	....	0	W	78.3	21.2	15.0	6.2	3.73	.....
31	....	....	....	....	SW	W	75.0	....	....	....	....	HvFr
Means	....	....	1.15	....	....	....	95.0	39.84	25.29	14.54	9.86	.....
Normal	....	....	0.95	....	....	....	163.0	....	....	....	....	.....

TABLE XI.

METEOROLOGICAL RECORD FOR NOVEMBER. 1902.

	Temperature. Dew Point and Relative Humidity								
	7 A. M.				7 P. M.				Daily Mean Dew Point
	Dry Bulb	Wet Bulb	Dew Point	Relative Humidity	Dry Bulb	Wet Bulb	Dew Point	Relative Humidity	
1	40.5	37.5	34.1	78.6	39.2	30.6	15.7	38.0	24.9
2	20.8	20.4	19.6	95.1	38.3	29.9	14.9	38.1	17.2
3	34.8	30.2	23.2	62.1	56.7	40.5	18.1	22.2	21.7
4	31.0	27.0	20.1	63.5	35.2	30.4	23.1	60.8	21.6
5	24.8	23.4	20.8	84.5	24.4	22.8	19.7	82.1	20.2
6	18.4	18.0	17.1	94.7	32.6	29.6	25.0	73.7	21.1
7	30.4	27.1	21.5	69.3	44.2	35.4	23.1	43.2	22.3
8	27.6	25.4	21.5	77.6	48.6	36.8	19.9	31.9	20.7
9	34.8	30.6	24.4	65.4	46.5	38.2	28.1	48.6	26.2
10	33.6	30.4	25.7	72.6	41.3	36.4	30.3	65.7	28.0
11	32.3	30.1	26.9	80.3	42.2	36.2	28.7	59.1	27.8
12	40.6	38.2	35.6	82.8	39.9	35.0	28.8	64.6	32.2
13	22.6	22.2	21.4	95.3	32.2	29.4	25.6	75.0	23.3
14	20.4	20.1	19.5	96.2	39.2	33.8	26.6	60.3	23.1
15	32.0	31.8	31.5	98.2	26.6	26.2	25.6	95.8	28.5
16	14.2	14.0	13.4	97.0	25.2	25.0	24.3	95.6	18.9
17	24.8	24.1	22.9	92.3	41.4	31.6	14.6	33.5	18.7
18	21.6	20.4	18.0	85.6	35.3	29.8	21.0	55.5	19.5
19	25.2	23.8	21.2	84.7	38.2	32.6	24.7	57.9	23.0
20	26.2	25.2	23.5	89.3	27.0	25.2	22.1	81.3	22.8
21	23.4	22.7	21.4	92.0	35.2	32.1	27.9	74.7	24.6
22	22.0	21.2	19.6	90.4	31.0	28.2	23.8	74.2	21.7
23	20.0	19.6	18.8	95.0	44.3	38.0	30.6	58.9	24.7
24	23.8	21.8	17.9	77.4	26.2	24.7	22.0	84.0	20.0
25	29.0	27.2	24.4	82.2	31.2	26.0	16.2	52.9	20.3
26	70.3	15.8	11.9	79.7	21.2	19.8	16.9	83.0	14.4
27	23.2	20.8	15.8	72.7	40.0	29.9	10.3	29.3	13.0
28	26.8	20.8	5.4	39.2	19.2	16.8	10.5	69.3	8.0
29	8.2	8.0	7.3	96.3	12.2	10.8	6.2	77.8	6.7
30	4.0	3.8	3.0	95.7	29.0	26.2	21.4	72.7	12.6
Means	25.14	23.39	20.25	82.86	34.79	29.59	21.51	61.99	20.92
Normal	25.6	22.7	------	------	34.0	28.4	--- --	------	18.5

TABLE XI—Continued.

METEOROLOGICAL RECORD FOR NOVEMBER, 1902.

	Daily Mean Relative Humidity	Maximum Temperature	Minimum Temperature	Daily Mean Temperature	Range	Barometer, Corrected for Temperature and Instrumental Error			Terrestrial Radiation	
						7 A. M.	7 P. M.	Mean	Instrument Reading	Radiation
1	58.3	53.8	36.2	45.0	17.6	25.062	25.189	25.125	33.2	3.0
2	66.6	55.5	19.7	37.6	35.8	25.295	25.087	25.191	15.1	4.6
3	42.1	63.8	31.9	47.8	31.9	24.898	24.829	24.864	27.5	4.4
4	62.2	45.9	29.8	37.9	16.1	25.034	24.889	24.961	26.8	3.0
5	83.3	43.1	24.4	33.7	18.7	24.955	24.947	24.951	17.6	6.8
6	84.2	46.0	14.9	30.5	31.1	24.924	24.903	24.914	11.1	3.8
7	56.2	56.1	21.9	39.0	34.2	24.868	24.875	24.871	18.0	3.9
8	54.8	57.1	28.0	42.5	29.1	24.970	24.902	24.936	24.0	4.0
9	57.0	64.7	33.8	49.3	30.9	24.942	25.022	24.982	28.1	5.7
10	69.1	54.8	31.8	43.3	23.0	25.013	24.801	24.907	26.1	5.7
11	69.7	69.2	28.7	48.9	40.5	24.743	24.639	24.691	24.8	3.9
12	73.7	45.5	38.3	41.9	7.2	24.685	24.927	24.806	34.1	4.2
13	85.2	49.0	22.6	35.8	26.4	25.049	24.944	24.997	17.5	5.1
14	78.2	39.7	18.2	29.0	21.5	24.868	24.859	24.863	14.1	4.1
15	97.0	40.2	26.2	33.2	14.0	25.054	25.117	25.086	20.0	6.2
16	96.3	41.0	13.6	27.2	27.4	25.129	25.032	25.080	9.4	4.2
17	62.9	59.0	21.9	40.4	37.1	24.822	24.931	24.877	18.2	3.7
18	70.6	52.1	20.0	36.1	32.1	24.879	24.714	24.796	15.9	4.1
19	71.3	54.5	24.0	39.2	30.5	24.763	24.716	24.720	19.6	4.4
20	85.3	41.8	23.3	32.6	18.5	25.037	25.060	25.048	18.7	4.6
21	83.4	57.0	18.6	37.8	38.4	24.993	25.018	25.006	15.8	2.8
22	82.3	43.1	22.8	32.9	20.3	25.260	25.063	25.161	17.0	5.8
23	77.0	59.1	19.0	39.1	40.1	24.916	24.844	24.880	15.0	4.0
24	80.7	47.0	23.2	35.1	23.8	24.926	24.706	24.816	16.2	7.0
25	67.5	36.7	24.0	30.3	12.7	24.921	25.054	24.988	19.8	4.2
26	81.4	46.1	16.2	31.2	29.9	25.131	25.015	25.073	12.6	3.6
27	51.0	53.7	14.9	34.3	38.8	24.740	24.618	24.679	11.3	3.6
28	54.2	32.0	18.0	25.0	14.0	24.842	24.988	24.870	8.0	10.0
29	87.1	36.0	7.8	21.9	28.2	24.964	25.009	24.987	2.0	5.8
30	84.2	43.2	3.8	23.5	39.4	25.003	24.885	24.944	—1.0	4.8
Means	72.42	49.56	22.58	36.07	26.97	24.956	24.916	24.936	------	----
Normal	67.7	51.0	21.1	35.5	30.2	--------	--------	25.006	------	6.0

TABLE XI—Concluded.

METEOROLOGICAL RECORD FOR NOVEMBER, 1902.

Precipitation				Direction of Wind		Total Movement 24 Hours following 7 A. M.	Actinometer at Noon				Frost or Dew
Time of Beginning	Time of Ending	Total Amount Rain and Melted Snow	Average Depth of Snow	7 A. M.	7 P. M.		Black Bulb	Bright Bulb	Difference	Radiation	
9.00 A	------	T	------	0	N	265.5	41.2	22.3	18.9	12.63	-----
------	------	------	------	NW	W	129.6	------	------	------	------	Hv Fr
------	------	------	------	N	NW	211.8	32.0	21.7	10.3	6.63	-----
------	------	------	------	W	W	168.2	32.7	16.2	16.5	10.43	-----
------	------	------	------	SE	W	148.7	------	------	------	------	L, Fr
------	------	------	------	W	W	82.2	37.7	18.5	19.2	12.48	Fr
------	------	------	------	W	W	81.9	31.9	19.2	12.7	8.09	-----
------	------	------	------	NW	SW	89.1	30.6	18.9	11.7	7.41	-----
------	------	------	------	W	NW	98.6	------	------	------	------	-----
------	------	------	------	W	W	69.6	20.5	15.2	15.3	3.18	-----
------	------	------	------	W	W	181.6	------	------	------	------	Fr
4.30 P	------	T	------	0	SE	87.5	15.8	9.6	6.2	3.58	Rn
------	------	------	------	W	W	139.3	37.2	19.4	17.8	11.59	Fr
7.15 P	Nt	------	------	W	W	86.6	------	------	------	------	Hv Fr
7.00 A	------	.27	2.5	SW	SW	62.0	39.6	16.9	22.7	14.78	Sn
------	------	------	------	SW	SW	52.9	------	------	------	------	Hv Fr
------	------	------	------	W	W	192.6	36.8	31.2	5.6	3.81	Hv Fr
------	------	------	------	W	W	102.4	36.8	18.5	18.3	11.85	Fr
------	------	------	------	W	W	105.2	29.7	18.4	11.3	7.12	Fr
------	------	------	------	E	N	101.9	28.1	12.2	15.9	9.72	Fr
------	------	------	------	E	NW	87.7	37.1	19.5	17.6	11.46	Fr
------	------	------	------	SE	NW	115.7	29.5	15.4	14.1	8.77	Fr
------	------	------	------	NW	NW	125.6	------	------	------	------	Fr
Nt	------	------	------	S	NW	282.7	34.2	16.5	17.7	11.26	-----
------	------	T	------	NW	NW	338.4	31.6	12.0	19.6	12.14	Sn
------	------	------	------	E	N	99.0	35.3	16.7	18.6	11.90	-----
------	------	------	------	SW	NW	304.2	------	------	------	------	Fr
10.30 A	------	T	------	NW	E	226.6	------	------	------	------	-----
------	------	------	------	W	NW	72.3	30.9	11.3	19.6	12.07	-----
------	------	------	------	NW	NW	81.8	------	------	------	------	Fr
------	------	0.27	2.5	----	----	139.7	32.46	17.48	14.98	9.55	-----
------	------	0.38	------	----	----	178.0	------	------	------	------	-----

TABLE XII.

METEOROLOGICAL RECORD FOR DECEMBER, 1902

	Temperature, Dew Point and Relative Humidity								Daily Mean Dew Point
	7 A. M.				7 P. M.				
	Dry Bulb	Wet Bulb	Dew Point	Relative Humidity	Dry Bulb	Wet Bulb	Dew Point	Relative Humidity	
1	24.9	22.8	18.8	77.0	40.8	31.8	17.0	37.5	17.9
2	27.1	22.3	11.6	52.2	23.2	19.8	11.9	61.3	11.7
3	17.6	14.2	3.8	54.7	18.2	15.0	5.8	58.1	4.8
4	14.2	12.8	8.7	79.2	47.1	37.8	26.0	43.5	17.4
5	27.3	24.7	20.1	73.4	29.0	26.7	22.9	77.4	21.5
6	20.7	19.3	16.3	82.8	23.2	20.8	15.8	72.5	16.0
7	20.4	19.2	16.6	85.3	23.2	21.8	19.1	83.9	17.9
8	22.7	22.7	22.7	**100.0**	33.9	28.2	18.4	52.1	20.5
9	29.6	25.1	16.6	57.6	31.2	26.3	17.3	55.5	17.0
10	28.0	24.1	16.5	61.6	28.0	23.9	15.8	59.7	16.1
11	20.2	18.8	15.7	82.5	28.0	24.9	19.2	69.2	17.5
12	15.3	14.9	13.8	94.3	30.8	30.4	**29.8**	96.2	21.8
13	27.0	26.5	25.7	94.8	26.8	26.8	26.8	**100.0**	26.2
14	20.8	20.8	20.8	**100.0**	24.0	20.8	13.8	64.4	17.3
15	14.1	11.8	4.6	66.0	0.6	—0.2	—3.7	80.4	0.5
16	—13.2	—13.8	**—19.4**	73.5	—1.0	—2.0	—6.8	73.7	—13.1
17	— 2.8	— 2.8	— 2.8	**100.0**	3.8	2.8	—1.3	78.5	— 2.1
18	3.0	2.2	— 1.2	82.3	27.8	24.2	17.3	64.2	8.1
19	33.0	31.0	28.2	82.3	34.0	31.6	28.3	79.5	28.2
20	39.6	31.8	19.4	44.0	41.0	30.8	11.9	**30.2**	15.7
21	15.2	14.4	12.1	88.4	21.2	20.4	18.7	90.2	15.4
22	7.2	6.6	4.4	88.7	24.2	23.2	21.3	89.0	12.8
23	30.9	29.2	26.7	84.1	33.0	29.6	24.5	70.5	25.6
24	17.2	16.6	15.1	91.8	22.0	20.8	18.4	85.8	16.8
25	11.6	10.4	6.4	80.6	25.2	22.8	18.2	74.0	12.3
26	15.0	14.6	13.5	94.2	27.5	25.6	22.3	80.5	17.9
27	48.2	37.8	24.2	38.9	35.8	27.7	11.6	36.2	17.9
28	24.2	21.8	17.0	73.3	17.0	16.1	13.7	89.7	15.3
29	10.0	9.0	5.6	82.9	18.0	16.8	13.8	84.2	9.7
30	7.2	6.9	5.8	94.3	17.2	15.9	12.5	82.4	9.2
31	8.0	7.6	6.2	92.6	19.2	17.4	13.0	76.9	9.6
Means	18.85	16.88	12.69	79.13	24.32	21.89	15.91	70.88	13.98
Normals	20.0	17.6	------	------	26.9	22.9	------	------	13.7

TABLE XII—Continued.

METEOROLOGICAL RECORD FOR DECEMBER, 1902.

Daily Mean Relative Humidity	Maximum Temperature	Minimum Temperature	Daily Mean Temperature	Range	Barometer, Corrected for Temperature and Instrumental Error			Terrestrial Radiation	
					7 A. M.	7 P. M.	Mean	Instrument Reading	Radiation
57.2	49.3	16.4	32.8	32.9	24.689	25.069	24.879	16.2	0.2
56.7	33.3	23.0	28.2	10.3	**24.554**	24.839	24.696	22.8	0.2
56.4	32.0	17.2	24.6	14.8	25.130	24.999	25.065	13.0	4.2
61.3	53.2	11.7	32.4	41.5	24.742	24.694	24.718	7.7	4.0
75.4	43.9	23.7	33.8	20.2	24.820	24.796	24.802	18.8	4.9
77.7	41.2	17.3	29.3	23.9	24.894	25.088	24.991	12.6	4.7
84.6	41.0	13.4	27.2	27.6	25.120	25.226	25.173	8.2	5.2
76.0	47.0	22.0	34.5	25.0	25.112	25.067	25.089	22.0	------
56.6	54.0	24.0	39.0	30.0	24.980	24.901	24.941	20.0	4.0
60.6	52.1	26.1	39.1	26.0	24.867	24.881	24.874	20.1	6.0
75.9	44.2	19.0	31.6	25.2	24.887	24.807	24.847	14.2	4.8
95.2	43.2	15.2	29.2	28.0	24.834	24.912	24.873	11.0	4.2
97.4	29.3	26.0	27.6	**3.3**	24.942	24.922	24.932	25.2	0.8
82.2	27.0	18.0	22.5	9.0	24.903	24.944	24.923	*21.0	**—3.0**
73.2	28.0	------	14.0	28.0	25.029	25.025	25.027	—11.3	11.3
73.6	24.9	**-17.6**	3.7	**42.5**	25.129	25.140	25.135	**-25.2**	7.6
89.3	35.6	—5.0	15.3	40.6	25.191	25.123	25.157	—12.1	7.1
73.2	39.6	—1.3	19.1	40.9	24.998	24.794	24.896	—17.9	**16.6**
80.9	39.7	25.2	32.5	14.5	24.624	24.621	24.622	24.0	1.2
37.1	46.2	33.4	39.8	12.8	24.713	24.943	24.828	**31.3**	2.1
89.3	35.8	12.6	24.2	23.2	25.044	25.220	25.132	7.5	5.1
88.9	33.2	6.2	19.7	27.0	**25.270**	25.091	25.181	0.2	6.0
77.3	43.6	21.0	32.3	22.6	24.902	25.068	24.985	17.7	3.3
88.8	29.1	14.9	22.0	14.2	25.080	25.164	25.122	11.2	3.7
77.3	41.9	10.3	26.1	31.6	25.067	25.094	25.080	8.0	2.3
87.3	35.3	13.0	24.2	22.3	24.954	24.874	24.914	10.0	3.0
37.6	**58.2**	21.0	39.6	37.2	24.668	24.716	24.692	18.0	3.0
81.5	32.2	17.0	24.6	15.2	24.966	25.004	24.985	13.5	3.5
83.5	36.0	7.2	21.6	28.8	24.958	25.108	25.033	5.0	2.2
88.4	40.0	6.0	23.0	34.0	25.079	24.984	25.032	3.0	3.0
84.7	44.8	7.6	26.2	37.2	24.913	24.947	24.930	3.8	3.8
75.05	39.83	14.34	27.09	25.49	24.937	24.970	24.954	10.31	4.03
70.7	43.6	15.2	29.0	28.3	----------	----------	24.973	------	5.8

*Covered with snow.

TABLE XII—Concluded.

METEOROLOGICAL RECORD FOR DECEMBER, 1902.

	Precipitation				Direction of Wind		Total Movement 24 Hours Following 7 A. M.	Actinometer at Noon				Frost or Dew
	Time of Beginning	Time of Ending	Total Am't Rain and Melted Snow	Average Depth of Snow	7 A. M.	7 P. M.		Black Bulb	Bright Bulb	Difference	Radiation	
1	------	----	----	----	NW	NW	240.8	13.5	7.8	5.7	3.24	-----
2	------	----	----	----	NW	N	461.2	----	----	----	----	-----
3	------	----	----	----	NW	S	127.5	30.9	11.3	19.6	12.07	-----
4	------	----	----	----	E	W	317.2	14.6	5.5	9.1	5.15	-----
5	------	----	----	----	SW	NW	133.6	28.0	15.5	12.5	7.73	-----
6	------	----	----	----	SE	E	137.6	----	----	----	----	Fr
7	------	----	----	----	0	S	82.1	----	----	----	----	Fr
8	------	----	----	----	0	W	102.2	11.2	3.5	7.7	4.27	-----
9	------	----	----	----	W	W	99.8	----	----	----	----	-----
10	------	----	----	----	W	W	91.3	----	----	----	----	-----
11	------	----	----	----	NW	NW	59.2	24.7	11.3	13.4	8.06	-----
12	5.30 P	7.25 P	.05	0.5	NW	NW	90.0	30.0	12.2	17.8	10.96	Fr
13	7.30 A	----	.31	4.0	SE	0	42.3	----	----	----	----	Sn
14	------	10.00 A	.38	5.6	N	NW	267.7	----	----	----	----	Sn
15	------	----	----	----	NW	S	76.3	37.3	15.5	21.8	13.99	-----
16	------	----	----	----	NW	W	52.2	33.7	8.7	25.0	15.42	Fr
17	------	----	----	----	NE	W	53.5	37.2	16.0	21.2	13.63	Fr
18	Nt.	Nt.	----	----	SW	SW	109.4	----	----	----	----	-----
19	------	----	.03	0.5	NE	NW	527.2	18.8	8.6	10.2	5.93	Sn
20	------	----	----	----	NW	NW	344.2	19.7	11.2	8.5	5.01	-----
21	------	----	----	----	NW	S	57.0	----	----	----	----	Fr
22	------	----	----	----	NW	E	67.0	34.1	15.5	18.6	11.79	Fr
23	------	----	----	----	SE	S	194.4	27.5	15.5	12.0	7.41	Fr
24	------	----	----	----	NW	NW	70.0	28.7	9.6	19.1	11.59	Fr
25	------	----	----	----	W	0	57.3	----	----	----	----	Fr
26	------	----	----	----	NW	E	123.0	11.6	4.2	7.4	4.12	Fr
27	------	----	----	----	W	NW	377.7	41.0	24.0	17.0	14.27	-----
28	------	----	----	----	NW	N	150.6	----	----	----	----	-----
29	------	----	----	----	SE	E	93.2	28.6	10.4	18.2	11.07	Fr
30	------	----	----	----	0	W	74.3	31.1	12.0	19.1	11.81	Fr
31	------	----	----	----	NW	NW	81.4	34.5	16.5	18.0	11.47	Fr
Means	------	----	0.77	10.6	----	----	153.6	26.84	11.74	15.10	9.45	-----
Normals	------	----	0.37	----	----	----	184.0	----	----	----	----	-----

TABLE XIII.

SUMMARY FOR AGRICULTURAL COLLEGE, FORT COLLINS, COLORADO.

Latitude, 40° 34′. Longitude, 105° W. from Greenwich. Elevation of Barometer, *5,004 Feet; Ground, *4,990 Feet.

FOR 1902.

MONTH	TEMPERATURE (In Degrees Fahrenheit)											No. Days		Precipitation (Inches)	Snowfall (Inches)	No. of Stormy Days	Relative Humidity, Mean	Dew Point, Mean	No. of Days Frost or Dew Was Observed	
	Mean (½ Max. and ½ Min.)	Average Maximum	Average Minimum	7 A. M.	7 P. M.	Absolute Maximum	Absolute Minimum	Mean Range	Greatest Range	Wet Bulb 7 A. M.	Wet Bulb 7 P. M.	Av. Temperature Below 32°	Minimum Below 32°						Frost	Dew
January	24.2	39.2	9.1	12.2	20.6	62.2	—31.4	30.1	43.6	11.0	17.7	17	31	0.32	6.75	3	78.2	9.9	19	-------
February	32.0	45.5	18.5	22.4	31.2	63.0	—23.0	27.0	48.2	20.2	26.4	9	27	0.15	2.25	2	70.8	17.0	11	-------
March	35.3	48.0	22.5	28.6	35.6	63.9	2.0	25.5	51.9	25.5	29.4	10	26	1.50	2.50	8	61.8	18.3	8	-------
April	45.7	61.0	30.4	40.9	48.2	79.8	18.0	30.6	45.2	36.1	39.1	1	17	0.61	----	5	58.8	29.0	9	-------
May	56.1	70.5	41.7	52.9	59.2	85.9	29.6	28.8	47.8	47.0	49.1	0	1	2.13	----	12	61.2	40.8	5	3
June	63.6	79.0	48.2	59.5	67.1	96.0	37.0	30.8	48.1	53.8	55.0	0	0	2.43	----	8	62.0	48.2	1	9
July	66.0	82.5	49.5	62.4	68.2	98.0	38.8	33.0	49.2	56.1	58.7	0	0	1.31	----	8	65.1	52.7	----	17
August	68.7	85.1	52.3	63.7	68.3	99.6	42.3	32.8	46.6	56.3	57.2	0	0	0.67	----	3	60.1	50.7	----	10
September	56.8	74.1	39.5	47.8	56.9	89.8	22.0	34.6	56.6	42.9	47.9	0	3	7.12	----	4	64.5	38.9	6	7
October	48.9	64.5	33.2	38.1	47.3	80.0	25.5	31.3	47.3	35.4	41.6	0	12	1.15	----	6	74.4	34.3	20	2
November	36.1	49.6	22.6	25.1	34.8	69.2	3.8	27.0	39.4	23.4	29.6	8	27	0.27	2.50	1	72.4	20.9	16	-------
December	27.1	39.8	14.3	18.8	24.3	58.2	—17.6	25.5	42.5	16.9	21.9	21	30	0.77	10.6	4	75.0	14.0	14	-------
Average	46.7	61.6	31.8	39.4	46.8	99.6	—31.4	29.7	56.6	35.4	39.5	66	174	18.43	24.6	65	67.0	31.2	109	48
Normal	46.6	62.2	31.8	39.5	46.8	99.6	—38.4	30.3	----	35.1	39.1	76	174	14.66	----	71	65.3	30.4	-------	-------

* Position of barometer unchanged. Corrected by levels of the U. S. G. S. connecting with those of the U. S. C. and G. S.

TABLE XIV.

SUMMARY FOR ARKANSAS VALLEY SUBSTATION, ROCKY FORD, COLORADO.
Latitude, 39° 3′. Longitude, 103° 45′ W. Elevation, 4,160 feet.

FOR **1902.**

MONTH	Temperature (in Degrees Fahrenheit)											No. Days		Precipitation (Inches)	Snowfall (Inches)	No. of Stormy Days	Relative Humidity, Mean	Dew Point, Mean	No. Days Frost or Dew Was Observed		Prevailing Direction of Wind
	Mean	Average Maximum	Average Minimum	7 A. M.	7 P. M.	Absolute Maximum	Absolute Minimum	Mean Range	Greatest Range	Wet Bulb 7 A. M.	Wet Bulb 7 P. M.	Av. Temperature Below 32°	Minimum Below 32°						Frost	Dew	
January	29.8	46.5	13.1	16.5	28.5	68	—10	33.4	49	15.3	24.1	13	31	0.18	----	2	72.7	14.0	----	----	WNW
February	37.8	55.4	20.3	24.4	35.9	72	+ 9	35.1	53	22.6	30.3	7	24	0.57	----	2	69.3	19.6	----	----	NW
March	42.1	58.1	26.0	----	----	74	8	32.1	55	----	----	3	21	1.78	4.0	3	----	----	----	----	W
April	53.7	70.0	37.7	44.5	55.5	89	25	33.4	51	38.9	43.6	0	5	0.18	----	5	53.2	31.1	----	----	NE
May	63.9	80.0	47.8	56.2	65.4	89	35	32.2	46	50.3	52.6	0	0	4.02	----	7	59.3	43.0	----	----	NE
June	71.3	87.0	55.0	62.2	71.2	103	48	32.0	51	53.6	59.3	0	0	0.60	----	3	61.9	51.4	----	----	E
July	74.1	91.4	56.7	65.6	73.7	102	44	34.7	46	59.0	60.8	0	0	0.72	----	4	60.6	53.8	----	----	E
August	75.6	92.3	58.7	66.7	74.7	104	50	33.9	47	60.8	63.0	0	0	2.72	----	5	63.7	56.8	----	----	W
September	62.0	80.1	43.9	51.1	60.5	95	30	36.1	55	46.3	51.8	0	2	0.46	----	3	65.7	43.4	----	----	W
October	53.7	72.5	35.6	42.7	52.3	86	25	36.2	52	38.7	44.1	0	6	0.80	----	2	64.2	34.8	----	----	W
November	41.7	58.0	25.4	30.6	39.3	77	9	32.6	55	27.2	33.9	3	24	0.41	0.5	3	64.6	23.7	----	----	W
December	30.5	45.6	15.1	20.1	26.6	71	— 7	30.5	53	18.5	18.3	16	31	0.33	4.5	2	77.1	16.5	----	----	W
Average	53.0	69.7	36.3	----	----	104	—10	33.5	55	----	----	42	144	12.77	----	41	----	----	----	----	------
Normal	51.7	68.7	35.2	----	----	----	----	33.3	----	----	----	----	----	13.41	----	39	----	----	----	----	------

TABLE XV.

SUMMARY FOR PLAINS SUBSTATION, CHEYENNE WELLS, COLORADO.
Latitude, 38° 50′. Longitude, 102° 20′ W. Elevation, 4,278 feet.
FOR 1902.

MONTH	Temperature (In Degrees Fahrenheit)							No. Days		Precipitation (Inches)	Snowfall (Inches)	No. of Stormy Days	No. of Days Frost or Dew Was Observed		Average Cloudiness	Prevailing Direction of Wind
	Mean, (½ Max. + ½ Min.)	Average Maximum	Average Minimum	Absolute Maximum	Absolute Minimum	Mean Range	Greatest Range	Av. Temperature Below 32°	Minimum Below 32°				Frost	Dew		
January	28.9	44.1	13.7	68	−14	30.4	43	14	31	T	T	0	6	.....	.....	N
February	33.6	49.0	18.1	67	−11	31.0	46	14	25	0.25	2.5	1	9	.....	.....	NNE
March	39 6	53.1	26.0	70	1	27.2	50	6	22	1.92	3.0	4	.....	.....	.....	NW
April	49.9	65.6	34.2	87	21	31.4	46	0	11	0.78	1.5	3	.....	.....	.....	NE
May	62.7	78.1	47.2	92	35	31.0	42	0	0	3.12	.....	7	.....	.....	5.1	E
June	66.6	78.7	51.5	103	39	30.1	58	0	0	2.53	.....	5	.....	.....	4.9	SE
July	71.7	87.8	55.6	101	41	32.9	45	0	0	1.42	.....	4	.....	.....	1.8	S
August	73.7	88.7	58.6	104	45	30.1	51	0	0	6.06	.....	7	.....	.....	3.3	SE
September	59.5	74.6	44.3	91	29	30.1	47	0	2	0.20	.....	1	.....	.....	2.3	W
October	54.4	69.3	39.4	90	32	29.9	47	0	0	1.32	.....	5	.....	.....	3.2	NW
November	40.0	54.0	26.0	77	9	27.2	43	5	20	0.	.....	0	.....	.....	3.8	NW
December	27.6	40 3	14.8	65	0.1	25.5	42	23	31	0.75	7.5	6	....	.....	4.5	W
Average	50.7	65.3	35.8	104	−14	29.7	58	62	140	18.35	14.5	43	.....	.....	3.6	.....
Normal	50.5	65.3	35.6	.....	.....	29.6	.....	.....	.....	16.18	.....	42.9	.....	.....	.....	.....

TABLE XVI.

SUMMARY AT LONG'S PEAK HOUSE, ESTES PARK P. O., COLORADO.
Elevation, 9,000 feet, Approx. Carlyle Lamb, Enos A. Mills, Observers.
FOR 1902.

MONTH	Mean Temperature	Average Maximum	Average Minimum	Absolute Maximum	Absolute Minimum	Mean Range	Greatest Range	No. of Days		Precipitation (Inches)	Snowfall (Inches)	No. of Stormy Days
								Average Below 32°	Minimum Below 32°			
January	22.8	34.9	10.8	51	—15	24.1	48	20	31	0.35	3.5	4
February	26.9	35.8	18.1	49	— 5	17.7	35	20	28	1.00	1.0	2
March	22.8	33.3	12.2	45	0	21.1	37	28	31	1.36	18.5	8
April	35.6	46.9	24.3	63	5	22.5	42	10	24	1.32	13.2	4
May	42.8	55.3	30.4	67	15	25.0	41	1	20	2.90	6.0	8
June	50.4	65.1	35.7	77	26	29.4	41	0	3	1.40	T	5
July	52.3	67.7	36.9	81	27	30.8	41	0	6	2.40	T	8
August	54.5	70.1	39.0	83	33	31.1	42	0	0	2.79	-------	12
September	47.1	63.5	30.7	74	13	32.8	45	0	17	4.42	21.0	7
October	39.4	52.7	26.1	65	10	26.6	45	3	28	1.60	11.0	6
November	29.2	41.9	16.4	60	— 6	25.5	45	18	28	1.00	17.5	5
December	26.1	37.8	14.4	52	— 2	25.5	42	24	31	0.75	12.5	5
Average	37.5	50.4	24.6	83	—15	26.0	48	124	247	21.29	104.2	74
Normal	37.7	49.9	25.5	------	----------	24.4	------	119	224	17.41	----------	68

TABLE XVII.

SUMMARY AT GLENEYRE P. O., NEAR HEAD OF THE LARAMIE RIVER

Elevation, 8,000 feet. Mrs. F. W. Sherwood, Observer.

FOR 1902.

MONTH	Av. Temp. 7 A. M.	Av. Temp. 2 P. M.	Av. Temp. 9 P. M.	Mean Temp. (½ Max. + Min.)	Average Maximum	Average Minimum	Absolute Maximum	Absolute Minimum	Mean Range	Greatest Range	No. Days Av. Below 32°	No. Days Min. Below 32°	Precipitation (Inches)	Snowfall (Inches)	No. of Stormy Days
January	13.2	34.9	16.5	21.4	35.9	6.8	55.	—20.	29.1	50	26	31	.....	7.0	4
February	18.8	35.2	20.9	25.5	36.0	15.0	49.	— 3.	21.0	41	23	28	.....	10.5	6
March	15.8	35.9	19.1	23.5	36.9	10.2	45.	—13.	26.7	50	25	31	1.40	20.0	4
April	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
May	41.5	63.3	39.9	48.2	65.9	30.6	78.	18.	35.3	50	0	17	0.30	4.0	1
June	53.6	71.0	47.7	55.6	74.3	36.8	86.	25.	37.6	57	0	4	0.10	.....	1
July	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
August	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
September	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
October	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
November	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
December	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Average	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Normal	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....

TABLE XVIII.

SUMMARY AT MR. G. L. BARNES', COWDREY (FORMERLY PINKHAMPTON), NORTH PARK, COLORADO.

Elevation 8,400 feet.

FOR 1902.

MONTH	Mean Temp. (½ 7 A. M. + 7 P. M.)	Av. Temp. 7 A. M.	Av. Temp. 12 M.	Highest	Lowest	Mean Range	Greatest Range	No. Days Av. Temp. Below 32°	No. Days Minimum Temp. Below 32°	Precipitation	Snowfall	No. of Stormy Days
January	20.50	6.70	34.40	50.0	−17.0	27.60	42.0	28	31	1.00	10	4
February	28.90	17.90	40.00	58.0	— 4.0	22.10	50.0	18	28	1.20	12	7
March	28.70	15.40	42.00	62.0	−10.0	26.60	50.0	21	31	2.40	24	7
April	39.80	27.27	52.40	74.0	6.0	25.13	54.0	3	26	.85	8.5	4
May	51.25	36.29	66.22	82.0	18.0	29.94	52.0	0	8	.63	.....	5
June	59.4	43.73	75.07	86.0	28.0	31.33	48.0	0	3	.16	.....	3
July	59.9	43.29	76.52	92.0	32.0	33.23	50.0	0	1	1.29	.....	7
August	61.39	44.87	77.90	92.0	36.0	33.03	46.0	0	0	.81	.....	6
September	51.20	36.13	66.20	78.0	18.0	30.06	54.0	0	8	1.11	.....	4
October	42.00	28.64	55.29	76.0	18.0	26.60	52.0	1	18	.62	.....	5
November	31.20	21.36	41.10	62.0	— 2.0	19.80	40.0	14	25	.10	4.0	3
December	22.9	13.6	32.2	52.0	−14.0	18.6	44.0	23	28	1.75	17.5	10
Average	41.4	27.9	54.9	92.0	−17.0	27.0	54.0	108	207	11.92	76.0	65
Normal	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....

TABLE XIX.

PRECIPITATION, 1902.

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Year
Cowdrey (formerly Pinkhampton)	1.00	1.20	2.40	0.85	0.63	0.16	1.29	0.81	1.11	0.62	0.10	1.75	11.92
Long's Peak house	3.50	1.00	1.36	1.32	2.90	1.40	2.40	2.79	4.42	1.60	1.00	0.75	21.29
Waterdale	0.32	0.13	1.20	0.69	2.78	1.56	0.53	0.18	4.13	0.96	0.49	0.83	13.80
Fort Collins	0.32	0.15	1.50	0.61	2.13	2.43	1.31	0.67	7.12	1.15	0.27	0.77	18.43
Rocky Ford	0.18	0.57	1.78	0.18	4.02	0.60	0.72	2.72	0.46	0.80	0.41	0.33	12.77
Cheyenne Wells	T	0.25	1.92	0.78	3.12	2.53	1.42	6.06	0.20	1.32	------	0.75	18.35
Gleneyre	0.70	1.05	1.40	------	0.30	0.10	------	------	------	------	------	------	------

TABLE XX.

WEEKLY MEANS OF SOIL TEMPERATURE, SET A, IN AN IRRIGATED PLAT NEAR THE COLLEGE BUILDING. (In Degrees Fahrenheit.)

FOR 1902.

WEEK ENDING	DEPTH					
	3 In.	6 In.	1 Ft.	2 Ft.	3 Ft.	6 Ft.
January 5	32.3	33.6	34.4	38.8	41.7	45.2
January 11	31.4	33.4	34.4	38.2	40.9	44.3
January 18	32.2	33.3	33.6	37.9	40.5	43.6
January 25	31.6	32.6	33.7	37.4	40.0	43.0
February 1	26.5	28.2	30.0	35.4	38.7	42.1
February 8	28.0	28.5	29.2	33.4	36.6	40.8
February 15	30.6	31.1	31.4	34.0	36.6	40.0
February 22	31.7	31.9	32.4	35.2	37.3	39.8
March 1	33.3	34.1	34.9	37.1	38.5	40.1
March 8	34.7	35.4	35.8	38.2	39.5	40.7
March 15	36.5	37.3	37.6	38.0	40.4	41.2
March 22	37.9	38.3	38.4	40.5	40.7	41.6
March 29	39.6	40.1	40.5	41.6	42.0	42.2
April 5	38.9	39.2	39.5	41.0	42.0	42.5
April 12	46.0	45.8	45.4	44.5	43.9	43.2
April 19	45.5	45.7	45.4	45.6	45.3	44.4
April 26	48.2	48.3	48.2	47.7	46.9	45.4
May 3	52.1	51.8	50.9	49.7	48.4	46.5
May 10	56.0	55.7	54.7	52.9	51.0	48.2
May 17	59.3	58.9	57.9	55.5	53.4	50.0
May 24	56.2	56.4	56.8	56.1	54.7	51.6
May 31	59.9	59.5	58.7	57.1	55.5	52.6
June 7	65.4	64.7	63.4	60.2	57.5	53.8
June 14	67.7	67.1	65.8	63.0	60.2	55.7
June 21	65.5	65.7	65.0	63.5	61.5	57.3
June 28	67.9	67.7	66.8	63.5	62.1	58.2
July 5	66.2	66.4	65.8	.....	62.8	62.7

TABLE XX—Concluded.

WEEKLY MEANS OF SOIL TEMPERATURES, SET A, IN AN IRRIGATED PLAT NEAR THE COLLEGE BUILDING. (In Degrees Fahrenheit.)

FOR 1902.

WEEK ENDING	DEPTH					
	3 In	6 In.	1 Ft.	2 Ft.	4 Ft.	6 Ft.
July 12	66.3	66.4	65.9	.....	63.2	59.9
July 19	67.6	67.9	67.5	.....	64.1	60.6
July 26	66.9	67.5	66.9	.....	64.5	61.4
August 2	70.4	70.0	69.1	.....	65.4	62.1
August 9	69.7	70.7	69.7	.....	66.9	63.1
August 16	69.9	70.1	69.6	.....	67.0	63.9
August 23	69.4	70.1	70.0	.....	67.6	64.4
August 30	68.2	68.8	68.9	.....	67.7	64.9
September 6	64.3	65.7	66.4	.....	66.8	64.8
September 13	61.2	62.8	63.9	.....	65.7	64.3
September 20	60.3	61.8	62.7	.....	64.2	63.6
September 27	53.5	54.5	55.5	.....	60.1	61.1
October 4	51.4	52.7	54.2	.....	.....	60.0
October 11	50.9	51.7	52.6	.....	.....	58.5
October 18	49.6	50.8	51.7	.....	.....	57.3
October 25	49.7	50.7	51.5	.....	.....	56.3
November 1	45.9	47.3	48.5	.....	.....	55.4
November 8	42.0	43.7	45.3	.....	.....	54.0
November 15	42.1	43.3	44.5	.....	.....	52.5
November 22	37.3	39.0	40.7	.....	.....	51.1
November 29	34.6	36.5	38.4	.....	.....	49.4
December 6	32.0	33.8	35.6	39.6	41.8	47.7
December 13	32.7	33.9	35.1	38.4	40.3	46.0
December 20	31.6	33.1	34.6	37.8	39.5	44.9
December 27	31.3	32.6	33.9	37.0	38.7	44.0
Average	48.84	49.54	49.87	44.63	51.21	51.69

TABLE XXI.

WEEKLY READINGS (NOT AVERAGES) OF SOIL THERMOMETERS, SET C, ON UNIRRIGATED GROUND.

FOR 1902.

DATE	DEPTH			
	6 In.	1 Ft.	2 Ft.	3 Ft.
January 2	32.6	33.6	36.8	39.3
January 9*	32.4	33.2	36.2	38.5
January 16	31.5	32.4	39.5	37.8
January 23	30.5	31.8	34.7	37.2
January 30	25.2	28.0	33.0	35.3
February 6	28.2	28.5	31.8	34.3
February 14	31.2	31.3	33.1	34.7
February 20	32.0	32.1	33.8	35.1
February 27	32.2	32.6	34.3	35.5
March 6	32.7	33.1	34.8	35.8
March 13	34.3	34.1	35.5	36.3
March 20	37.8	35.6	36.0	36.8
March 27	39.7	38.8	39.2	38.8
April 4	40.3	39.2	39.3	38.7
April 10	45.7	44.4	42.8	41.2
April 17	45.4	44.2	43.5	42.5
April 24	47.7	46.4	45.9	44.5
May 5	54.1	52.6	50.4	48.8
May 22	56.3	54.8	54.1	52.0
May 28	56.3	56.4	55.5	53.2
June 12	65.1	63.7	60.6	57.2
June 19	64.9	63.1	61.0	58.2
June 26	68.8	68.0	62.4	59.5
July 3	66.9	66.4	62.6	60.1
July 8	65.5	65.6	62.4	60.3
Average	43.9	43.6	44.0	43.7

*Instruments removed on account of new barn erecting on their site.

TABLE XXII.

DATES OF EXTREME TEMPERATURES AT DIFFERENT DEPTHS FROM READINGS AT 7 A. M. AND 7 P. M. SET A.

YEAR	DEPTH											
	3 Inches				6 Inches				12 Inches			
	Date	Max.	Date	Min.	Date	Max.	Date	Min.	Date	Max.	Date	Min.
1889	June 30	87.7	Jan. 9	16.0	July 1	81.2	Jan. 9	21.0	June 30	76.8	Jan. 21-22	26.0
1890	July 1	86.2	Jan. 2	14.5	July 1	81.2	Jan. 2	20.0	July 16	72.5	Jan. 24	25.5
1891	July 24	84.0	Feb. 9	17.8	July 11	80.6	Feb. 2	21.9	----------	----	----------	-----
1892	Aug. 24	84.2	Jan. 13	16.3	Aug. 14	80.8	Jan. 11	20.7	Aug. 15	72.5	----------	-----
1893	June 28 to July 4	87.5	Jan. 18	21.3	July 5	83.9	Jan. 18	26.0	July 5	76.1	Jan. 21	30.3
1894	June 12	78.6	Dec. 28	11.7	July 27	76.1	Dec. 28	21.4	July 27	71.5	Dec. 28	24.3
1895	July 6	83.2	Jan. 15	8.5	July 6	78.8	Jan. 15	13.0	July 29	71.6	Jan. 15	19.2
1896	July 13	90.8	Jan. 4	18.8	July 13	86.1	Jan. 4	22.7	July 13	77.1	Jan. 4	27.9
1897	July 7	78.2	Jan. 5	18.9	Aug. 12	77.3	Jan. 5	23.9	Aug. 12	77.0	Jan. 5	29.5
1898	July 15	85.4	Dec. 14	20.0	July 17	82.2	Jan. 27 to Dec. 14	24.7	July 19	77.7	Jan. 27	28.0
1899	June 28	84.3	Jan. 10	18.8	June 28	79.2	Feb. 8	21.6	*July 24	73.9	Feb. 7	25.3
1900	June 23	84.3	Feb. 17	24.4	June 23	78.7	Feb. 17	26.6	Aug. 20	73.0	Feb. 18	28.7
1901	July 7	79.6	Jan. 2	19.3	July 22-23	75.8	Feb. 5	24.8	July 22-24	73.4	Feb. 10	27.8
1902	Aug. 1	77.7	Feb. 2	23.6	Aug. 2	74.1	Feb. 2	25.7	Aug. 3	71.5	Feb. 2	27.5

* 74 June 29 after watering grass.

TABLE XXII—Concluded.

DATES OF EXTREME TEMPERATURES AT DIFFERENT DEPTHS FROM READINGS AT 7 A. M. AND 7 P. M. SET A.

YEAR	DEPTH											
	2 Feet				3 Feet				6 Feet			
	Date	Max.	Date	Min.	Date	Max.	Date	Min.	Date	Max.	Date	Min.
1889	July 18	67.3	Jan. 28	30.9	Aug. 19	64.6	Jan. 29-31	33.3	Sept. 5-10	60.0	Mar. 3	39.2
1890	July 17-28 Aug. 7	66.9	Feb. 11	30.6	Aug. 21	64.6	Jan. 29	33.3	Sept. 1-12	60.0	Feb. 18	39.4
1891	July 26	68.7	Feb. 14-16-17	32.1	Aug. 16, 17 to Aug. 19, 20	65.6	Feb. 19, 22 to Feb. 23, 26	34.0	Sept. 17	63.8	Mar. 12-23	39.0
1892	Aug. 17	68.7	Jan. 24-25	31.4	Aug. 18	65.5	Feb. 28	33.6	Sept. 1	60.2	Feb. 24-26	39.6
1893	*July 6	75.3	Jan. 22	32.6	July 24	67.6	Jan. 23-27 to Feb. 11	34.8	†July 6	67.4	Feb. 21, 22-25	40.2
1894	June 28	69.8	Feb. 25	31.5	°June 28	69.7	Feb. 27-28	33.5	‖June 28	64.4	Mar. 15	38.5
1895	Aug. 2	68.0	Jan. 16	27.5	Aug. 7-8	65.9	Jan. 18	32.8	Aug. 30 to Sept. 19	61.0	Mar. 1	39.3
1896	Aug. 15-17	71.9	Jan. 6	31.6	Aug. 16 17	69.5	Jan. 8, 17, 18	35.5	Aug. 24-25	62.8	Feb. 17-22	41.0
1897	Aug. 12	§76.1	Feb. 2	32.4	§Aug. 17	73.6	Feb. 2-10	35.5	§Aug. 16	75.5	Mar. 24 to April 2	41.0
1898	July 30	73.0	Jan. 28 to Feb. 12	33.0	Sept. 1	70.6	Feb. 7-20	36.5	Sept. 5-6	67.5	April 10	43.4
1899	July 26-28	69.1	Feb. 15	30.9	July 28	67.2	Feb. 23 to Mar. 4	34.0	----------	----	----------	----
1900	July 15	69.2	Feb. 19	33.1	Aug. 20	68.9	Feb. 19-24	36.5	----------	----	----------	----
1901	July 21	70.5	Feb. 12-15	32.5	Aug. 4	68.6	Feb. 14-16	36.0	----------	----	----------	----
1902	¶June 24	64.0	Feb. 4 5	33.0	Aug. 20-23	67.8	Feb. 2-6-7	36.3	Aug. 28-Sept. 1	65.0	Feb. 18-21	39.7

* Water applied to lawn, 69.2. July 31, was probably highest otherwise.
† Water applied to lawn, 62.6, September 11-13.
° August 22, 66.7.
‖ September 2, 62.5.
§ Affected by irrigation.
¶ Broken June 24
Observations made at 2 and 9 p. m. before July 1, 1889. Six-foot thermometer broken September 10, 1898.

TABLE XXIII.

EVAPORATION FROM WATER SURFACE, TANK 3x3x3 FEET, FLUSH WITH GROUND, AT FORT COLLINS, COLORADO. (In Inches.)
Latitude, 40° 34′. Longitude, 105+W. Elevation, 4,980 Feet.

YEAR	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Year
1887	2.46	3.23	4.60	5.55	5.19	5.75	5.23	4.24	4.12	3.26	1.48	1.60	46.71
1888	.....	.....	.....	.....	4.45	*7.70	*7.00	4.06	3.94	2.17	1.35	0.99	.....
1889	1.08	1.03	2.75	4.06	3.72	4.34	5.20	5.15	5.19	3.28	.62	1.42	37.84
1890	.86	2.36	3.58	3.50	4.32	5.71	5.44	5.76	3.69	2.71	1.32	1.10	40.25
1891	*1.89	1.90	2.23	2.24	5.03	4.97	5.72	4.91	4.12	3.62	1.74	0.75	39.12
1892	2.51	‡2.15	2.78	3.58	3.49	4.20	4.69	5.64	5.11	3.33	1.93	1.13	40.54
1893	¶	*1.52	3.79	5.40	5.12	6.12	6.41	4.73	5.04	3.79	1.05	1.88	.....
1894	†1.14	†1.15	1.95	4.61	4.66	5.01	5.74	4.88	3.77	3.75	1.64	1.22	39.52
1895	†1.19	†1.19	¶	4.91	4.27	4.13	4.57	4.52	4.06	2.24	1.53	1.68	.....
1896	2.64	2.25	2.39	4.71	5.91	5.09	5.23	5.80	3.34	2.94	1.62	1.25	43.17
1897	1.80	2.20	¶	3.33	4.13	4.26	4.64	4.76	3.97	2.88	1.47	0.94	.....
1898	1.12	*1.31	2.53	4.65	3.90	5.67	7.33	6.57	5.57	4.64	1.36	0.67	45.32
1899	§1.51	§1.39	§1.54	3.79	5.35	6.37	5.38	5.86	5.01	2.87	1.86	1.15	42.11
1900	.96	1.55	2.32	3.12	4.53	5.51	6.26	5.43	4.55	3.74	2.10	1.54	41.61
1901	1.19	.81	2.79	3.54	5.25	5.16	6.96	5.46	5.01	3.55	2.81	1.03	43.59
1902	.91	1.25	1.58	4.08	5.06	5.73	5.49	6.20	4.41	2.89	1.81	0.85	40.26
Average	1.52	1.69	2.68	4.07	4.65	5.36	5.71	5.25	4.43	3.23	1.61	1.20	41.40

*Based on record for part of month.
†From record of two months.
‡From record from February 17th.
¶Tank punctured. Record lacking.
§From record of three months.

TABLE XXIV.

RAINFALL AT THE AGRICULTURAL COLLEGE, FORT COLLINS, COLORADO.

YEAR	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Year
1872	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.02	0.20	.....
1873	0.25	0.16	0.00	1.20	2.30	1.50	1.30	0.85	0.75	0.42	0.20	0.17	9.10
1874	0.06	0.43	1.29	0.77	2.95	0.65	3.15	0.25	0.00	1.00	0.02	0.00	10.40
1879	.....	.....	.....	.....	.....	.....	.....	.....	.....	1.75	0.15	0.60	.....
1880	0.72	1.09	0.38	0.94	0.60	0.86	1.80	0.37	1.47	2.07	.....	0.10	.....
1881	1.10	0.55	1.45	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
1882	.....	.....	0.17	.....	4.67	3.07	1.76	0.89	2.51	0.82	0.29	.....	.....
1883	1.00	1.50	0.68	.....	2.51	3.18	.....	1.78	1.00	1.29	T	1.33	.....
1884	1.10	0.70	1.15	3.94	4.84	.....	.....	.....	.....	0.10	1.80	0.35	.....
1885	1.77	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
1886	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.69	1.18	0.33	.....
1887	0.86	0.23	0.25	1.10	1.23	1.96	3.05	2.12	0.54	0.43	0.15	0.00	12.12
1888	0.29	0.36	0.73	1.23	3.39	0.47	0.60	1.01	0.29	0.88	0.38	0.16	9.79
1889	0.21	0.34	0.65	2.07	3.39	2.06	0.79	0.95	0.42	3.16	0.43	0.01	14.48
1890	0.13	0.21	0.22	3.92	1.19	0.12	1.27	3.14	0.07	0.70	0.32	0.12	13.58
1891	2.32	0.16	1.21	2.14	4.07	1.30	0.17	2.05	1.01	0.20	0.60	0.46	15.69
1892	0.60	1.29	1.52	1.60	4.83	2.42	1.32	0.22	0.14	0.93	0.23	0.01	15.45
1893	0.02	0.54	0 14	1.66	1.92	0.26	0.64	0.92	0.18	0.16	0.55	0.12	7.11
1894	0.25	0.60	0.67	0.89	3.09	0.42	1.72	1.53	2.29	T	0.14	0.76	12.36

1895	0.24	1.52	0.54	1.36	3.62	3.65	3.75	1.45	0.47	1.06	0.40	0.01	18.07
1896	0.43	0.03	1.73	1.26	1.68	3.05	3.05	2.20	1.55	0.49	0.05	0.24	15.76
1897	0.18	0.54	2.15	1.39	2.06	1.69	2.65	1.74	0.75	0.75	0.67	0.67	15.24
1898	0.14	0.08	0.50	1.08	3.65	1.37	0.50	0.98	0.50	0.82	1.24	0.17	11.03
1899	0.66	1.04	1.50	1.10	1.01	1.03	4.95	0.99	0.21	3.23	T	0.47	16.19
1900	0.25	1.12	1.07	10.56	1.75	0.82	1.14	0.16	1.92	0.24	0.07	0.11	19.21
1901	0.19	0.38	1.88	3.62	7.47	2.35	0.71	0.72	2.10	0.36	0.02	1.37	21.17
1902	0.32	0.15	1.50	0.61	2.13	2.43	1.31	0.67	7.12	1.15	0.27	0.77	18.43
Normal	0.57	0.59	0.93	2.12	2.93	1.65	1.78	1.19	1.20	0.95	0.38	0.37	14.66

TABLE XXV.

SUMMARY FOR AGRICULTURAL COLLEGE, FORT COLLINS, COLORADO.

Latitude, 40° 34′. Longitude, 105 W. from Greenwich. Elevation of Barometer, 5,004 Feet; Ground, 4990 Feet.

FOR 1901.

MONTH	TEMPERATURE (In Degrees Fahrenheit)											No. Days		Precipitation (Inches)	Snowfall (Inches)	No. of Stormy Days	Relative Humidity, Mean	Dew Point, Mean	No. of Days Frost or Dew Was Observed	
	Mean (½ Max. and ½ Min.)	Average Maximum	Average Minimum	Wet Bulb 7 A. M.	Wet Bulb 7 P. M.	Absolute Maximum	Absolute Minimum	Mean Range	Greatest Range			Av. Temperature Below 32°	Minimum Below 32°						Frost	Dew
January	28.2	43.8	12.6	16.9	27.7	61.8	—21.7	31.2	46.0	14.4	22.6	18	30	0.19	2.0	3	66.0	10.7	13	------
February	23.9	38.4	9.4	13.9	24.2	63.0	—14.7	29.1	43.7	12.6	20.6	18	27	0.38	5¼	7	78.9	12.2	10	------
March	34.7	48.1	21.3	28.9	35.8	71.9	— 7.5	26.9	48.5	25.1	29.6	10	26	1.88	----	7	62.9	18.8	2	------
April	44.0	56.9	31.1	39.5	45.9	81.8	8.7	25.8	42.7	35.7	37.9	5	16	3.62	19.0	7	65.4	30.0	9	2
May	57.0	71.1	42.8	54.0	59.3	82.9	31.1	28.2	42.4	48.0	50.3	0	1	7.47	---	11	62.6	42.8	2	10
June	63.3	78.3	48.3	60.1	66.5	94.4	38.2	30.0	43.4	53.9	56.6	0	0	2.35	----	8	64.0	49.8	------	5
July	72.5	90.1	54.9	68.3	74.0	96.7	47.9	35.2	44.5	61.6	62.0	0	0	0.71	----	3	62.6	56.7	------	10
August	69.0	85.0	52.9	64.2	68.3	96.7	43.6	32.1	49.0	58.1	59.6	0	0	0.72	----	12	67.7	54.6	------	19
September	59.1	75.4	42.7	50.6	58.3	86.6	29.4	32.7	54.1	46.3	48.5	0	6	2.10	----	3	64.1	40.5	9	12
October	49.7	66.6	32.9	39.0	46.8	82.0	25.0	33.7	49.3	35.5	39.9	0	16	0.36	----	2	66.7	31.6	8	------
November	40.0	56.8	23.1	27.7	36.5	69.6	12.0	33.4	49.9	24.6	30.4	2	26	0.02	T	1	64.9	20.4	4	------
December	27.7	40.4	15.1	20.2	28.0	64.6	—31.0	25.2	46.8	17.9	24.5	18	30	1.37	15.5	8	76.4	16.5	14	------
Average	47.4	62.6	32.3	40.3	47.6	96.7	—31.0	30.3	54.1	36.1	40.2	71	178	21.17	----	72	66.9	32.1	71	58
Normal	46.6	62.2	31.8	39.5	46.8	----	------	30.2	----	35.1	39.1	76.4	174 2	14.48	----	71.3	65.2	30.4	------	------

TABLE XXVI.

SUMMARY FOR ARKANSAS VALLEY SUBSTATION, ROCKY FORD, COLORADO. H. H. GRIFFIN, Observer.
Latitude, 39° 3′. Longitude, 103° 45′. Elevation, 4 160 Feet.

FOR 1901.

MONTH	TEMPERATURE (In Degrees Fahrenheit)											No. Days		Precipitation (Inches)	Snowfall (Inches)	No. of Stormy Days	Relative Humidity, Mean	Dew Point, Mean	No. Days Frost or Dew Was Observed	
	Mean (½ Max. + ½ Min.)	Average Maximum	Average Minimum	7 A. M.	7 P. M.	Absolute Maximum	Absolute Minimum	Mean Range	Greatest Range	Wet Bulb 7 A. M.	Wet Bulb 7 P. M.	Av. Temperature Below 32°	Minimum Below 32°						Frost	Dew
January	31.1	50.3	11.9	16.1	30 3	70	--22	38.4	56	12.8	24.8	11	31	0.20	2.5	1	65.3	11.0	1	.....
February	28.6	44.0	13.2	17.1	29.5	69	— 5	30.9	49	16.0	25.6	16	28	0.10	0.5	1	74.0	15.6	4	.....
March	40.8	57.3	24.4	30.0	41.9	83	10	32.9	59	26.7	33.6	2	26	1.00	9.0	3	58.7	20.8	....	.....
April	51.8	67.8	35.8	43.2	53.4	86	16	32.0	50	38.3	43.6	0	10	2.36	1.0	6	59.5	32.5	....	.....
May	61.4	75.8	46.9	55.6	62.3	88	37	28.8	46	50.2	52.2	0	0	1.34	....	7	62.1	44.4	....	.....
June	71.8	89.7	54.0	*61.2	*70.0	105	43	35.7	46	*54.6	*56.0	0	0	0.23	....	2	*56.4	*47 7	....	.....
July	79.4	97.0	61.8	71.5	79.2	103	57	35.2	44	62.8	64.2	0	0	1.48	....	2	54.7	57.1	....	.....
August	75.2	91.7	58.7	66.8	74.6	100	53	32.9	41	61.7	63.6	0	0	0.74	....	7	67.3	58.4	....	.....
September	65.7	83.5	47.8	55.9	67.5	93	33	35.7	53	50.2	54.8	0	0	0.48	....	2	58.1	45.2	....	.....
October	55.4	73.3	37.6	44.3	55.8	84	28	35.8	50	44.3	55.8	0	3	0.25	....	2	69.1	35.7	....	.....
November	44.1	63.3	24.9	30.8	44.1	76	15	38.4	55	26.9	36.1	0	23	0	....	0	57.3	22.3	....	.....
December	30.0	46.5	13.5	17.6	29.8	75	--16	32.9	54	15.8	25.9	13	31	0.50	3.0	5	74.3	15.6	....	.....
Average	52.9	70.0	35.9	42.5	53.2	105	--22	34.1	59	38.4	44.7	42	152	8.68	16.0	38	62.3	33.8	....	.....
Mean	51.7	68.6	35.2	42.8	52.6	....	....	33.3	....	38.7	45.0	....	....	13.47	....	39.3	66.5	36.3	....	.....

*Record 19 days.

TABLE XXVII.

SUMMARY FOR PLAINS SUBSTATION, CHEYENNE WELLS, COLORADO. J. E. PAYNE, Observer.
Latitude, 38° 50′. Longitude, 102° 20′. Elevation, 4,278 Feet.

FOR 1901.

MONTH	TEMPERATURE (In Degrees Fahrenheit)												No. Days		Precipitation (Inches)	Snowfall (Inches)	No. of Stormy Days	Relative Humidity, Mean	Dew Point, Mean	No. Days Frost or Dew Was Observed		Average Cloudiness	Prevailing Direction of Wind
	Mean (½ Max. and ½ Min.)	Average Maximum	Average Minimum	7 A. M.	7 P. M.	Absolute Maximum	Absolute Minimum	Mean Range	Greatest Range	Wet Bulb 7 A. M.	Wet Bulb 7 P. M.	Av. Temperature Below 32°	Minimum Below 32°						Frost	Dew		
January	30.2	44.7	15.7	21.3	25.9	64	−17	28.9	43	18.6	21.9	15	31	0.15	1.0	1	67.4	12.8	----	----	3.1	W
February	24.7	37.0	12.4	17.6	22.4	63	−14	24.6	38	17.0	20.8	18	27	0.38	3.0	5	88.2	16.7	----	----	4.5	NW
March	36.0	50.0	21.9	30.0	35.2	79	3	28.1	55	26.8	30.4	11	30	0.71	4¾	6	70.6	21.9	5	----	4.7	NW
April	47.8	62.5	33.2	43.4	48.1	83	9	29.3	47	39.2	41.5	2	12	4.02	2.5	5	70.1	34.5	----	----	5.0	ESE
May	58.7	72.9	44.4	57.4	59.0	84	30	28.5	40	50.2	50.7	0	1	1.18	----	4	61.5	43.7	2	5	4.6	SE
June	71.6	89.2	54.2	68.5	77.3	103	38	34.7	43	58.0	58.6	0	0	0.90	----	3	49.0	49.3	----	2	3.4	SSE
July	78.9	95.7	62.2	73.3	81.6	103	58	33.5	42	62.2	63.0	0	0	2.63	----	4	48.5	53.9	----	----	3.2	SSW
August	74.3	89.3	59.4	67.7	74.3	109	54	29.8	49	62.7	66.1	0	0	2.59	----	6	72.9	61.2	----	10	----	SW
September	64.0	79.1	48.8	56.3	64.3	90	30	30.3	45	52.3	57.6	0	1	1.12	----	4	74.0	51.3	2	3	3.0	ESE
October	54.0	69.7	38.2	----	----	83	26	31.4	45	----	----	0	1	0.49	----	2	----	----	----	4	----	S
November	43.4	59.5	27.2	----	----	76	16	32 3	48	----	----	1	23	0.02	----	1	----	----	19	4	----	SW
December	29.5	43.6	29.5	----	----	72	−21	28.2	53	----	----	16	30	0.25	4.5	2	----	----	7	----	----	NNW
Average	51.1	66.1	37.3	----	----	109	−21	30.0	55	----	----	62	156	14.44	15¾	43	----	----	33	28	----	----
Normal	50.5	65.0	35.5	44.7	49.2	----	----	29.8	----	39.6	41.8	----	----	15.89	----	43.3	67.3	34.6	----	----	----	----

TABLE XXVIII.

SUMMARY AT CARLYLE LAMB'S, AT THE BASE OF LONG'S PEAK, ESTES PARK P. O., COLORADO.
Elevation, 9,000 feet, Approx.

FOR 1901.

MONTH	TEMPERATURE							No. of Days		Precipitation (Inches)	Snowfall (Inches)	No. of Stormy Days
	Mean (½ Max. and ½ Min.)	Average Maximum	Average Minimum	Absolute Maximum	Absolute Minimum	Mean Range	Greatest Range	Average Below 32°	Minimum Below 32°			
January	23.4	34.4	12.4	48	—20	22.0	39	26	31	0.69	11.0	7
February	21.0	31.8	10.2	45	—13	21.6	43	23	28	0.40	5.0	6
March	23.9	33.6	14.2	48	— 6	19.4	38	24	29	1.00	18.0	8
April	32.0	43.3	20.8	63	— 8	22.5	39	14	26	1.80	27.0	8
May	43.9	55.3	32.5	67	24	22.8	32	0	10	1.73	3.0	10
June	51.1	64.3	37.9	79	29	26.3	38	0	1	1.47	.....	5
July	58.5	74.3	42.7	82	35	31.6	42	0	0	0.85	.....	5
August	55.8	69.3	42.3	80	37	27.0	39	0	0	2.22	.....	15
September	47.4	61.9	32.9	70	19	29.0	42	0	12	1.59	.....	3
October	41.4	54.6	28.2	67	21	26.4	....	....	....	0.95	.....	3
November	35.1	46.8	22.7	59	6	23.5	43	7	28	0.18	3.0	2
December	23.6	33.6	13.5	51	—14	20.1	34	23	30	0.91	17.0	6
Average	38.1	50.3	25.9	82	—20	24.4	....	....	....	13.79	84.0	78
Normal	37.7	49.8	25.6	....	.....	24.1	....	....	....	17.02	.....	67.8

TABLE XXIX.

SUMMARY AT GLENEYRE P. O., NEAR HEAD OF LARAMIE RIVER. MRS. F. W. SHERWOOD, Observer.
Elevation, 8,000 Feet.

FOR 1901.

MONTH	TEMPERATURE										No. of Days		Precipitation (Inches)	Snowfall (Inches)	No. of Stormy Days
	7 A. M.	2 P. M.	9 P. M.	Mean (½ Max. + ½ Min.)	Average Maximum	Average Minimum	Absolute Maximum	Absolute Minimum	Mean Range	Greatest Range	Av. Temperature Below 32°	Minimum Below 32°			
January	18.4	32.1	19.9	22.8	33.4	12.2	49	—14	21.2	39	26	31	0.40	4.	2
February	14.1	33.1	16.1	20.6	34.4	6.9	49	—19	27.5	51	26	28	0.70	7.	3
March	17.2	34.6	18.7	23.7	36.7	10.7	54	— 8	25.9	47	25	31	1.35	13.5	6
April	37.0	46.7	28.3	34.3	50.8	17.7	80	— 8	33.1	54	14	26	3.70	37.0	8
May	43.2	60.2	40.6	48.1	64.5	31.8	76	21	32.7	43	0	14	2.60	19.0	8
June	49.5	69.6	45.6	54.2	72.4	36.0	90	26	36.4	52	0	4	1.10	6	5
July	59.6	82.5	55.3	64.5	85.0	43.9	95	29	41.2	58	0	1	T	.....	0
August	54.9	77.2	51.4	60.6	78.5	42.8	93	36	35.7	57	0	0	0.60	.....	6
September	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
October	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
November	29.2	47.7	27.4	33.6	47.9	19.4	60	7	28.5	44	13	30	0.20	2	1
December	17.8	30.5	18.0	20.6	31.4	9.8	49	—27	21.5	44	29	31	1.90	19	7
Average	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Normal	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....

TABLE XXX.

SUMMARY AT MR. GEO. A. BARNES', PINKHAMPTON, NORTH PARK, COLORADO.
Elevation, 8,400 Feet.
FOR 1901.

MONTH	TEMPERATURE								No. of Days		Precipitation (Inches)	Snowfall (Inches)	No. of Stormy Days
	Mean	7 A. M.	12 M.	7 P. M.	Highest	Lowest	Mean Range	Greatest Range	Av. Temperature Below 32°	Minimum Below 32°			
January	23.0	11.9	33.8	.....	50	—16	21.7	48	23	29	.....	5.5	3
February	24.5	12.3	36.7	.....	56	—21	24.4	48	18	25	.....	16.5	11
March	29.7	16.6	42.2	.....	64	— 4	25.6	60	18	29	.....	32.5	9
April	40.4	25.8	55.1	.....	76	— 7	29.3	60	5	19	.....	32.5	5
May	53 1	38.5	67.6	.....	84	22	29.2	44	0	3	1.07	.....	12
June	58.4	43.7	73.1	.....	98	32	29.4	54	0	0	1.05	.....	7
July	70.5	49.4	90.7	.....	100	36	41.3	56	0	0	0.20	.....	4
August	63.3	48.3	78.3	.....	98	39	30.0	54	0	0	2.58	.....	15
September	51.0	34.3	67.7	.....	82	22	3.3	50	0	11	0.17	.....	2
October	44.1	29.0	59.2	.....	74	22	0.2	48	1	20	1.07	.....	5
November	34.3	22.8	45.9	.....	60	10	23.1	42	9	24	.....	6.0	4
December	22.8	14.3	31.3	.....	46	— 13	17.0	50	24	27	.....	21.0	12
Average	42.9	28.9	56.8	.....	100	—21	27.9	60	98	187	.....	.....	89
Normal	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....

TABLE XXXI.

WEEKLY MEANS OF SOIL TEMPERATURES, SET A, IN AN IRRIGATED PLAT NEAR THE COLLEGE BUILDING. (In Degrees Fahrenheit.)

FOR 1901.

WEEK ENDING	DEPTH					
	3 In.	6 In.	1 Ft.	2 Ft.	3 Ft.	6 Ft.
January 5	24.7	27.7	30.4	36.2	40.7	
January 12	28.9	30.1	31.7	35.4	39.1	
January 19	31.3	32.5	33.4	35.7	38.9	
January 26	31.4	32.5	33.5	36.0	38.9	
February 2	29.0	30.9	32.6	35.9	38.7	
February 9	25.6	27.5	29.8	34.2	37.6	
February 16	26.8	27.9	29.2	32.7	36.3	
February 23	31.8	32.5	33.0	34.6	36.8	
March 2	35.4	35.5	35.6	36.0	37.8	
March 9	36.1	36.7	37.4	38.1	39.5	
March 16	36.0	36.5	37.1	38.3	39.8	
March 23	37.4	37.8	38.4	39.1	40.5	
March 30	37.0	37.9	38.9	39.9	41.2	
April 6	37.2	37.7	38.3	39 5	41.0	
April 13	38.2	39.8	39.3	40.3	41.8	
April 20	40.0	39.9	39 4	39.6	41.1	
April 27	49.1	48.5	47.3	44.4	43.8	
May 4	53.2	52.8	51.8	49.2	47.7	
May 11	53.9	53.7	53.1	51.3	50.1	
May 18	58.6	57.8	56.7	53.9	52.3	
May 25	58.8	58.9	58.6	56.7	55.0	
June 1	61.1	60.6	59.8	57.5	56.0	
June 8	61.4	61.3	60.8	58.7	57.3	
June 15	63.3	63.2	62.9	60.5	58.7	
June 22	65.9	65.0	63.7	60.9	59.4	
June 29	71.1	70.0	68.5	64.6	61.9	
July 6	71.2	70.6	69.3	66.3	63.9	

TABLE XXXI—Concluded.

WEEKLY MEANS OF SOIL TEMPERATURES, SET A, IN AN IRRIGATED PLAT NEAR THE COLLEGE BUILDING. (In Degrees Fahrenheit.)

FOR 1901.

WEEK ENDING	DEPTH					
	3 In.	6 In.	1 Ft.	2 Ft.	3 Ft.	6 Ft.
July 13	71.9	71.8	70.8	67.7	65.4	----
July 20	72.8	72.6	71.9	69.1	66.8	----
July 27	73.1	73.1	72.6	70.2	68.1	----
August 3	72.6	72.6	72.1	69.9	68.3	----
August 10	69.6	70.1	70.1	69.1	68.2	----
August 17	69.8	70.1	69.9	68.5	67.6	----
August 24	68.3	68.9	68.9	68.1	67.5	----
August 31	68.5	68.8	68.7	67.6	66.9	----
September 7	66.8	67.6	67.8	67.3	66.9	----
September 14	63.2	64.3	65.1	65.6	65.9	----
September 21	57.7	59.2	60.7	62.7	63.9	----
September 28	57.4	58.8	59.8	61.2	62.3	----
October 5	55.7	57.1	58.2	59.8	61.1	----
October 12	53.1	54.8	56.2	58.2	59.8	----
October 19	50.0	51.7	53.1	55.9	57.8	----
October 26	49.5	50.9	52.1	54.4	56.3	----
November 2	49.1	50.6	51.9	53.8	55.6	----
November 9	44.3	46.9	48.6	51.8	54.0	----
November 16	42.4	44.3	46.0	49.4	52.1	----
November 23	41.1	42.7	44.3	48.0	50.2	----
November 30	40.6	42.0	43.2	46.1	48.8	----
December 7	39.1	40.7	41.9	45.5	47.7	----
December 14	34.4	36.2	38.3	43.0	46.0	----
December 21	31.9	33.6	35.4	40.6	43.8	----
December 28	32.9	34.1	35.5	39.8	42.6	----
Average	49.42	50.18	50.64	51.32	52.10	----

TABLE XXXII.

WEEKLY READINGS (NOT AVERAGES) OF SOIL THERMOMETERS, SET C, ON UNIRRIGATED GROUND.

FOR 1901.

DATE	DEPTH			
	6 In.	1 Ft.	2 Ft.	3 Ft.
January 3	25.7	28.3	34.8	38.0
January 10	28.2	30.0	33.8	35.3
January 17	30.0	31.0	34.0	35.9
January 24	30.1	30.8	33.8	34.2
January 31	28.7	29.9	33.6	35.6
February 7	27.2	28.2	32.3	34.1
February 14	25.2	26.1	35.5	34.3
March 14	36.1	35.1	36.1	36.8
March 21	37.8	36.0	37.3	37.4
March 28	37.1	37.2	38.2	38.3
April 4	37.7	37.2	37.5	37.9
April 11	36.7	36.9	38.8	38.8
April 18	36.9	35.6	37.3	38.1
April 25	49.4	46.5	43.5	41.2
May 2	55.2	52.0	48.0	45.2
May 9	54.7	52.1	50.0	47.8
May 16	57.9	54.7	52.4	50.2
May 22	54.5	55.4	55.9	53.0
May 31	59.8	58.8	56.7	53.8
June 7	61.2	59.2	57.4	55.1
June 13	63.2	60.5	58.7	56.1
June 20	64.9	61.7	59.2	56.6
June 27	67.6	65.1	62.3	59.1

TABLE XXXII—Concluded.

WEEKLY READINGS (NOT AVERAGES) OF SOIL THERMOMETERS, SET C, ON UNIRRIGATED GROUND.

FOR 1901.

DATE	DEPTH			
	6 In.	1 Ft.	2 Ft.	3 Ft.
July 7	69.1	66.8	64.2	61.2
July 11	70.1	67.3	64.6	61.8
July 18	70.4	68.2	66.1	63.1
July 24	73.2	70.5	67.3	64.0
August 8	69.9	68.3	67.2	65.0
August 14	70.3	68.2	66.8	64.8
August 22	68.7	67.1	66.4	64.8
September 7	65.6	65.1	65.2	63.9
September 13	62.9	62.6	63.9	63.3
September 25	58.5	58.3	60.2	60.3
October 3	57.1	56.7	58.6	58.7
October 17	50.8		53.8	55.0
October 24	50.7	50.1	52.3	53.3
October 31	49.8	49.8	51.8	52.8
November 7	45.7	46.3	48.9	51.2
November 15	40.0	42.6	46.8	49.1
November 22	39.7	40.9	44.7	47.0
November 27	39.8	40.6	43.9	46.0
December 6	39.3	39.0	42.5	44.5
December 13	33.8	36.5	40.3	42.9
December 19	33.7	35.6	38.8	41.6
December 27	33.7	34.7	38.0	40.3
Average	48.86	48.26	51.54	49.05

This set of thermometers is placed on a knoll near the farm barn, unirrigated.

The evaporation is measured in a tank three feet cube placed flush with the ground. The readings of the height of the surface of the water are made by means of a hook gage, which permits the measurements to be taken to the one-thousandth part of a foot. From April to September readings are taken twice per day, at 7 a. m. and 7 p. m. From September until the formation of ice, late in November, the readings are taken at 7 a. m only. In the winter season, after ice forms, readings are taken monthly. The ice is broken until it is free from the sides of the tank, then the level of the water surface is measured. Sometimes ice forms to a considerable thickness, and the separation of the ice from the sides of the tank has led to punctures of the sides.

A set of maximum and minimum thermometers are kept at the surface of the water during the summer season. An anemometer located near the tank records the wind movement. The average temperature of the tank is less than that of water freely exposed to the air during the summer season, so that the evaporation is less than that from lakes under ordinary conditions.

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