REPORT

—OF THE—

STATE BOARD OF AGRICULTURE

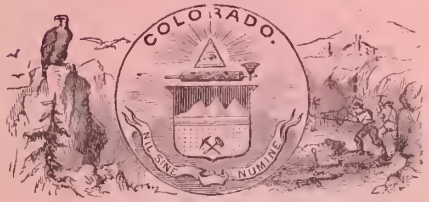
—AND—

STATE AGRICULTURAL COLLEGE

—OF THE—

STATE OF COLORADO.

1881-1882.



DENVER, COLO.:
TIMES—PUBLIC PRINTER.
1883.

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MEMBERS STATE BOARD AGRICULTURE.

Hon. B. S. LaGrange,	Greeley	Term expires		1883.
Hon. W. F. Watrous,	Ft. Collins	"	"	1883.
Hon. R. A. Southworth,	Denver	"	"	1885.
Hon. P. M. Hinman,	Ft. Collins	"	"	1885.
Hon. Orzo Bracket,	Castle Rock	"	"	1887.
Hon. David Boyd,	Greeley	"	"	1887.
Hon. Henry Foote,	Del Norte	"	"	1884.
Hon. John J. Ryan,	Loveland	"	"	1884.

His Excellency, F. W. Pitkin, Governor of State.

C. L. Ingersoll, President of College, member *ex officio*.

STATE AGRICULTURAL COLLEGE,
FORT COLLINS, Dec. 18, 1882.

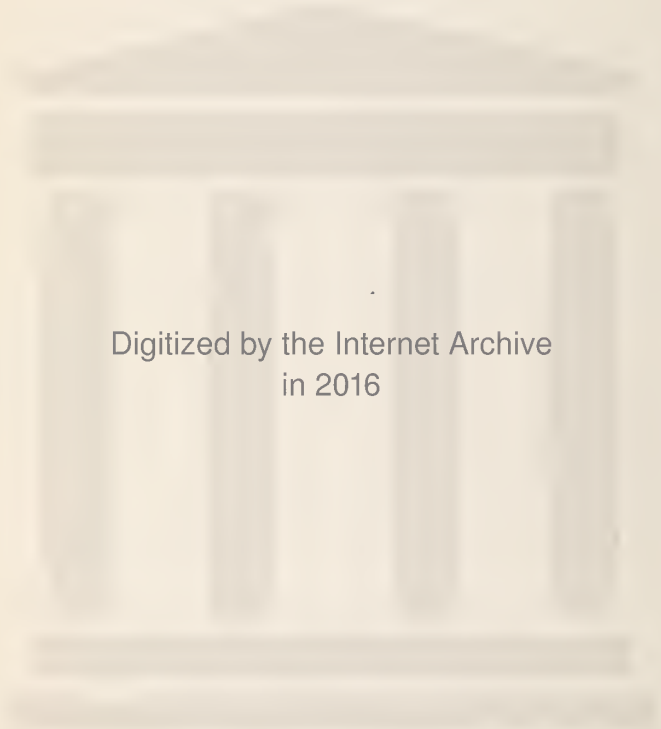
To His Excellency, FREDERICK W. PITKIN, Governor of Colorado:

I have the honor to submit herewith, as required by statute, the accompanying Biennial Report, with supplementary papers.

Respectfully yours,

P. M. HINMAN,

Secretary Colorado State Board of Agriculture.



FINANCIAL STATEMENT.

FOR THE YEAR 1881.

Commencing February 23d, 1881, ending December 14th, 1881.

Orders drawn on Fiscal Agent, on account of cash on hand	$ 309 85	
Certificates of Indebtedness drawn on State Treasurer, special appropriation fund	5,000 00	
General tax fund	14,135 23	
Total amount expended		$19,445 08
Paid to following accounts:		
Expense account	$ 522 00	
State Board of Agriculture	1,272 40	
Salary account	4,597 00	
Floral department	53 30	
Students' labor	305 59	
Secretary's office	182 02	
Chemical department	448 52	
Dormitory	6,149 55	
Apiary account	27 25	
Bills payable	3,612 00	
College Farm	2,266 95	
Mechanical department	8 50	
		$19,445 08

STATEMENT FOR THE YEAR 1882.

Commencing December 15th, 1881, ending December 12th, 1882.

Certificates of Indebtedness drawn on State Treasurer		$16,947 19
Paid to following accounts:		
State Board of Agriculture	$1,073 70	
Salary account	7,541 82	
Floral department	79 53	
Cistern (Dormitory)	171 85	
College barn (new building)	1,708 90	
Students' labor	395 52	
Secretary's office	74 44	
Chemical department	245 54	
Dormitory	485 48	
College Farm	1,418 12	
Expense account	1,100 07	
Experimental department	112 65	

Apiary account	17 04	
Mechanical department	786 10	
Library	73 50	
Tool account	70 18	
Meteorological department	35 55	
Stock (horse)	125 00	
Horticultural department	1,118 35	
Department Natural Science	98 75	
Mathematical department	135 00	
Labor not included above	80 00	
Total		$16,947 19

CASH RECEIPTS AND DISBURSEMENTS.

For the years 1881, 1882, commencing Feb. 23d, 1881, ending Dec. 12, 1882.

	Cr.	
College farm	$ 655 79	
Horticultural department	76 55	
Incidental fees	236 00	
Matriculation fees	375 00	
Room rent (Dormitory)	70 00	
		$1,413 34

	Dr.	
Pard State Treasurer	$1,289 85	
" Library account	42 69	
Cash on hand to balance	80 80	
		$1,413 34

Of the items above enumerated, the following amounts have been expended in permanent improvements:

The last Legislature voted an appropriation of $5,000 for the building of a dormitory. A building for this purpose, appropriate in design and construction, was completed in the month of September, 1881, at a total cost of $6,796.88. This building is now complete, and occupied for the purposes for which it was constructed.

It was also discovered that, owing to the altitude of the farm, a flume was required for its irrigation. Such a flume was constructed, its length being seven hundred and fifty feet, at a cost of $1,000. A ditch leading thereto was also constructed, at a further cost of $300.

Fencing of the farm formed the last item of permanent improvements for the year 1881, and cost an additional sum of $200.

During the year 1882, the following additions have been made toward the permanent enlargement of the needs and facilities of the institution:

A building, temporarily occupied as a barn, was built at a cost of $1,708.90; a small building used in the care and propagation of plants, $300; and, in connection therewith, the grading and improvement of grounds, costing $700 more.

From this brief statement it will be seen that of the amounts expended for the years 1881 and 1882, $11,005.70 was expended in the way of permanent improvements, and for purposes for which no further immediate provisions are required.

The salaries form an inconsiderable item in our expense account, and are as follows:

President Ingersoll	$2,500
Professor Blount	1,600
" Davis	1,200
" Williams	1,000
Mrs. Blount (in charge of the Horticultural Department)	200
Matron (in charge of the dormitory)	400
Farm Manager	1,000
Secretary	200

For your information I have the honor to submit the following

INVENTORY.

Floral department	109 80
Furniture and fixtures in college buildings	2,646 35
Horticultural department	2,514 05
Mechanical department	507 18
Buildings and improvements	28,960 00
Farm (240 acres)	12,000 00
Tools, crops and stock on hand	3,264 17
Total	$50,571 12

These estimates are undoubtedly conservative, and I point to the fact that the above assets have been acquired at a total cost to the State of $47,177.60.

In view of the fact that as yet the institution has no landed or other funds devoted to its maintenance, it is recommended that the one-fifth of one mill tax be continued, until such time as it shall have become self-sustaining from other resources now reasonably held in expectancy. A grant of 90,000 acres has been made by the Government of the United States, of the land of the public domain. This, it is hoped, will be selected and formally dedicated

to the institution within the present year, so that we may reasonably hope to find the institution shortly independent of the bounty of the State, by reason of the above mentioned appropriation and resulting sales.

It gives me great pleasure to note the material growth and enhancement of our agricultural interests, for the furtherance of which the Agricultural College was called into being, and for which it now exists and should be maintained. I am indebted to the "Colorado Farmer" and "Denver Republican" for much of the following data, bearing upon the agricultural and live-stock interests of the State. The former took great pains to arrive at the exact figures of our live-stock interests, and has the following to say in regard thereto:

CATTLE.

"We find the returns for 1871 of cattle were 145,916. These grew in numbers so that in 1875 we find the cattle returned at 299,515, an increase in five years of over 100 per cent. In 1878 the herds had increased to 493,279, and in 1879 to 523,585, or an increase for the last five years of nearly 80 per cent. In 1880 the number had grown to 541,563, and in 1881 they decreased to 411,970. It is to be remembered that this year was the most disastrous to the stock interests of Colorado of any in the history of the State. For nearly a year and a half previous to the assessment of 1881 there had been but little rain, only seven inches in 1880, or less than half the annual rainfall, and to add to the calamity of short grass and scarcity of water, snow fell early in the winter of 1880 and lay in hard crusts all over the range. That so many cattle were left to be returned to the assessor in the spring of 1881 has been the wonder of all who were observers of the facts I have recited. In 1882 the herds had increased a trifle, or to the number of 423,948. or the conscience of owners only permitted the return of an increase of about one-tenth of the number driven into the State in excess of the number of beeves sold.

"To believe that 423,948 cattle are one-half of those in the State is a stretch of credulity that we will not ask of

our readers, but again we wish to say the return is just as honest as that made by other classes of business men who can hide their property. The value for cattle in 1881 was $4,611,359, and for '82, $5,435,616, or about 20 per cent. gain. In 1882 there has been quite a large number of cattle shipped out of the State, and not so many brought in as were in 1881.

"We have tried hard to obtain the exact number of cattle bought by Colorado cattle men, but we have failed; for some reason or other the buyers will not impart the information. To obtain information as to the number of cattle shipped out of the State is an easier matter, and we find that the Burlington and Colorado railway has shipped about 50,000 head, the Union Pacific, over both roads, something less than 27,000, and the Atchison, Topeka & Santa Fe less than 20,000 head. A number of Colorado cattle were shipped from points without the State, and it is safe to assume we sold out of the State 110,000 head of beef cattle.

"To sum up the cattle business of the State, we can say it never looked more encouraging. The range, when properly occupied, will support two million cattle and five million sheep. To properly utilize our plains, pre-emption and homestead laws must be changed so far as the purely grazing grounds are concerned. We think there are now in the State fully three-quarters of a million cattle; the quality of the cattle has improved very much in the past five years, and will continue to improve, for the rule is now to use none but good bulls. The price of beef promises to be maintained for some years, at least, and it is safe to say that no business promises better returns for money invested than does that of cattle breeding on the plains of Colorado.

"To supply our own population, permanent and transient, has required an amount in beef and in veal equal to 65,000 head. It is safe to assume that the 175,000 beeves slipped and eaten at home averaged 900 pounds apiece, making a total of 157,500,000 pounds of beef. We find by a reference to the table of average prices of beef in our markets (see table on another page) for the past year was $4.20 per cwt., and that this beef sold was worth to the people of the State the large sum of $6,615,000. Can our

readers imagine what vast wealth these figures indicate? Yet the gathering of this, which is almost clear profit, has been accomplished without one tenth part of the fuss and trumpeting of newspapers that accompanied the strike of the Robinson mine. It is about "played out." The cattle business will go on forever.

SHEEP.

Any attempt to arrive at the exact number of sheep is attended with the same difficulties—the shifting, migratory state of the business, and the failure to properly account to the assessors. It would be far within the limits to say that on the plains of Colorado roam a full million of sheep, worth at least three million dollars. The annual clip was about five million pounds, the average price for wool having been nineteen cents. This would make our wool crop for the year 1882 worth nearly one million dollars.

SWINE.

It is a great matter of regret that hogs are not more largely engaged in, as the soil of Colorado is admirably adapted to the growth of field peas and feed barley. The "Farmer" estimates that Colorado used, in the year 1882, two million dollars worth of the product of the hog, of which Colorado raised less than one-twentieth. In 1882 there were returned only 4,507, a falling off of nearly one hundred per cent. over the returns of 1879.

HORSES AND MULES.

It is an acknowledged fact that in no business are the returns greater than in the raising of horses on the plains of Colorado. The "Farmer" estimates that "the money returns from a dozen brood mares, properly handled, will be as great as that from sixty cows, running on the range." The assessor's returns show the following:

	Horses.	Mules.
For 1879	60,460	5,240
" 1880	69,274	5,997
" 1881	70,133	6,361
" 1882	74,393	6,994

The total valuation of horses for 1882 was $3,138,463; of mules, $481,727, being an average of $44.50—certainly a very low valuation.

In this connection I submit the following table, showing the average price of the products of agriculture and live-stock, together with the estimated amount and value of crops for the year 1882:

GENERAL AVERAGE FOR THE YEAR 1882.

Beeves,	per cwt.	$4	20	Eggs,	per doz.	$	29½
Sheep,	" head	3	30	Chickens,	" "	4	70
Hogs,	" cwt.	7	58	Turkeys,	" lb.		14¼
Beef,	" "	8	75	Butter,	" "		32
Mutton,	" "	7	35	Cheese,	" "		15¼
Pork,	" "	10	92	Onions,	" cwt.	3	03
Veal,	" "	9	78	Beets,	" "	1	99
Wool,	" "	19	00	Potatoes,	" "	1	72
Flour,	" "	3	30	Cabbage,	" "	2	25
Barley,	" "	2	24	Turnips,	" "	1	98
Oats,	" "	2	07	Hay loose,	" ton	16	42
Wheat,	" "	1	94	Hay baled,	" "	19	17
Corn,	" "	2	01	Alfalfa,	" "	15	06
Bran,	" "	1	20	Straw,	" "	9	66

ESTIMATED AMOUNT AND VALUE OF CROPS OF 1882.

Wheat	1,460,000	bushels;	Value	$1,168,000
Oats	748,000	"	"	523,000
Corn	328,000	"	"	295,500
Barley	146,000	"	"	182,500
Potatoes	755,000	"	"	528,500
Hay	250,000	tons;	"	2,000,000
Vegetables	30,000	acres;	"	3,000.000
Fruits	2,500	"	"	1,250,000
			Total Valuation,	$8,947,500

It is estimated that the dairymen and farmers of the State make annually about 700,000 pounds of butter, receiving an average of forty cents a pound for the commodity. It is further estimated that our State requirements are about five times greater than the home product. With the fine grasses and climate of Colorado, there is no apparent reason

why we should not be wholly supplied at home. Certainly no region is calculated to produce a finer quality, nor does any market offer better compensation.

Thus much for our live-stock interests—interests so akin and identified with agriculture, as to make their recital of especial interest in this report.

The five great grain-producing counties of the State, Weld, Boulder, Larimer, Jefferson and Arapahoe, in 1881, were enabled to make the following showing of their products:

WELD COUNTY.

Wheat	185,000	bushels,	$222,000
Oats	40,000	bushels,	26,000
Barley	12,000	bushels,	13,000
Corn	20,000	bushels,	15,000
Potatoes	50,000	bushels,	75,000
Hay	5,000	tons,	100,000
Vegetables and fruits			200,000
Total			$651,000

BOULDER.

Wheat	370,000	bushels,	$445,000
Oats	4,000	bushels,	3,000
Barley	6,000	bushels,	6,500
Corn	15,000	bushels,	11,250
Hay	4,000	tons,	75,000
Potatoes	25,000	bushels,	37,500
Vegetables and fruits			100,000
Total			$678,250

LARIMER.

Wheat	200,000	bushels,	$240,000
Oats	80,000	bushels,	52,000
Barley	10,000	bushels,	12,000
Corn	10,000	bushels,	15,000
Potatoes	25,000	bushels,	35,000
Hay	8,000	tons,	120,000
Vegetables and fruits			100,000
Total			$574,000

JEFFERSON.

Wheat	150,000 bushels,	$187,500
Barley	2,000 bushels,	2,000
Corn	3,000 bushels,	2,000
Oats	50,000 bushels,	35,000
Potatoes	75,000 bushels,	85,000
Hay	8,000 tons,	160,000
Vegetables and fruits		450,000
Total		$922,500

ARAPAHOE.

Wheat	80,000 bushels,	$100,000
Oats	40,000 bushels,	30,000
Barley	20,000 bushels,	25,000
Corn	18,000 bushels,	16,000
Potatoes	50,000 bushels,	65,000
Hay	10,000 tons,	200,000
Vegetables and fruits		500,000
Total		$946,000
In all		$1,771,750

These counties, in 1882, show a marked increase in the cereals, and point to a very satisfactory increase in our agricultural interests. For the year 1882, I submit the following statement;

WELD COUNTY.

Wheat	244,000 bushels,	$195,000
Oats	82,000 bushels,	61,500
Barley	9,000 bushels,	10,750
Corn	85,000 bushels,	76,500
Potatoes	200,000 bushels,	150,000
Hay	45,000 tons,	360,000
Alfalfa	2,500 tons,	31,250

Of these we find the average per acre, for wheat, 18 bushels; for oats, 30 bushels; for corn, 15 bushels; for hay, 1½ tons.

BOULDER COUNTY.

WHEAT.—Acreage 18,835; yield 376,700 bushels; average per acre 20 bushels; value $301,360.

OATS.—Acreage 3,100; yield 93,100 bushels; average per acre 33 bushels; value $65,170.

BARLEY.—Acreage 4,000; yield 81,620 bushels; average per acre 21 bushels; value $100,000.

CORN.—Acreage 2,600; yield 46,800 bushels; average per acre 18 bushels; value $42,120.

HAY.—Acreage 6,000; yield 5,925 tons; average per acre about one ton; value $55,000.

ALFALFA.—Acreage 1,250; yield—250 acres cutting three tons, and 1,000 newly seeded cutting half a ton—1,250 tons; value $15,000.

Garden stuff, fruit, dairy products, poultry, eggs, etc., etc., $120,000; total nearly $800,000.

LARIMER.

WHEAT.—Acreage 30,000; yield 412,120 bushels; average per acre 14 bushels; value $330,000.

OATS.—Acreage 3,350; yield 86,300 bushels; average per acre 26 bushels; value $60,500.

BARLEY.—Acreage 390; yield 6,900 bushels; average per acre 18 bushels; value $8,750.

CORN.—Acreage 2,500; yield 50,000 bushels; average per acre 20 bushels; value $45,000.

POTATOES.—Acreage 1,000; yield 80,000 bushels; average per acre 80 bushels, value $60,000.

HAY.—Acreage 6,000; yield 6,000 tons; average per acre 1 ton; value $48,000.

ALFALFA.—Acreage 1,000; yield 4,000 tons; average per acre 4 tons: value $50,000.

JEFFERSON.

WHEAT.—Acreage 7,000; yield 126,000 bushels; average per acre 18 bushels; value $100,800.

OATS.—Acreage 1,200; yield 40,000 bushels; average per acre 33 bushels; value $28,000.

BARLEY.—Acreage 300; yield 7,200 bushels; average per acre 24 bushels; value $9,000.

CORN.—Acreage 250; yield 5,000 bushels; average per acre 20 bushels; value $4,500.

POTATOES.—Acreage 1,200; yield 120,000 bushels; average per acre 100 bushels; value $90,000.

HAY.—Acreage 10,000; yield 10,000 tons; average per acre 1 ton; value $120,000.

FRUITS AND VEGETABLES.—Estimated value $600,000.

REPORTS OF DEPARTMENTS

STATE AGRICULTURAL COLLEGE,

For the Years 1881 and 1882.

PROF. BLOUNT'S REPORT.

SHOWING THE PROGRESS IN HIS DEPARTMENTS AT THE AGRICULTURAL COLLEGE DURING THE PAST YEAR.

President, C. L. Ingersoll:

SIR—I have the honor of submitting the following as my annual report in in the

EXPERIMENTAL DEPARTMENT.

The two (2) acres of experimental grain, mentioned in my last report, have been harvested and threshed, but not weighed up. The 29 varieties of winter wheat put in last fall (October 27), made a fair crop, none of them producing less than two bushels (or 120 fold) from every pound of seed sown. Six (6) of these were sown on subsoiled land, and received no irrigation whatever. All the rest were irrigated twice. Three of the six were perfect in all respects, and are among the finest samples grown. The other three rusted, and are a little shrunken.

All the winter wheat ripened about ten days earlier than the spring varieties.

I have no hesitancy in recommending the cultivation of winter wheat, and think all farmers whose land can be

properly prepared should sow as much as possible. Nor do I hesitate to recommend subsoiling, especially in clay land, from the fact that the moisture, obtained from the snows of winter and the rains of spring, is held in sufficient quantity to prevent the growing crops from having a backset. It also does away, in such seasons as this, with one irrigation.

Of the 151 varieties of spring wheat, sown in March, all except five rusted on the blades. A few were so badly damaged by rust on the stalks that the yield is greatly diminished and the grain badly shrunken.

I sowed twelve kinds of oats in March. The seed came from New Zealand, Australia and some of the states. The white Australian is by far the finest and best. All of them did well, but will do better, I think, when acclimated.

I obtained eight kinds of barley from New Zealand, Manitoba, California and Mexico. All of them are remarkably fine, heavy and prolific. The Chevalier, from France, in particular is very superior.

I sowed eight kinds of sorghum, the seed of which came from Asia and the states. Six of them ripened nicely, and the other two produced nothing.

I planted potatoes, treating them in the hill with plaster, coal ashes, sulphur, sulphate of copper, and nothing. None of them turned out anything remarkable. Those treated with coal ashes did best.

Of the other seeds sown and crops harvested, none failed to make fair returns. Some difficulties have attended successful experimental work this season. Owing to repairs being made in the spring on ditch No. 2, water could not be obtained and applied at the time it was most needed. I have learned by experience that in order to obviate rust, the wheat crop must suffer no backset while growing. It must germinate early and receive moisture sufficient to keep growing from the first. No new growth should be encouraged under any circumstances. Another difficulty was the want of time during the summer term to give attention to the growing crops.

CLASS ROOM B.

Before the opening of the term the classes in Physical Geography, U. S. History and English Analysis were assigned to my room. Being absent and not ready for work in the school-room until Oct. 6, Prof. Ingersoll kindly heard the Physical Geography class, Prof. Davis the U. S. History, and Prof. Williams the Analysis for nearly five weeks—the time I was absent attending the Exposition and State Fair with the college exhibit of cereals.

The Physical Geography class of 21—8 ladies and 13 gentlemen—stands well up to grade except two. These two are making progress slowly and may pass.

The class in U. S. History of 21—7 ladies and 14 gentlemen—is making considerable progress with the exception of 3. One (Lindenmeier) has been dropped from the class on account of continued unexcused absence.

The Analysis class of 5 ladies and 11 gentlemen is doing good work with the exception of four.

In my opinion these delinquents are competent enough to prepare the lessons assigned but are deficient in application. I cannot yet recommend that they be finally dealt with, as their habits of study are improving slowly.

PROF. A. E. BLOUNT.

FT. COLLINS, DEC. 14th 1882.

PROFESSOR DAVIS' REPORT.

President Edwards:

When I entered upon the duties of my position a year ago, I was instructed that, as the institution was yet young, and the number of students not yet great enough to warrant the employment of a large number of instructors, I would be expected to take charge of the students in the various mathematical studies, as well as to organize and conduct a class in chemistry.

As the studies thus allotted me were admitted to be those of two altogether distinct departments in the college work, I report the work of the two departments separately.

CHEMISTRY.

Upon connecting myself with the college, I found that no room had been provided for use as a work room in chemical analysis; no apparatus had been procured and as yet, no class had been organized in chemistry. Finding that I would be unable to do any analytical work during at least the first year, I immediately ordered a bill of chemicals and apparatus to the value of $335.11 to be used for class illustration. To the material of this bill have been added from time to time, in the course of the year, other needed articles of laboratory furniture, a complete list of which is hereto appended. Believing that the elements of chemistry can be best taught by a course of lectures, carefully supplemented by experiments performed in the presence of the class, or, where practicable, by the class, I prepared a course of lectures to cover the field of elementary chemistry, including a thorough discussion of the nomenclature and system of classification now in use among chemists. A class consisting of thirteen students was organized. Four of these students left college before the term closed. Only five of the class presented themselves at the closing examination of the term and but one of these answered the required number of questions to entitle him to pass.

While I recognize that no study in this college should be taught as a specialty, I have, also, felt that all studies should be so taught, and the students required to be so familiar with the matter in hand, as to satisfy the instructor that he is sufficiently conservant with the matter in hand to promise the mastery of the next steps if allowed to proceed. I freely admit that, in coming to a new institution, I was disposed to set too high an estimate upon the mental development of the students with whom I was expected to deal; but, had not the class in chemistry, when first organized, been made the catch-all for those students who could not well be provided for in other classes, there would have been greater reason to hope for a successful issue of the new work.

One element which was conducive to fatal results in this first class in chemistry, was the persistency with which most of the members, none of whom had before taken a study by lecture, destroyed their notes taken from the daily lectures, though repeatedly told that the preservation of these notes was necessary to a successful review of the subject at the close of the term's work.

Owing to the change in the course of study and the rearrangement of the order of succession of the terms which go to make up the college year, it was thought advisable to repeat the lectures on Elementary Chemistry to a class to be organized for the second term. A class of ten students was organized. Of these ten, three left college before the close of the term; three from irregularity in attendance at class recitations, made so low a record as to render their cases hopeless, and their names were dropped from the class roll; the remaining four passed the examination. Thus we were ready to enter with a class of five students upon the second regular term of chemical work, which, according to schedule, was to be a course of practice in blow-pipe analysis with six weeks' lectures upon organic chemistry. Here arose the insurmountable difficulty, of having no room of any description in which tables for blow-pipe work could be constructed and used, and no money to defray the expense of constructing such tables, if a room could have been found available. This condition of the case being reported to the state board at their autumn session, they decided that the only thing that could be done was to drop chemistry from the course of study, until the necessary appliances could be procured. As a consequence I have taught a class in Lockyer's Astronomy in the place of chemistry, during the third year of my term of service.

The work of this class will be spoken of more at length in another place.

In conclusion I would say that the chemical department of the college, and myself as the curator, have received some sharp though unjust criticism because, in my reply to frequent requests that I perform analytical work, I have been obliged to say, "I am unable, with the time and material at my command, to do chemical work." While I perform cheerfully all work which, for the good of the

institution, I am asked to take upon my hands, I must respectfully submit, that until there is provided a place in which to work, material with which to work, and time for performing the work, it will be impossible to till, to any great extent, the field of chemical investigation.

MATHEMATICS.

In this department, during the term commencing April 18, 1881, I taught a class of two students in Peck's Arithmetic, in connection with the Introductory Department.

I was also given charge of a class of thirteen students in Olney's Complete Algebra. As the class had already completed the study to fractions, we took up the subject at that point, and continued the study through the literal arithmetic to algebra proper. Of the thirteen students, five left college before the close of the term; only three of the remaining eight passed the required examination.

During the term I also taught a class of seven students in Olney's Geometry, commencing at the first of the book. Two of the seven left college before the close of the term, because of sickness; two others left because of their parents needing them at home. Of the remaining three, but one became a candidate for examination, and he passed an examination which received the marking of 97 per cent. The two students who left this class because of work at home, came back and passed the examination in time to go forward with the work of the second term.

During the term commencing September 19, 1881, I taught a class of fifteen students in algebra. At my suggestion the Faculty adopted Olney's University Algebra to be used for the second and third terms, after one term devoted to the Complete Algebra. After a trial of two terms on this plan, I am free to admit that, for the students whom we are to expect for some years at this college, as well as for those we already have, this is too difficult a course in algebra. I would therefore respectfully recommend that the use of the University Algebra be, for the time, dropped, and that the entire three terms be given to the study of the Complete.

Of the class last referred to, a large proportion were those students who had failed to pass the examination of the previous term; the remaining members of the class were those who had passed the examination. All were thrown into the same class from the fact that, by commencing the University Algebra, we were to take a thorough review of those principles which the delinquents had failed to master; while at the same time enough new matter would be presented to make it worth the while of the remainder of the class to pursue the work. From this class six names were dropped before the close of the term. Six of the remaining nine passed the required examination.

A class of twenty-three students spent eight weeks in the study of Robinson's Higher Arithmetic. The remaining four weeks of the term were lost in awaiting the arrival of text books. Three of these students were dropped from the class before the close of the term. Of the remaining twenty, thirteen passed a satisfactory examination.

My time being fully occupied, Professor Blount relieved me of the class in geometry of this term.

During the third term of the year just closed, I have taught classes in algebra, arithmetic and astronomy.

The algebra class, consisting of seven members, has completed the subject through affected quadratics. They have all made good class records, the average of the term's record being 89.4 per cent. One of the students was called away by the sickness of her mother, the day before the examination; the remaining six members of the class passed the examinations, three of them getting a marking of 99 per cent. The average for the whole class was 90.8 per cent.

The arithmetic class has had in all thirty-two members. Of these, two were transferred to the lower class, and nine left college before the close of the term. All of the remaining twenty-one have made good class records. The average of the class markings of the term amounts to 84.6 per cent. The arithmetic has been completed to the subject of stock investments.

The class in astronomy have completed the text book, with the exception of a chapter on astronomical instrumens,

and one on spectrum analysis, which chapters were, from a lack of time, omitted. The class consisted at first of fourteen members; of these five left college before the close of the term. The remaining nine all have made commendable progress, the average of the class record amounting to 91 per cent.

METEOROLOGY.

When I entered upon the college work, the meteorological instruments were placed in my charge, with instructions that I keep a record of three regular daily observations and transmit a report once a month to the chief signal officer at Washington.

Owing to the fact that the barometer was found to have, in the midst of the column of mercury, a large bubble of air, I discarded its use. Being thoroughly convinced that the readings of the standard barometers, and of the dew point instrument were materially affected by the heat radiated from the brick wall near which they were suspended, I did not transmit reports to Washington until I had received orders directly from the Department to use the instruments as they were. Though the observations were carefully taken and recorded for the greater part of the time during the year, the report for the month of March, 1882, was the first one forwarded to Washington. When in Washington recently, Professor Blount succeeded in getting from the Department of the Signal Service a very fine barometer for use at the college. In the work of taking observations Professor Blount has kindly aided me by keeping the record when I was not at college.

Respectfully submitted,

CHARLES T. DAVIS,

Professor of Chemistry and Mathematics.

Fort Collins, Dec. 12, 1881.

REPORT OF FARM MANAGER, YEAR 1881.

To the State Board of Agriculture:

GENTLEMEN: In making this, my first report, I will call your attention to the fact that at the time I was appointed to superintend the farm department there never had been anything in way of raising grain accomplished outside of the experimental plats. I found that all ditches were to be made also the main lateral to the farm had to be made new and before the water could be had; and new ditches made to successfully hold and carry the water over the fields. The grain had suffered from getting dry.

We sowed what was thought to be twenty acres in wheat and five acres in oats. Eight acres of the wheat were sown on land fresh broke in the spring, the balance, twelve acres, on land plowed last fall. All the wheat was sown with a drill and harrowed well after it. We commenced sowing on the 24th day of March—putting in some for several days—and finished seeding the wheat the 12th day of April. The last being an acre of new land, freshly plowed. The first irrigating was done on May 27, and all lands that water could be put on was then irrigated for the first time. There were twelve acres that it was the 10th of June before we could get the ditch and water to irrigate it, and that being new land the grain suffered to a greater or less extent, how much I am unable to say. Yet from the twenty acres there were threshed five hundred and thirty-five bushels of good wheat. We had three varieties, namely, Nos. 4, 33 and 35, that shelled very badly before harvest, and in handling the loss must have been at least from two to three bushels to the acre.

In seeding, I sowed fifty pounds per acre on two acres, forty pounds per acre on four acres and thirty pounds per acre on twelve acres. While I did not keep each acre separate to thresh, for the reason that at the time of stacking it was very wet and I did not like to have so many small stacks as each acre would make for fear of loss, yet at harvest, and at all time the best grain was that of thirty pounds of seeding—admitted so by all that saw it. And

compared with the thick and thin, at least it was as good and apparently stood as well with larger heads and better straw.

The yield from the twenty acres was 535 bushels, machine measure, which did hold out full sixty pounds per bushel. Which would give 26¾ bushels per acre.

The cost of the wheat is as follows:

Plowing, seven days, harrowing and drilling, 6 days, making 13 days man and team @ $3.00,	$39.00
640 lbs. seed @ 3 cents per pound,	20-40
One man ten days irrigating @ $1.60,	16.00
Students' labor, irrigating, 36 hours @ 10c,	3.60
Students' labor, hoeing, 38 hours @ 10c.,	3.80
Threshing everything,	39.20
Harvesting, cutting, $2.00 per acre,	40.00
Shocking, three days one man, $1.60,	4.80
Stacking five days man and team,	15.00
Help, one man student,	4.75
Making a total cost of	$183.55

This does not include the plowing of twelve acres last fall, which perhaps would then have cost $15.00 more making an entire expense of $198.55, or a small fraction over 37 cents per bushel, the entire cost put in sacks at the threshing machine. The cost of drilling was more than double what it ordinarily would be, from the fact that in using so many kinds of seed it requires some time to clean the drill every time a change is made.

Oats, we had in five acres, three acres on new land and two acres on land plowed last fall and plowed again this spring. We sowed on one acre 75 pounds, no one acre 60 pounds, and on three acres, 30 pounds per acre. There could be no perceivable difference from one acre with another. We threshed out 202 bushels of oats or 40 bushels per acre. The cost of production was:

Plowing four days, $3.00,	$12.00
Drilling and harrowing, two days, $3.00,	6,00
Irrigating, three days,	4.80
Irrigating, students' labor, sixteen hours,	1.60
Harvesting machine,	10.00
Shocking,	1.60

Stacking, one day,	3.00
Threshing,	15.15
Seed, 195 pounds @ 3c,	5.85
Total cost,	$60.00

or within a fraction of 29 cents per bushel. The figures in each case are actual with the exception of the time that I, myself, was irrigating. There were several times that I went and helped to direct and turn the water on the grain. I think that usually it would not take the amount of time given for irrigation, but as there was a part of the land new and no one acquainted with the land, it is evident that any one can do much better irrigating after once having irrigated the land and found out just how the water will go and where the difficult spots are. I used a ten-hoed Triumph drill and can recommend it as doing good work. The harrow used is one of those with adjustable teeth, and did not give satisfaction at all. The teeth would get out of order in spite of all we could do. The grain was cut with a Wood twine binder, and gave good satisfaction. We cut and put up two stacks of hay, estimated at fifteen tons, using a Wood iron frame mower, which does good and satisfactory work; also used a Tiger rake. That works well. I have used the old lumber from the fence that was taken down and built a shed for tools, as an addition to the stable for horses and cows. Am feeding three horses that belong to members of the faculty at $5.00 per month for hay; have two cows, belonging, one to myself, and one to Mr. A. E. Nettleton, of Denver, that we are feeding for the milk for the dining hall. If it is thought best to put in crop all the land now under fence that could be farmed in general crops, I think that it will be necessary to have at least another team. While the team that we now have is a good one for work, it has been kept as busy as it could be, not having missed any time that a team could work since I have been here. There is a large amount of team work to be done in the spring to make the contemplated ditches and finish up the lake commenced, with necessary roads. The farm should have a harvester for the purpose of harvesting our own grain, as the hiring of one is unsatisfactory and not always convenient at the time that the grain should be cut.

In the horticultural department I would report that I have had about three thousand trees set out. The cotton-

woods set out along the fence on the front have done well. The trees set out around the park and lake, were injured early in the spring on account of not getting water as soon as they should, but I think that there was about 85 per cent. of them living and doing well at the beginning of winter. The young orchid that was planted in the spring did very well. There was a mistake made in the selection of the land, it being too near the slough running through the place, and has seeped and is rapidly becoming alkalied. I would recommend that a plat of one or two acres be put in small fruits this spring, also that one or two acres be put in nursery stock, as the majority of the labor for doing this and caring for it in the future can be largely done by the students, and that perhaps with as much or more profit than anything else. I think that the board should at this meeting make a selection of the plats, should they conclude to have this done, so that the proper arrangement of the soil can be made at the earliest possible time in the spring. I would suggest that the slough down through the place be drained, in such a way as to make it of some use. There could be a system of drainage started and carried out that would demonstrate what utility there is in drainage. The land on each side is increasing each year in the amount that is getting too wet, and unless stopped will interfere largely with the production of the hay, and also quality, and at the same time be an unsightly spot throngh the farm that should, if possible, be done away with. I would report that the wheat that was threshed there is 350 bushels in the elevator, 100 bushels in the mill for flour for the dining hall, and bran to feed horses and cows; the balance is in sacks in the basement of the college, principally kept for seed. The oats are all in the basement in a bin.

Respectfully submitted,

P. M. Hinman,

Farm Manager.

Fort Collins, Dec. 12th 1881.

REPORT

—OF—

PRESIDENT C. L. INGERSOLL,

—TO—

STATE BOARD OF AGRICULTURE.

FOR THE YEAR ENDING DECEMBER 1ST, 1882.

SIRS:—In accordance with the provisions of the law, I hereby submit the annual report of the workings of the college which is under your charge.

The faculty of one year ago has been changed somewhat—these changes taking place in accordance with resolutions passed or committee reports adopted by your body.

Mr. J. S. Tibbils was elected superintendent of horticulture and began his labors Feb. 5, 1882. He continued his labor until his resignation took effect Oct. 1, 1882. President Edwards resigned on April 7, 1882, when Prof. Blount according to law, he being the senior professor, acted as president until the election of Prof. C. L Ingersoll, of Purdue University, Indiana, to fill vacancy caused by resignation of Dr. E. E. Edwards. Mrs. P. M. Hinman was retained as instructor from the commencement of the year until the close of the school year, July 7, 1882.

At special meeting of the board held July 26, a president was elected and also a professor of mechanics. Mr. F. H. Williams of Moline, Illinois, a graduate of Stevens' Institute of Technology, Hoboken, N. J., as M. E. At the

same meeting the resignation of Mr. Hinman as farm manager was accepted to take effect Jan. 1, 1883, when the professor of agriculture with the co-operation of the president is to manage the farm and experiments unitedly.

The present faculty is C. L. Ingersoll, M. S. president; A. E. Blount, A. M., professor agriculture and botany; C. F. Davis, B. S., professor chemistry and physics; F. H. Williams, M. E., professor drawing and mechanics; P. M. Hinman, secretary and farm manager; Mrs. A. E. Blount, superintendent floral department; Mrs. A. E. Blount, superintendent horticultural department; Mrs. C. L. Ingersoll, matron of ladies' dormitory.

The latter appointment was made only temporarily and because in the multiplicity of duties other suitable person could not be found. The winter term of 1882 as also of the spring term of the same year, I refrain from speaking of, except in a general way, as I was not connected with the school. The attendance is noted in a table annexed, showing comparison between 1881 and 1882.

The attendance was good in the two terms mentioned, when we consider the lateness of the spring term, ending Jnly 7th.

I believe the new arrangement of closing in June as adopted will be much better for both teacher and pupil.

The curriculum of study has been changed to conform to that adopted by the board, and appears to work well. We have no senior class as yet, so that we cannot judge of it in its entirety until this year shall be completed. At the commencement of this term Prof. Blount was granted permission to attend the exposition and the state fair with an exhibit of cereals and grasses from the experimental grounds and from Larimer county. He was absent four weeks. At the time he left I was quite unwell, and during the first week of school was under the doctor's care. By this sickness the labor of four men was thrown upon two, and by them was carried in such a manner that none of the classes suffered materially, although the work was neglected until the middle of the second week in the shop and laboratory.

Since the return of Prof. Blount each has performed his allotment of labor and everything gone on very smooth-

ly. The faculty in all matters have been united and strong, and especially so in the matter of discipline. It has been necessary from the first to bring the attention of the students to a general spirit of listlessness and lawlessness which has seemed to pervade all. In bringing about morality and good order it has been necessary to suspend three students; two for drinking to drunkenness and one for insubordination. Two of these have returned and give evidence of good intentions and are doing good work, while the third, after an apology deemed sufficient, was, at his request, granted an honorable dismissal. Four other students have been suspended for failure to keep up their work properly. One of these has passed examination and has been readmitted to classes, while the others have signified their intention of making up their back work and entering next term, or at farthest, next year. Lack of preparation was one reason of failure.

TABLE OF ATTENDANCE.

Terms.	1881.			1882.		
	G.	L.	Total.	G.	L.	Total.
First Term	19	15	34	43	24	67
Second Term	17	13	30	15	14	29
Third Term.	27	26	53	35	22	57
Total	63	54	117	93	60	153
Students counted once			62			95

This shows an increase of over 50 per cent. in the attendance of 1882 over 1881.

Juniors, 5; sophmores, 12; freshmen, 16; preparatory, 16; specials, 8. Total, 57 enrolled. Total in actual attendance in daily recitation, Dec. 1, 1882, 50.

I have compiled data in regard to the percentage of our students, of which the following is a brief summary:

Of all matriculants from the beginning until now I find:

56 per cent. are children of farmers.

44 per cent. are children of others.

FALL TERM 1882.

69 per cent are children of farmers,
31 per cent are children of others.

BY CLASSES.

Juniors, 100 per cent. children of farmers.
Sophmores, 83 per cent children of farmers.
Two higher classes, 88 per cent. children of farmers.

According to action of board in July, requisition was made for thirty stand of arms of the state government.

The quartermaster-general sent us thirty Spencer carbines, which, although not well adapted to our use, help us very much. The small hall (on the west) has been converted in part into an armory.

The drill has been carried on daily with but four exceptions from 12 to 12:20. Prof. Williams was given charge by vote of faculty, and has performed about three-fourths of the labor; the other one fourth has been by myself.

A communication as requested by resolution was sent to the war department asking for the detail of an officer for militia drill and instruction. Gen. Sherman replied that we could get no detail direct before July 1, 1884, as two details to this district were now at the State University and Kansas Agricultural college. Since the above was written we have permission to have an officer from Fort D. A. Russell, at Cheyenne. Signed by Gen. Sherman but not ordered by war department.

For the amount of time put upon it, the company has done well and now with the small time devoted to it makes quite a respectable military appearance. Good soldiers are not made in a day.

The law has provided that ladies shall be admitted, taught and labor the same as male students; "no one is exempt for physical disability." It is one of the difficulties to get over, and has been compassed in other colleges by introducing music and painting. In the Kansas agricultural college a professor of music is elected by the board, and he

receives no salary but is compensated by a fee from each student taking music. Painting could be managed in the same way. If the ladies could be required to take music or painting and spend two hours daily, paying their own fees therefor, it would add to the value of the institution for education of ladies during those terms when work could not be furnished among the flowers or in the mechanic shops.

With the advent of water works we should very soon take into consideration the propriety of being connected therewith for purposes of convenience and better fire protection. Especially should the dormitory, laboratory and greenhouse be connected.

This involves the items of plumbing and sewerage, which should be referred to the committee for report at a future meeting of the board.

The main building and dormitory should be painted next year (inside and out) with good two-coat work. A few other repairs are needed. The advisability of making a staircase for the purpose of access to the tower, and the better looking after the bell, as well as the meteorological instruments, should be considered.

Our chemical laboratory, fitted up so cheaply, is already too small for our increasing classes and work. In looking over the needs of the college, I would recommend that the present barn be converted into a chemical and physical laboratory, and that we ask the legislature for the sum of $10,000 for the purpose of erecting mechanic shops and a green house, etc. The plan of conversion, with a somewhat detailed statement of the cost of the same accompany this report, and are marked.

The present greenhouse is all that could be expected from the money expended, and while it has answered its purpose well, is entirely inadequate for the purpose and the needs of an agricultural college. I would therefore recommend that the site of this building be changed, and that as soon as practicable a greenhouse be erected near the entrance to the grounds, where the structure and flowers will be more seen and visited. To this end the present laboratory could be utilized as an addenda to such a structure and thus at the same time preserve one of the oldest land marks about the college.

I refer you to a paper marked for an intelligent plan of and position for such a building.

After consultation, and feeling the unnatural condition of things in various directions, it was the unanimous opinion of those here at the college that the new building ought not to be used for stabling stock, and so it was decided to let the present sheds stand until spring when they could be removed. I recommended this chiefly because I had not sufficiently studied the needs of the college or thoroughly looked over the ground so as to know what was best.

There remains some grading to be done before the final seeding to grass is to be accomplished, especially in front of the dormitory and in rear of main building. This should be attended to early in the spring and grass sown. The college should have some groups of evergreens set out to break the monotony in many directions.

A few fruit trees will need to be taken out near the laboratory to give place and room clear of shade, for the greenhouse.

I have had much cleaning up done in various directions, but there is plenty more to do. Inasmuch as student labor is very unsatisfactory, where exact work and care must be maintained, I have seen fit to hire a janitor whose duty has been, first, to ring the bell and build fires ; second, to get fuel for greenhouse and assist in putting it in order for winter ; third, to take the observations at 7 a. m. and 9. p. m. regularly ; four, to take vegetables to the kitchen and make record of the same ; also to draw oil and render an account to Secretary Hinman ; five, to sweep the main building and dormitory once each day and to empty the ashes carefully ; six, to look after the fires very carefully, especially at night, and in a general way to look after the interests of the college ; seven, to feed the pigs and look after the outhouses to see that they were kept neat and in order ; eight, to be ready to put in other time when called upon by the president. He has assisted in banking up and grading at the brick barn, he has picked up about the grounds, transferred coal etc., and been to town on errands for the college.

This does not constitute all, but gives you an idea of the necessity of having a good, reliable man for such work.

Mr. W. Van Patton has been engaged and has worked since Nov. 1, at $30 a month and boards himself. His wife labors in the kitchen and this makes a home for him, and enables him to work so cheaply. He has been faithful, energetic and shows as much interest, apparently, as if the property were largely his own.

Since the change, bells are rung on time and the recitation rooms have, as a rule, been comfortable and well kept.

For an intelligent and concise statement of the progress on the farm, I will refer you to the report of Secretary Hinman, farm manager. The crops have been quite good, the wheat averaging nearly twenty-seven bushels per acre.

No plan has been perfected for the management in 1883. A scheme for that year will be submitted to the board at the February meeting for your adoption. For further particulars I will refer you to the report.

At the commencement of the school year the farm was unable to furnish milk to the dormitory, and for the first month milk was purchased of a milkman and sometimes of other parties. This unsteady and often precarious mode of supply was quite inadequate to supply the demand. In consequence I purchased the pure Jersey cow, Myrtle 2d, of Jesse Harris.

It may be worth while for the board to decide on what specimens of beef breeds we shall keep on the farm for purposes of illustration, etc., in the near future. Some plan will soon be needed.

Although the law requires that the work upon the farm shall all be experimental, yet I believe it a proper time to lay out experimental ground where the college can show to the state to a much better advantage the way to conduct *accurate* experiments, and at the same time try to assist in solving some of the vexed questions which arise in agriculture.

Our exhibit at the exposition won golden encomiums, and never has been excelled in this state or any other in our union.

We have thus shown what our state and our college can do.

I would recommend that the plat of land lying on College Avenue, at the south of the farm and east of the railroad, a plat of about twelve acres, be devoted to experimental purposes.

A plan of division has been worked out by Professor Blount and myself, marked D.

This will give as fine a set of plats for experiment as is possessed by any college in the United States, unless Purdue University, and I think this will equal theirs with the additional point of control of water in our favor.

We wish to push this feature in the next year, and I would therefore recommend that $400 be set aside for this especial purpose, for 1883.

In the near future a building will be needed (not very costly) which will be adapted to the wants and needs of the work, and which shall stand near this (north) end of the ground. The flume has been put in order and the work of the whole farm department has been kept well in hand. It will take one season nearly before I shall be capable of making suggestions that shall be worth much. In a general way, however, I would recommend the seeding down of the major part of the farm to grass, alfalfa and the keeping of more stock.

The report of Mr. Tibbits gives an intelligent statement of what has been accomplished in this department. In my opinion the results are estimated too high, not from a desire to be popular, but from an undue value, which seems sometimes to attach to things which we own or have to do with.

I agree with the report that it is unwise to go into market gardening any more than to instruct our students and to supply the boarding needs at the dormitory.

I would recommend that the seeds, etc., on hand and not needed be at once sold or placed on sale so that the college may at once or as soon as possible realize on the investment. Several of the things are of a perishable nature and should have immediate attention.

The cellar at the barn has been utilized for storage.

I would recommend further that the floral and horticultural departments be united and that a man be secured who is a professional florist, horticulturist and landscape gardener, one who will be capable of teaching the class in horticulture and floriculture. Such a man can be obtained at a salary of $1,200 for the first year. An assistant can be hired to work under eye and instructions for $40 per month, or a little more. There are several reasons why those should be united:

1. They properly belong together.

2. They can be more profitably carried on together, and

3. They can use the water when and where it seems best.

4. Prof. Blount will be relieved of much that now takes considerable of his time, and can thus devote more of his time to the experimental work of the college.

This shall not be construed into any reflection on the work performed by Mrs. Blount, as she has done admirably and as well as any woman could, unless she had special training for this work, in show or commercial green-houses. The show of flowers on the lawn in front of the college was fine and reflected great credit on her skill in arrangement and adaptation to circumstances. The show was the admiration of all visitors.

For the work performed in this department I would refer you to the report of Prof. Davis. By way of summary of results this term, I will say that the classes in chemistry have done well. The class in analysis have even accomplished more than most classes in other colleges in the same time. All seem to have enjoyed work with a single exception.

After looking over the wants and needs of this department, I requested Professor Davis to make out a bill which should cover what the department would need for the further prosecution of work for this year, or to June 1, unless it might be a few chemicals where quantities could not be accurately stated. The list was submitted and after a few corrections I took the responsibility of ordering as

much of the material as would be needed to begin the work of next term with the next class in the laboratory. The bill amounted to about $120 on which we get sixty days' time. The fees from students next term at the opening will two thirds pay the bill, and future fees will cancel it fully.

The faculty have carried the work in this department during this term; but now it becomes apparent that with the increased size of classes, together with an increased number of classes that we must have an instructor in this department.

I put into your hands papers containing applications, recommendations, etc., of men for such a position. I would recommend that we only fill the position temporarily, of instructor, and elect a professor at a later meeting. For $500 we can get an adequate instructor for the remainder of the year (two terms); his salary to close June 7, when school shall close. The two applicants are Mr. Floyd Davis, of Rolla, Mo., now teaching science in the School of Mines at that place; and Mr. Edward Mead, of Purdue University in June last, but since on the United States River and Harbor Survey with United States engineer corps in the Wabash and Ohio valleys.

In accordance with the report of the committee at the last meeting of the board we secured the services of Mr. F. H. Williams as professor of mechanics and drawing. He arrived here and began work August 15. In connection with myself he made out a list of tools needed and materials necessary for the construction of benches for a shop. The most of the material was purchased in Denver, where good rates and discounts were obtained to help the college. The remainder was purchased here. The shop is arranged to accommodate eight in wood work, six in bench work and iron and two at the forge. Total, sixteen in all. For an intelligent statement of what has been accomplished, I refer you to detailed report of Professor Williams.

I feel free to say that while much has been accomplished that the department has not met my expectations, or rather did not for the first eight weeks. This was due in part to three causes: First, the term was opened at great disadvantage, with only two professors to do the work of four, and the head of the institution sick.

If the professor of mathematics is given us for the remainder of the year, this will relieve him greatly and only require of him work in his special line. He has taken charge of the many repairs and changes made at the college and has done well, I might say admirably, in there.

From the first we have had the services of a carpenter to make the benches, to make changes at the outhouse, to make a granary and finish the barn, etc., etc.

This man, Mr. Fuller, has shown excellent judgment and as his services were needed he has been retained for such work that must be done. As he was here and needed in the shop when so many (16) new beginners were there, he has assisted in the instruction in wood work during two hours of each working day. If the changes mentioned in connection with the chemical laboratory are to be made he could very profitably be retained and do most of the carpenter work required in the change.

The work performed by the students in the last six weeks has been very creditable to them and compares favorably with the work of similar students at other industrial colleges.

In looking over this department the need of more room is imperatively felt; and whether to utilize the present barn for a shop or to devise some other plan, must engage the attention of the board.

If the change from a barn to a chemical laboratory is thought of, then we must appear before our legislature and ask for a sum of money equal to $10,000 for various purposes, viz: mechanic shop, greenhouse, etc., and this in addition to the one-fifth mill tax.

The college can live and make some growth without the sum mentioned if the one-fifth mill tax is continued, but this extra sum will put us on a splendid growing basis, and if the one-fifth mill tax be made perpetual we shall have as good a school of its kind as there is in the United States.

It is much better to build a building designed from the foundation for a shop than to transform one into a shop which was first designed for some other purpose.

Hence I make my recommendations as above, accompanied by plans. The plan marked is for a shop.

I would report that we have the sum of $20,888.61 to carry us through to January 1, 1884, as the result of the one-fifth mill tax.

If the legislature will grant us the sum of $1000 for the purpose of erecting a mechanic shop, greenhouse, etc., then the expenditures for the college as I have planned them could be as follows and thus expand the institution to do good and better work.

President's and others, salaries as follows:

President,	$2,500	
Prof. Blount,	1,600	
Prof. Davis,	1,600	
Prof. Williams,	1,200	
Prof. Mathematics,	1,000	
Prof. of Horticulture,	1,000	
Total salaries,		$8,900
Two men on farm and other help,		1,000
Horticultural department help,		500
Student labor paid,		600
Total, instruction and labor,		$11,000

BUILDINGS.

Mechanic shop,	7,500	
Greenhouse,	2,000	
Barn,	2,000	
Chemical laboratory,	1,500	
		$13,000

REPAIRS, IMPROVEMENTS AND RUNNING EXPENSES.

Repairs and painting buildings,	500	
Grading and improvements,	500	
Expenses, mechanical department,	600	
Expenses, chemical department,	600	
Total,		$2,200

APPARATUS, BOOKS, ETC.

Natural science,	500	
Mathematical department,	500	
Physical apparatus,	500	
Library,	500	
Experiments,	500	
		$2,500

OTHER EXPENSES.

State board,.....	800	
Secretary's salary,.....	800	
		1,600

RECAPITULATION.

Salaries and labor,,.....	11,000	
Buildings and changes,.....	13,000	
Rep air,improvements and running expenses,.....	2,200	
Apparatus, books and experiments,.....	2,500	
Other expenses,.....	1,600	
		$30.300

ASSETS (SUPPOSED.)

One fifth mill tax,.....	20,888.61	
Appropriation,.....	10,000.00	
Balance,		$588.61
	$30,888,61	$30,888.61

As you see, this makes no allowance for the amount anticipated to January 1, 1883. If, however, we could obtain the amount named as an appropriation, we could afford to wait for some of the things mentioned in some of the departments, so that not more than $1,500 need be anticipated for next year and none the year following, as if we receive the sum mentioned, in 1883, and can have the one-fifth mill tax thereafter, we would be able to get along nicely until we need our main building duplicated, in order to give us more room.

MISCELLANEOUS.

The faculty, early this year, appointed a committee upon a system of electric alarm to strike the hours of recitation. This committee reported that a programme clock could be purchased for $23.50, and bell, battery and attachments would not bring the sum to more than $30.

Mr. Hart wishes to deposit quite a fine collection of geological specimens at the college. We should also have cases for geological specimens, as our students and others would soon gather quite a collection. I received a very fine specimen of mountain lion, which I sent to Denver to be mounted. Cost, $18.00, and freight, 88 cents.

I have also obtained blank teachers' record for use, that the whole school work shall be kept intact and on file in this office. The students' record from the first has been written up, but there are some things quite questionable, as the records have been so imperfectly preserved or kept at the time.

I have also purchased an assay furnace for use in the chemical laboratory, as I thought the institution should have one and the students be taught the process of assaying in the course of chemistry. We do not expect to make experts, but rather to turn their attention chiefly to qualitative and quantitative analysis.

From the first I very much desired to arrange to have the library increased and put in a suitable room. We first tried the room over the president's office, but with no one in charge it did not do well. We next took the room formerly used as public parlor and fitted it up at a cost of $23, a person put in charge, and the change was apparent immediately. Having no suitable place for my own library, I deposited 300 volumes for the use of the students and Professor Williams about 80 more.

As a result of the change, 247 books were drawn in the first twenty-three days after the change, or from Nov. 5, to Nov. 28. The expense of the care of the library is ten cents per hour, and the hours are from 8 to 12 a. m., from 1 to 2:30 p. m., and from 6 to 7 p. m., of five days in the week. On Saturday and Sunday the library is opened two hours, viz: from 2 to 4 p. m. This gives a total of thirty-six and one half hours per week or $3.65. For rules for management I refer you to rules on the door.

Another thing which should soon engage the attention of the board, is the procuring of a good safe for the proper preservation of valuable books and papers—the property of the college. We hope never to suffer by fire, but in case we should, we might lose all our records and accounts. Such a catastrophe should be guarded against.

The department of mechanics is desirous of having a foot lathe purchased on which quite a range of work can be accomplished. Such a machine with tools can be put down here for about $75.00. If the plan be to wait and keep the

shop in the present quarters, then I would advocate the purchase of the lathe next term, after money is in the treasury for the use of the college.

I would call attention to the recommendation of the professor in regard to a deposit of $5.00 and a charge for material used.

As the sophomore class are one study short this next term, having completed the study of English literature one year ago under the old arrangement of studies, I would ask the privilege of giving to those young ladies instruction in French. And I would further suggest the propriety of giving the young ladies a year of language other than English in their senior year, in place of stock breeding and veterinary science.

I have required the inventory to be taken according to law in each department of the college and the result aggregated that we might see how much property was owned by the state and under your control.

INVENTORY.

Buildings and improvements,	28,960.00
Farm—240 acres,	12,000.00
Farm department—stock, crops, etc.,	3,264.17
Apparatus and fixtures,—	2,646.35
Horticultural department,	2,514.05
Chemical department,	569.57
Mechanical department,	507.18
Floral department,	109.80
Total,	$50,571.12

EXPENDITURES.

The board voted at the last meeting the sum of $875.00 for specific objects. The amounts expended are as follows:

Department of mechanics and drawing	$507.18
" " natural history	102.75
" " experimental agriculture	33.17
" " chemistry and physics	112.64
Library, (books, binding, and chart)	79.75
Office of President and Secretary (desk and printing)	49.00
Stoves for class rooms	30.00
Total,	$914,49

This shows an overdraft of $39.49, which is due to the fact that the items charged against the department of mechanics and drawing include the entire cost of the department in material used. This is all on hand and appears in the inventory above.

APIARY.

The apiary was under the charge of Prof. C. F. Davis from Aug. 4th to Nov. 20th, 1882, at which time Prof. S. E. Blount took the supervision and secured the bees in comfortable winter quarters. The bees should have continuous care, and next year this difficulty will be obviated. The statement of the account with the apiary shows a balance of $7.94 to its credit.

For an intelligent account of the apiary account, I refer you to to the statement by Professor Davis, which extends from August 4, to November 20, when Professor Blount took charge and put the bees in winter quarters. Bees should have continuous care, and next year we shall try and do better by the apiary. The statement shows a balance of $7.94.

In closing this report I beg to have your indulgence on account of its length.

It seems necessary for us at this time, if we believe in the permanency of the college, to begin to look at least one degree ahead and see what the college may be. With such an ideal before us we can then labor more earnestly and understandingly for its advancement.

Respectfully submitted,

C. L. INGERSOLL.

DECEMBER, 13, 1882.

PROF. BLOUNT'S REPORTS ON WHEATS.

THE LETTER FROM WASHINGTON.

DEPARTMENT OF AGRICULTURE,
Washington, D. C. March 10, 1882.

Dear Sir:—I enclose a copy of the analysis which we have made of the wheats which you left with us. You will see that they are all remarkably good and very similar in composition. In order that they may be more thoroughly understood we should have a history of each variety and the treatment which it has undergone. Can you furnish me with the same for publication in connection with the analysis in our next report?

Yours, etc.,

CLIFFORD RICHARDSON,

Assistant Chemist.

ANALYSIS.

	720	721	722	723	724	725	726	727	728	729	730	732	732	733	734	735
	Blount's Hybrids.						Sd fr. N So. Wales,	Centen nial. 726	El Dorado	White Mexi'n. 13	Jndkin 19	Austra- lian Cl. 22	Foun- tain. 71	Perfec- tion. 76	Rus- sian. 15	Rio Gr'nde 17
	No 10.	No. 15.	No. 16. Select.	No. 17.	No. 18.	No. 19. Select.	No 20.									
Color	Amber.	Red.	Red.	Red.			Yellow.		Yellow			Yellow.	Yellow.	Yellow.	Red.	Red.
Hardness	Hard		Soft	Hard.			Hard.		Hard			Soft.	Hard.	Hard	Soft.	Soft.
Wt. of 100 grains	. . .	. . .	4.824	5.137	. . .	. . .	4.657	. . .	4.702	. . .	. . .	5.506	5.100	5.536	4.131	5.106
Specific gravity	1.397	. . .	1.331	1.308	. . .	. . .	1.255	. . .	1.242	. . .	. . .	1.305	1.306	1.330	1.311	1.310
Fresh gluten	42.22	32.24	32.92	34.16	32.22	36.96	35.22	28.31	23.80	25.06	42.12	33.59	25.23	35.15	35.36	32.41	35.01
Dry gluten	14.44	11.38	11.19	11.88	10.74	12.14	11.74	10.64	9.22	9.49	14.33	12.10	8.91	11.93	12.07	12.13	12.34
Total nitrogen	2.20	1.96	1.88	2.18	2.07	1.99	1.96	2.02	1.93	1.88	2.21	1.96	1.79	2.18	2.27	2.32	2.35
Moisture	9.72	10.07	9.53	9.93	9.74	10.45	10.59	9.47	9.66	10.55	9.91	9.75	9.78	10.58	9.93	9.55	9.57
Ash	2.28	1.93	2.04	2.07	2.19	2.54	3.57	2.18	2.35	2.24	2.60	2.57	1.85	2.79	1.99	1.99	2.68
Fat	2.16	2.68	2.54	3.93	1.58	2.19	2.32	2.40	2.00	2.43	1.89	2.42	2.23	2.15	2.32	2.62	2.96
Sugar, etc.	4.12	2.92	3.38	6.20	3.32	3.44	3.64	4.22	3.06	3.28	3.46	4.96	3.30	2.86	2.84	3.70	2.86
Dextrine, etc.	2.22	2.46	1.90	9.00	1.40	2.68	2.60	3.08	2.10	1.82	2.20	2.80	1.92	2.32	1.80	2.20	2.58
Starch, etc.	61.10	66.12	67.24	53.66	67.23	64.47	63.32	64.68	67.67	66.83	64.61	63.53	68.28	64.36	65.39	63.96	63.53
Alb. solmatch	4.30	3.19	4.26	.80	3.57	3.28	3.71	5.05	4.26	3.83	4.20	1.97	3.01	3.33	4.34	3.81	3.19
Albumen	9.60	9.06	7.49	12.82	9.37	9.16	8.54	7.57	7.80	7.92	9.61	10.28	8.18	10.29	9.84	10.68	11.50
Crude fibre	1.32	1.57	1.62	1.59	1.60	1.79	1.67	1.35	1.10	1.10	1.52	1.70	1.45	1.32	1.55	1.49	1.79
Total No. M. X. 6,25	13.75	12.25	11.75	13.62	12.94	12.44	12.25	12.62	12.06	11.75	13.81	12.25	11.10	13.62	14.18	14.49	14.69

ANALYSIS—CONTINUED.

	736	737	738	739	740	741	742	743	744	745	746	747	748	749	750	751
	Tonzelle 21	Germ'n Fife 77	Oregon Club 10	Sonora 12	Imperial Fife 14	Lost Nation 20	Pringle No 6 33	Hybrid No. 4 84	Clawson 37	Hedge Row 41	Hedge Row, Rc 69	White Chaff 74	Triticum 79	Durum Russia 81	Doty 87	Mokin 86
Color	Yellow	Red	Yellow	Yellow	Yellow	Red	Yellow	Medi'm	Yellow	Yellow	Yellow	Red	Yellow	Medi'm	Red	Red
Hardness	Medi'm	Soft	Soft	Soft	Hard	Soft	Medi'm	Hard	Soft	Medi'm	Hard	Soft	Hard	Hard	Soft	Soft
Wt. of 100 grains	5.214	5.366	4.434	4.739	4.147	3.851	5.145	4.630	4.565	4.072	4.499	4.214	5.758	5.928	4.873	5.193
Specific gravity	1.301	1.283	1.326	1.344	1.325	1.323	1.304	1.347	1.287	1 357	1.338	1.233	1.315	1.326	1.284	1.293
Fresh gluten	33.05	38.33	28.92	34.86	39.47	29.52	34.78	33.69	26.91	34.01	30.14	32.24	34.32	37.54	35.81	30.60
Dry gluten	10.90	14.45	10.06	11.80	14 23	11 23	11.83	12.06	9.99	12.11	10.69	11.37	13.08	13.51	12.52	13.83
Total nitrogen	2.16	2.41	1.96	2.27	2.55	2.07	2.10	2.44	1.88	2.18	2.07	2.24	2.18	2.44	2.24	2.44
Moisture	10.93	10.42	9.59	10.17	9.43	10.24	9.89	9.83	10.14	9.07	9.17	9.57	10.00	9.91	9.41	9.38
Ash	2.10	2.31	1.91	2.02	2.64	2.17	2.13	2.23	1.94	2.08	2.59	2.13	2.67	2.32	2.35	2.53
Fat	2.35	2.79	2.19	2.13	2.31	2.99	2.52	2.20	2.31	2.11	2.09	2.44	2.65	2.00	2.50	2.97
Sugar, etc.	3.24	2.02	3.10	3.18	4.04	3.32	3.52	2.94	4 10	2.80	3.12	4.80	4.60	4.28	3.68	5.12
Dextrine, etc.	1.88	1.50	1.50	3.02	2.06	2.40	2.20	2.06	2.20	2.02	2.10	2.00	2.84	3.00	2.32	2.04
Starch, etc.	65.05	63.42	67.86	63.92	61.95	64.01	65.85	63.65	65.86	66.68	66.66	62.88	62.09	61.30	63.94	61.17
Alb. solmatch	4.01	4.24	4.24	1.51	5.96	1.64	5.25	3.40	3.44	4.66	4.19	4.89	5.65	6.48	5.69	5.36
Albumen	9.49	10.82	7.91	12.67	9.98	11.29	7.88	11.85	8.31	8.96	8.75	9.11	7.97	8.77	8.31	9.89
Crude fibre	1.65	1.48	1.60	1.40	1.63	1.74	1.76	1.78	1.60	1.62	1.33	2.18	1.51	1.54	1.80	1.54
Total No. M. X. 6.25	15.50	15.06	12.25	14.18	15.94	12.93	13.13	15.25	11.75	13.62	12.94	14.00	13.62	15.25	14.00	15.25

Blount's Hybrid No. 10 a cross of theNew York Deihl upon Virginia Golden Straw.

Blount's Hybrid No. 15 is a cross of the Sonora upon Lost Nature.

Blount's Hybrid No. 16 a cross of the improved Fife upon Russian.

Blount's Hybrid No. 17 a cross of the Odessa upon Sonora.

Blount's Hybrid No. 18 a cross of the Australian Club upon Improved Fife.

Blount's Hybrid No. 19 a cross of the Improved Fife upon Oregon Club.

Blount's Hybrid No. 20 a cross of the Oregon Club upon Sonora.

The first named variety in the list is the father, the second the mother.

These hybrids are but two years old and hence have not become "fixed." I crossed them in order to make the offspring better in quality and quantity, for both farmer and miller.

The objects attained by crossing wheats or hybridization, as it is improperly called, are manifold. It improves the plant in various ways. It makes it more vigorous, less liable to the attacks of vegetable parasites. The straw is stiffer, better glazed and more healthy, the leaves better feeders as well as the roots; the glumes are more compact and better filled, the heads longer and fertilizaton takes place much more surely and successfully.

Second, it improves the grain, makes it more plump, heavier, harder, consequently better suited to milling purposes. The bran is made thinner, more free from fluff and cellulose—the two obstacles that interfere so materially with milling. The grain is entirely transformed, being made to contain more or less gluten, starch and other elements that make good flour. The whole operation is very similar to breeding stock. The experimenter must thoroughly understand the entire vegetable and physiological structure of both wheats before he ean make a cross or an improvement on either parent.

An examination of the table of analysis, for instance, will show success and failures in my work. A success cannot always be made the first trial nor the second. The experimenter is compelled to cross and recross again sometimes, in order to make a wheat that will suit both farmer and miller. Take Hybrid No. 18 for instance. It is a failure so far as being fit for the mill is concerned. Why? because the per cent of gluten is very much less than that of its

mother (14.23) (Improved Fife), and but very little higher than that of its father, (8.91) (the Australian Club). Had it been 11.15 per cent. or the average of both, or more, there might have been a chance of making a success. One more trial (the third) will settle the question whether or not it is worthy to be placed among the standards. So far as it is a success or failure for the farmer, remains yet to be determined. Many wheats do splendid in the field and are no manner of account in the mill and *vice versa.*

Please notice No. 19 in the table. The father wheat (Improved Fife) contains 14.23 per cent of the gluten, the mother (Oregon Club) 10.06 per cent., exactly the per cent. that No. 19 contains. Now both these parent wheats are good for both farmer and miller and I have reason to conclude that their offspring will be better than either parent, when it becomes "fixed." It is now only two years old and will not become fixed or a standard until next year.

HISTORY.

The Black Bearded Centennial came originally from New South Wales.

It is probably the heaviest wheat known—74 pounds per struck bushel. It is an enormous feeder and an enormous yielder, two ounces producing last year 25 pounds six ounces.

From the table it cannot be said to be a good milling wheat.

It has the finest head and kernel of any I have ever handled or seen. It took the first premium for being the heaviest in New York last August, over two or three thousand competitors—average head weighing 107 grains troy, while the next heaviest weighed 92, making the Black Bearded Centennial 15 grains troy heavier than any other's average head.

The El Dorado is an improvement on the old Egyptian wheat, otherwise called Pharaoh's wheat, Seven-headed wheat, Mummy wheat, etc. In this county, (Larimer) it has produced 90 bushels per acre.

The White Mexican vs. White Siberian, originally came from Siberia, in Asia. It has held its own more

tenaciously than any of the old standards. It is whiter and lighter than it was ten years ago, but the table shows it to be the best milling wheat when improved (as I have improved it in the last three years) of all the thirty-two. For the farmer this variety is not profitable to raise, from the fact that the straw is very weak and rusts badly on all soils where there is the least dampness or too much alluvial matter in the soil.

The Judkin is a Pennsylvania wheat, and comes as one of the best winter varieties. I turned it into a spring wheat three years ago, since which time it has proved to be one of the best. It produces a little more grain in wheat than straw, and yields over 320 from one. Its color is red and remarkably uniform. It has a strong, stiff straw, a little too long, and has good milling properties.

While the Australian Club exhibits poor milling properties in the table it is one of the most prolific and successful varieties for the farmer. It produced 416 from one last year, and has straw, color and grain that can hardly be excelled. It came from Australia, but is no kin to the hard and soft Australian wheats. It is hard and has a large amber kernel.

The White Fountain comes to me from Montana. I have raised it but one year. It yields abundantly—404 from one—has a stiff, strong straw; does not rust and ripens evenly. The table shows its milling properties to be good. I received 101 pounds from four ounces sowing. It is a smooth white wheat of great value.

Perfection was received from Palestine last year under a variety of names. Half an ounce produced six pounds of grain and seven of straw. The straw is coarse, strong and stiff. The grain large, white and uniform in color. Its milling properties are fair. It does not appear to be subject to rust or smut in this climate. On the whole it is a good wheat for the farmer and miller.

The Russian came to me from Moscow three years ago. Three years' test makes it one of the best red wheats I have. It has one failing, shelling too easily when cut too ripe. Aside from this fault it commends itself to every farmer, and especially to the miller, as its flour is of the best. It produced, first year, 76 from one; second year, 172 from one; third year, 448 from one.

Rio Grande is the best of all the bearded varieties I have for milling. Like the Russian, it shells badly, being clad with but a single glume. Sometimes the grain grows without any natural covering at all. I have crossed it upon the Champlain, the effect of which has given every kernel in the offspring its proper amount of clothing—two glumes, two palets and two lodicules.

The Touzelle was obtained from France. It is the finest-looking of all the French bearded wheats. It improves rapidly by selection and cultivation. First year it produced 56 from one ; second year it produced 128 from one ; third year it produced 480 from one.

As will be seen in the table it is not yet a good milling wheat, from the fact that it is destitute of the proper per cent of gluten.

The German Fife came from Germany, and has been tested on these grounds but one year.

In all respects as the table and the experiments made here with it shows, it is unexceptionally one of the best wheats grown anywhere. It is not handsome, but very strong and a good one for both farmer and miller. It is a bearded red variety, strong straw, with grain well protected. One ounce produced seven pounds of grain and eight of straw—112 fold.

The Oregon Club has been a much better wheat than it now is. Its milling properties have greatly deteriorated by bad selection or no selection. It is prolific, nevertheless, producing this year 480 from one. There are two evils that attend this wheat. It will rust in damp seasons and low soils, and the heads break off badly in harvesting if permitted to get too ripe. I obtained seed from Oregon.

The Sonora sells readily for seed and flour. Some millers do not like it and some farmers won't raise it. It is really a good wheat if milled properly and cultivated with some care. I have raised it for three years. The first year it produced 56 from one ; the second year it produced 110 from one ; the third year it produced 448 from one.

It came from Mexico below the Gulf of California.

The Improved Fife commends itself to everybody who has seen and raised it. So far as the farmer's interests are concerned it will pay him to make use of it. It has for three years exhibited no failing whatever. The table shows it to be of the best milling properties. It is an improvement on the old Saxon Fife.

The first year it produced 56 from one. The second year it produced 126 from one. The third year it produced 416 from one, on these grounds.

The Lost Nation is an "old "stand by" in the eastern states. Seed was sent me three years ago from Chester County, Pa., and the three tests I have given it show it to be an excellent variety for the farmer, and the table shows it to be a pretty fair milling wheat.

The first year it produced 76 from one. The second year it produced 96 from one. The third year it produced 352 from one.

Although Pringle's Hybrids Nos. 4 and 6 exhibit fair milling properties in the table, they are not profitable to the farmer on account of one failing. Both shell so badly while being harvested that the farmer loses three or four bushels per acre. These came from Vermont.

The Clawson, from Pennsylvania, is so widely known it is hardly necessary to notice anything pertaining to it except the results that have been obtained on these grounds for three years. It is a winter variety and almost absolutely refuses to be transformed into a spring wheat. It has done well and commends itself to the farmer for being very prolific, and free from almost all diseases and accidents.

The first year it produced 68 from one. The second year it produced 136 from one. The third year it produced 544 from one.

The straw is strong, well glazed and never falls. The heads are remarkably long and always well filled. It does not "kill out" in the winter, but grows well and is green all the time no matter how cold it is.

The Hedge Row, white chaff, is properly named. From what source it came I am unable to say. It shows

fair milling properties and so far as being profitable in the field there is no doubt. The straw is coarse, stiff and rough and the chaff holds its grain as tenaciously as an animal holds its prey—in fact it is so hard to thrash that it is an utter impossibility to clean it thoroughly. It is a good variety to cross with a finer grain that shells easily. Hedge Row, red chaff, is in all respects like the other with the exception of its chaff and grain. White chaff—so called because its head when ripening fairly glistens in the sun —has several names. It is a bearded variety and very prolific, producing more than 400 from one.

Triticum I received from Samara, on the Volga river, last year. It has been tested but one year. It was the poorest looking wheat I had ever seen. The table shows it to be above medium for the mill, and one season here shows it to be excelled by but few. It produced as much grain as straw and yielded 192 fold.

The Durum and Doty came from Saratov, Russia, last year. One test proved but little as to their merit.

The Meekins came from St. Petersburg and commends itself to the farmer and miller.

My No. 10—a cross of the N. Y. Deihl upon the Virginia Golden Straw—now three years old, is "fixed," and so far claims the attention of all who see the grain or straw.

Its milling properties as seen in the table speak for themselves. It has a stiff, strong straw, has not rusted at all, and the head is of the finest and largest known. Over 100 grains are found in a large proportion of them. The wheat came from but one kernel planted in 1880. The one kernel produced the first year five good heads, containing in all 474 kernels. These I planted again in 1881, and I now have thirty pounds or more, which will produce at least 50 to 100 hundred bushels by careful sowing and cultivation.

All these remarks and statistics are made with reference to this climate and locality. They may or may not apply to other sections and other states. All these wheats have been improved by selection and crossing, cultivation

and irrigation. Under different treatment in this as well as in different soils and climates, they might do better or they might do worse.

I am convinced that wheats that are made on the ground where they are to be raised will do much better in every respect than any that may be imported.

A. E. Blount,

Agricultural College, Fort Collins.

PROF. DAVIS' REPORT.

President C. L. Ingersoll:

I would respectfully submit the following report of work in the department assigned to my supervision for the term ending December, 1882.

During the college term commencing January 16th 1882, I taught a class in arithmetic, one in algebra and one in astronomy.

The arithmetic class had, at the outset, or during the term, twenty-eight members. Of these, six left college before the close of the term. Of the remaining twenty-two, nineteen passed the required examination. There were seven students in the algebra class, all of whom passed the final examination.

Of the fourteen students who entered the astronomy class, five left college before the close of the term. The remaining nine passed good examination.

During the term commencing April 17, 1882, there were put in my charge classes as follows: one in ancient history, one in book keeping, one in algebra and one in geometry. The ancient history class had ten members, nine of whom passed the examination.

Of the book keeping class nine of the original eleven passed the examination.

Eight of the class of eleven in Agebra passed the examination. The entire class of six members in geometry passed good examinations. In this term a single student was placed in my charge for instruction in mechanics. The subject was followed during nearly the whole term, but the work being above the capacity of the student little progress was made and no examination given.

In the course of the summer vacation of 1882 it was decided to resume, at the opening of the autumn term, the chemical instruction which had been suspended by the state board because of lack of accommodations for carrying on analytical work.

The small brick building at the northeast corner of the college grounds was fitted up at an expense of thirty-three dollars, with tables, sinks, hoods and ventilating apparatus for six students.

During the present term a class consisting of six students have followed a course of analytical work consisting of six weeks in blow pipe work, succeeded by ten weeks in qualitative analysis by precipitation, which work will be continued through next term.

A bill of chemicals and apparatus for use in the laboratory was purchased in the early part of the term; the bill amounting to $73.39. Another bill amounting to $130.00 has been ordered for use during the winter term. An assay furnace has been placed in the laboratory for the examination of minerals. Though crowded for room, the students of this class have done admirable work.

A class of thirteen students have taken a course of lectures in elementary chemistry aud all give fair promise of passing good examinations at the close of the term.

Thus it is plain that the department has already outgrown the limited accommodations for room.

I have also taught classes in geometry, physics and agricultural chemistry, The students in each of these classes have made fine class records.

A class of seven students who were not sufficiently advanced to join the regular class in algebra was assigned to me. They have taken the subject to fractions, and will, with one or two exceptions, pass good examinations.

In order that the work in the chemical laboratory may be satisfactorily carried on, I would respectfully ask that the state board set aside for the use of the chemical department, for the quarter commencing January 1st, 1888, the sum of $100.00.

CHARLES F. DAVIS.

Fort Collins, Dec. 14th, 1882.

F. H. WILLIAMS' REPORT.

DECEMBER 1ST, 1882.

To the President of the State Agricultural College:

I herewith submit my report for the departments of Mechanics and Drawing.

These departments were organized by a resolution of the Board of Agriculture passed at their special meeting July 26th, but work was not begun until the middle of the next month.

The immediate aim of these departments is to give such instruction in the use of wood and iron tools, the forge, wood and iron machinery, of drawing tools and of drawing in connection with the above, as shall give the graduate of the course in agriculture the much needed ability of caring for the machinery and buildings on a farm. He will also be able, with a short apprenticeship, to command journeyman's wages in either wood or iron.

Previous to the middle of August, comparatively little had been done in the mechanical department. The stock of tools consisted only of those necessary to keep up repairs on the farm and about the buildings. These tools had been kept in an open shed, where a carpenter's bench had been placed. Many of them were much out of order from

careless handling, or from the effects of the weather on the wood. But all of these were used for furnishing the shop, after being repaired.

The available funds were not sufficient to make more than a start. It was thought best to prepare for eight students at wood-work, six at iron-work, and two at the forge, and with the exception of the few tools mentioned everything had to be planned for and purchased. The two west rooms of the college basement were assigned to the mechanical department.

The south room was fitted up for the wood and iron workers. Benches were built around three sides of the room with eight wood vises about five feet apart. In the center was placed a substantial oak bench with six iron vises about four feet apart. The stove, farm grindstone and saw horses for ripping boards occupy the north end of the room, so that when all are at work there is no room for visitors except in the doorways.

This makes a very good shop except for room and the poor light on cloudy days, when those at the iron bench and at the east side of the room do not have sufficient light.

In the north room a lumber rack was built and part of the room was given up to a coal bin. The portable forge and anvil block were set in one corner. The light here is much poorer than in the wood shop, as the rack and bin obstructed part of the light admitted by two of the three windows.

Tools for working wood and iron were purchased. Such tools as were most used were placed at each vise and one or more sets of other tools were placed in the closet or store room. A delay of several days was caused by not receiving tools as soon as ordered, but by the 14th of September arrangements were so far completed that eight of the class in shop practice could commence work, and by the 18th the full class of sixteen were at work. But they worked at much disadvantage, as part of the tools had not arrived and there were no drawers or racks to hold those tools they had. There was also much delay caused by foundrymen furnishing cast-iron.

The following are a list of tools for the woodworkers: small saw, cross-cut, hammer, mallet, try square, T bevel, gauge, dividers, fore, jack, smooth and block planes, screw-driver, brad-awl with tools, hand broom, oil can, oil stone, half set chisels, draw shave, spoke shave, half set bits, brace. These sets cost us about $17.50 each. The tools for the iron workers are: Hammer, bastard file, mill file, square file, smooth file, calipers in and out, cold chisels, etc., hand broom. These sets cost about $4.00 each. Each vise is numbered and the tools belonging there is stamped with this number. Some damage has been done to the tools and benches during the term. This has resulted partly because the tools were not adapted to the work done, and partly to the carelessness of the students.

I would recommend that a deposit at the beginning of each term be required of each student, to be applied in payment of damages done to the tools or property, and balance paid back at end of term or credited at beginning of next term. Such deposit answers two needs: First, of restraining the student, who will be much more careful in such cases. Second, giving prompt payment in case of damage from carelessness.

I would further recommend that from this deposit be taken the cost of materials, lumber, iron, oil, kerosene, nails, screws, glue, coal, etc., used by each during the term, and this for the same reasons as given for similar charge in chemistry.

Since the class commenced work drawers have been made for the benches, and racks for holding the tools. The remainder of the tools arrived, and many that were not in condition for use have been ground and prepared.

This work has been done by Mr. M. W. Fuller, who was hired at first to build the benches and fit up the shop, and who has since remained instructing in wood-work during shop practice, and at other times making repairs or improvements about the buildings. It was recommended by the faculty at their regular meeting, September 18th, that he be hired for this purpose.

To date he has occupied his time as follows:

FOR WORK OUTSIDE OF MECHANICAL DEPARTMENT.

Chemical Department test tubes	12 hours.
assay furnace stand	10 "
Drawing Department tables	47 "
boards and T squares	17 "
Buildings College—	
Office repairs	1 "
Cabinet	15 "
Armory gun rack	6 "
	108 hours.
Library post-office case	5 "
Book shelves	32 "
Picture frame	4½ "
Paper knives	2 "
Repairs chapel doors	7 "
Floor room, back posts	7 "
Basement partition	10 "
Stair door	10 "
Rear door	10 "
Windows	3 "
Observatory shelf	2 "
Chairs repairs	2 "
Coal bin	5 "
Out house	30 "
Dormitory windows	37 "
Labor on barn	24 "
Step ladder	6 "
Flower boxes	40 "
Shop practice	110 "
Wood benches	80 "
Racks, drawers	49½ "
Iron benches	20 "
Racks and drawers for same	34 "
Anvil block	7 "
Lumber rack	5 "
Tools repaired, etc.	72 "
Total time paid for	683½ hours.

Besides time of instructor for class and repairs, the current expenses are for materials used by the class. This last item will amount, for this term, to————, and for next two terms each, to

The course of work has been somewhat restricted this term. In woodwork, because tools did not come or were not ready for use; in iron work, from lack of cast iron; in blacksmithing, since proper quality of coal was not obtainable.

The woodworkers have made models involving the use of the plane—to plane flat, out of wind; to plane to thickness and width; to plane across grain.

Saw—to saw to a knife line. Next the various uses of saw, plane and chisel, by several models in mortising, gaining, dove-tailing, straight and corner, nailing, glueing, joint, mitre with and across grain, plain picture frame, joints and scarfs in carpentry, small screen door, panel door, pillar.

The iron workers have had exercises involving the use of the file, fileing square, hexagonal square, cross and small cube from round iron, chip and file to line, band iron, cross square with square hole, hexagonal star, octagon with hexagonal hole, ring with sides cut out and fitted to caliper, chipping cast iron flat surface to line, slot and champfer, draw filing, scraping and grinding three surface flats, cube filing by eye, check work, turn filing, points, shoulder across screw.

In blacksmithing, models have been made illustrating drawing, upsetting, bending, welding, hammering square, hexagonal, octagonal and round sections; making rings, round and square section.

I would recommend the purchase of a foot lathe, fitted with buzz and jig saw attachments, to cost about $75.00 delivered.

With this addition, while remaining in the present quarters, the first year's work would be somewhat as follows:

Wood work	12 weeks.
Iron work	12 "
Turning	6 "
Blacksmithing	6 "

The exercises to be about as enumerated, with some additions.

For wood turning the exercises would show the use of chisels—flat, gouge, diamond, cut off; different methods of holding work; exercises showing skill of student.

For iron turning by hand the exercises would show how to use the various hand tools, also the skill of students. Simple exercise with the buzz and jig saws would be given to familiarize the students with those parts preparatory to cutting out designs made in the drawing class.

By dividing the class and as at present assigning part to each kind of labor from fourteen to sixteen students can be accommodated. The second years' work would give exercises at the foot lathe, forge, and with the tools for wood and iron, more especially connected with machinery and building exercises in pattern making with lectures on founding and a visit to the foundry in town, the construction of models from designs made in drawing class, also models in architecture.

With the addition of a foot lathe the present outfit of tools is sufficient to fulfill the first part of the desired plan; to fit graduates to care for and repair frame buildings and machinery, as it is highly improbable that any other tools will find their way to the farm, but to complete the plan, and fit them to take journeymen's wages after a short apprenticeship, to the present outfit should be added power machinery for wood and iron and a foundry.

This is especially necessary in case it is decided to add to the college curriculum the courses of mechanical engineering and agriculture.

I would therefore recommend that as soon as possible, a new shop be built and that plans be made, the completion of which shall afford facilities for giving to students agriculture, mechanical engineering and architecture, the best existing course in practical mechanics.

This last may seem somewhat presumptuous but there are several reasons in its favor.

It needs no statement of mine to prove that Colorado is growing rapidly. Population and trade are increasing, railroads are building; agriculture is developing; mines are opening; there are more and more smelters, blast furnaces,

steel plants, iron works, etc., in this State. Not many decades will pass before this State will stand in the front rank as to wealth if not in population.

Hence it appears that many special technical schools will be needed to prepare, here at home, persons for such duties, instead of sending them and their money thousands of miles away to the eastern schools Colorado will be able to pay for such schools and should have the best obtainable. That instruction becomes more and more necessary for agricultural students is evident by a glance at the rapid increase in the use of machinery on the farm. The farmer should know how to use his steam engine and other machinery to the best advantage as before stated. To fit him for this he should have some such a course in mechanics as has been given above. A little of the expense of a shop prepared to give this course spent for more tools would fit the shop to train engineering and architectural students in a three years' course in mechanics, and the college classes would only be increased in number by a few subjects in higher mathematics and a little more advanced physics, an increase highly desirable.

It is doubtless inexpedient to at once carry out such a plan, for a shop, perhaps the next ten years will hardly find it completed, but it is better so to plan than without a plan, to add different parts as necessity demands. This is true, because to be complete, a shop is better as a whole, the machinery, power, forges, foundry, benches, etc., are in proper order relatively, and not as in too many shops, scattered about in every way and place.

The old reading room in the second story, assigned for drawing, contained some shelves partly filled with books and a reading stand. This stand with a few alterations made an excellent drawing table.

Two new tables were made in the shop.

The tables had division lines every three feet, so that twenty-six students could be accommodated. This would not have been possible without the excellent light furnished by five windows.

Black boards were made to use in explaining and illustrating problems.

Several times the class was hindered in its work, by delay in obtaining tools and materials. For the first few days lectures were given, explaining in regard to the tools the arrival of which was expected. About two months time was necessary to show that no paper of the size and quality desired could be obtained in Fort Collins, Denver, Chicago and New York, and to bring to us the ream of paper we now use.

During this time very fortunately, private supplies of paper were found, sufficient to employ the class most of the time, but some of the paper was of a very poor quality. All drawings are required to have a size 8x11 with an ink border, the lines of the border are made through the large margins, holes are made and the plates can then be bound.

As before stated the subject of drawing is only intended to help to a better understanding of the work in the shop, and is not, as supposed by some, to teach sketching or drawing as in art.

For the course in agriculture the instruction will be somewhat as follows: The first term will give practice in the use, repairs, and preservation of drawing, instruments, simple problems involving the use of lines of different kinds, relation, etc., the principles of orthographics, projection and plain lettering.

In the second term drawings of a full set of models, wood and iron, lettered and figured, to describe and give dimensions.

In the third term, plates in descriptive geometry and perspective.

In the first of the second year, drawings of machinery and details, how to take notes and dimensions for drawing, drawings for machine repairs. In the second term; designs plain, fancy, and scroll, details of architecture.

In the third term, full plans and specifications in architecture.

I would recommend that the second year class be assigned another room and each student provided with a table or desk, as the work of this year requires more room, and greater freedom of movement at work.

Besides the regular work in the mechanics and drawing I have had charge of the classics. First term, agricultural, preparatory and second term algebra, freshman.

In arithmetic the class commenced the book and during the term have proceeded as far as duodecimals. There has appeared in some of the students some lack of pride in keeping up the standing, as *how* to study, showing a lack of high school training. But during the term there has been considerable improvement.

The class in algebra commenced with the subject of fractions and has studied radicals, involution, and equations of one, two and more unknown quantities. During the first week or two the class showed that the subject was somewhat forgotten since last studying it, but as a class they have given more satisfaction as to work and interest, and have been more nearly of the same calibre as students.

F. H. Williams,

Mechanics and Drawing.

MR. HINMAN'S REPORT.

To the President of the State Agricultural College of Colorado:

I herewith submit the following report of the operations of the College farm for the year past, ending November 31, 1882:

The land farmed in crops the last year, as the report will show further on, was nearly all new and plowed for the first time. The ditches being new, and the surface of the land farmed being very uneven, long dikes or levees were required to get the water over for irrigating the crops. These being new would give way, causing loss of water and delay in getting the crops irrigated. I make this explanation, for everyone who has farmed in this State knows what the difficulties are, especially on very uneven ground, like the farm here.

I commenced plowing last fall, and plowed twelve acres of new ground and nine acres of stubble land. On the 20th of October I sowed four acres of winter wheat, on land plowed for the first time. This was drilled in and harrowed, putting in 40 lbs. of seed per acre, as follows: one acre of Clawson, one acre of Fulty, two acres Hedge's Prolific. The ground was very dry when the wheat was sown, and continued so dry that the wheat did not come up until the following April, making it so late and out of season that it rusted very badly, and made the yield very much less than it would have been under more favorable circumstances. I harvested the Fulty August 7th, and the Clawson and Hedge's Prolific August 12th, the Fulty being fully one week the earliest variety. The yield when threshed was as follows: Fulty, 11 bushels; Clawson, 10 bushels; Hedge's Prolific, 20½ bushels. All were injured by the rust to at least one-half, or the yield would have been double what it was. The Fulty was the best, from the fact of its being the earliest. As to the quality of the wheat, I am of the opinion that the Fulty wheat will give the best satisfaction, it being an amber wheat and hard variety, such as Miller's Desire; while both the Clawson and Hedge's Prolific are white and of the soft varieties, not possessing the strength and strong flour capabilities of the hard amber wheats.

FIELD NO. 1, WEST SIDE RAILROAD—8 ACRES.

I commenced drilling in spring wheat March 22d, finishing the first piece of eight acres on the 24th, on new land plowed in October. The land was thoroughly pulverized with a "Chicago Screw Pulverizer," and was in a good condition for new land, the seed-bed being finely prepared for the drill. On four acres I sowed 30 lbs. of seed per acre, and on the remaining four 40 lbs. of seed per acre, the seed being prepared by being well cleaned through the fanning mill. Weighed the quantity for each acre in a separate bag, and soaked it in a strong solution of blue stone or blue vitriol (sulphate of copper). After being drilled in it was harrowed with a light smoothing harrow. The wheat sown on this field is known as College No. 22 or Australian Club, a white wheat. The spring was dry, and the wheat did not commence to come up until April 25th,

making it late getting a start. I irrigated it once, commencing June 24th and finishing July 5th. One or two high places were not irrigated for several days later. The wheat rusted so as to diminish the yield at least five bushels per acre. I harvested it August 14th. In regard to the amount of seed used per acre, there could be noticed no difference between the half with 30 and the half with 40 pounds per acre. It being all threshed together and put in one stack, the amount from each was not separately accounted. The whole eight acres threshed out 176 bushels, or 22 bushels per acre.

PLAT NO. 2, EAST FROM RAILROAD, EIGHT ACRES.

This was stubble land, which had yielded a crop of wheat last season, and was plowed last fall. This was pulverized and drilled in the same as Plot No. 1, the preparation of the land being the same, the seed undergoing the same careful preparation. Three acres were sown with 30 pounds and five acres with 40 pounds of seed. The kind of wheat sown is one of Mr. Prindle's hybrids, No. 4 (college No. 34) having as yet no name. Commenced sowing this March 27 and finished March 29. This came up the same as Plot No. 1—about April 25; or, at least, that is the date that one could see that the grain was coming up. This was irrigated once, commencing June 28 and finishing July 12, being delayed several days of this time on account of a break in the main ditch; harvested it August the 15th; yield, when threshed, 234 bushels, or 29.2 bushels per acre. I think that this wheat will give good satisfaction, as it is a good strong grower, does not rust, and the berry is of a light amber color, hard; and, I believe, will prove a good milling wheat. It shells easily and should be harvested in time or will waste some.

PLAT NO. 3, SOUTH SIDE WEST EIGHTY.

Six acres of Prindle's hybrid No. 4 (college No. 34) fifty pounds of seed per acre. The land was plowed for first time and pulverized the same as above; wheat drilled in and harvested the same as that above on April the 18th; irrigated once, commencing June 24 and finishing July 7; harvested August 18; yielded, when threshed, 174 bushels,

or just 29 bushels per acre. This being Prindle's hybrid No. 4, (college No. 34) did not rust, was a good growth of straw and fine berry.

PLAT NO. 4, EIGHT ACRES.

This is alongside of Plot No. 3, and is the same kind of land, plowed and prepared the same, and seeded in the same manner, the day after April 19, with fifty pounds of seed per acre of College No. 22 or Australian Club. Irrigated the same and at the same time as plot No. 3; harvested August 17, yielding, when threshed, 164 bushels, or 20½ bushels per acre. The difference in the yield of these two plats arises from the fact that No. 4 rusted and No. 3 did not. This experiment would go to prove that there is a difference in the variety and kind of wheat, enabling the one to resist the rust while others can not. Here were two varieties sown at the same time, receiving the same treatment. Both looked the same up to a few days before harvest, there being no choice in stand or growth, the only difference being that one rusted while the other did not.

PLAT NO. 5.

This plat consisted of 1¼ acres of stubble land, plowed last fall, being on the east side of plat No. 2. This was prepared in the same manner and was drilled April 19, with the Australian Club (college No. 22) with 65 pounds of seed. This received the same treatment as plat No. 2, being contiguous, and was harvested at the same time. It threshed 21 bushels, or a little less that 20 bushels per acre. It was rusted very badly, making the yield at least nine or ten bushels less per acre.

PLAT NO. 6.

This consisted three acres under the Emigh ditch, and was a piece of stubble land, plowed last fall, having been in winter wheat the year before. This came up last fall and was drilled in alfalfa this spring. The wheat had a very good growth and was of a mixed variety, there being several experimental plats there last year. It was harvested

and threshed and realized 70 bushels. The figures above give the net amount of bushels from the machine, the rakings and clean-up at each stack amounting to 28 bushels more, making a total of all the wheat raised of 867 bushels on 32¼ acres on an average for the whole of 27 bushels per acre. This does not include the winter wheat referred to above, of which there were 41½ bushels, making a grand total of wheat raised by me on the farm of 908½ bushels, machine measure.

OATS.

PLAT NO. 1.

This ground was new plowed for the first time and pulverized with the "Chicago Screw Pulverizer" being drilled in and harrowed with light harrow afterwards. This plat No. 1, is on the west eighty, adjoining wheat plat No. 4, and consists of ten acres. The seed (white Australian) was cleaned well by running through the fanning mill, weighed, and soaked in vitriol water. Last year the same oats smutted very badly. This year blasted oats were very scarce, there being none to speak of. I believe that soaking oats in vitriol is as beneficial as the soaking of wheat for the prevention of smut. On this plat, I sowed 60 pounds of seed per acre, April 25th and 26th. This was irrigated once, commencing June 27th, ending July 7th. It was harvested August 11th, yielding, when threshed, 683 bushels by weight of 32 pounds per bushel, or 68.3 bushels per acre of good clean oats.

PLAT NO. 2.

Two acres sown April 26th on stubble land under the Emigh ditch, which was last year sown to wheat. The land was plowed, drilled in, and harrowed with a light smoothing harrow. It was harvested August 11th. Being under the Emigh ditch most of it was too wet for a crop. I seeded alfalfa with the oats and have a good stand of it. The oats threshed out 67½ bushels, or a little over 33 bushels per acre. The reason of the light yield is, that while some of the ground was too wet some was, also, too dry.

CORN.

PLAT NO. I.

This consisted of six acres on the northwest corner, and was last year sown to wheat. This I planted May 2d, in Blount's White Prolific. It was worked over four times with a cultivator made from the "Chicago Screw Pulverizer." It was hoed twice, and the ground kept clean. It was irrigated once after being cultivated, and gave great promises, which were blasted by its failure to mature. Being cut up, it made 127 shocks of good fodder. I am of the opinion that this corn is not adapted to this climate, owing to its lateness in maturing. However, the extreme coldness of the spring and exceeding moisture in the ground at the time of planting, may partially account for this failure, the corn not having come up until after May 26th.

PLAT NO. 2.

This consists of ten acres adjoining the lake, where the trees have been set out. It was plowed for the first time, this year, pulverized with the pulverizer, and planted May 8th and 9th, in Yellow Dent, planted only one way, and cultivated with the screw pulverizer twice and hoed once. It was irrigated once. It proved an unprofitable stand, owing to the continued cold weather in the spring, after planting. It was cut up and husked and realized 225 bushels of good, sound husked corn, or 22.5 bushels per acre. From this we also got fifteen loads of good fodder.

ALFALFA.

I sowed in alfalfa the land under the Emigh ditch that is usually too wet in the spring; also, the plat in the southwest corner of the 160 acres—in all, under ditch, 12 acres, 5 acres of the same being in grain as stated above. There was sown per acre 20lbs of seed, the same being drilled in with the grain drill. All made a good start and will undoubtedly give a good yield of hay next year. I also sowed one acre on land above the ditch, where it is too

high to be irrigated, Prepared the land with the Chicago Screw Pulverizer and drilled it in. There is a splendid stand and it will prove whether alfalfa can be grown without irrigation or not.

I have cut and put up thirty (30) tons of good hay, having cut it with one of Walter A. Woods' mowers. About fifteen (15) tons of this was cut on the west eighty, on ground mowed for the first time. This I have snugly stacked near the stable.

TOOLS USED.

Plowing was done with an Oliver Chilled, No. 20 cast plow, giving good satisfaction. The Chicago Screw Pulverizer was used in every field and plat, and for putting ground in good condition for seed, is the best implement I have ever seen used. It pulverizes the ground thoroughly to the depth of from 4 to 6 inches, leaving a fine level surface and helps largely to increase the yield of grain. Also by taking two sections, and a frame made for them we have one of the best cultivators I have ever used for sowed crops, using two horses. The harvester used was a Deering twine binder, six foot cut, giving good satisfaction, doing its work well, missing but few bundles and running very lightly, doing the work well with three horses. No repairs have been required during the season, and it now stands in the tool house in readiness for another season. The hay was cut with a Walter A. Wood mower, being the same as was used last year, only a little repairing having been found necessary, and a new knife required. For hay rake we have used the tiger, a good rake for general use on the farm. For a drill the triumph, 10 hoed, 8 inches apart, and one that I can recommend as doing good work.

PLOWING.

This fall we have plowed all the suitable land remaining on this 160 acres, amounting to about 30 acres, the greater portion being with three horses to the No. 20 Oliver Chilled plow. It was plowed from 7 to 9 inches deep. The ground being very dry it plowed quite hard, but is well done and will be in good condition the coming spring.

Sowed 14½ acres in winter wheat, as follows: 1½ acres in No. 40, Black Centennial; 4 acres in Hedge's Prolific; 4 acres in Clawson; 5 acres in Fultz.

This was sown October 30th and 31st, with drill, sowing 70 pounds of Black Centennial on the acre and a half, and 60 pounds per acre on the rest. The land was well plowed, drilled in, and pulverized with the "Chicago Pulverizer." It seemed impossible to get the land in good condition without using the pulverizer, as it was plowed dry and was cloddy; but the pulverizing left it in good shape.

RECAPITULATION OF CROPS.

WINTER WHEAT THRESHED.

Fulty	11	bushels.
Clawson	10	"
Hedge's Prolific	20½	"
Total	41½	bushels.
Deduct amount sown	13	"
Total net	28½	bushels.

These are divided as follows, and we now have on hand 6 bushels of Fulty, 6 bushels of Clawson, and 16½ bushels of Hedge's Prolific; in all 28½ bushels.

SPRING WHEAT THRESHED.

In spring wheat we have the following table:

Spring wheat threshed	867	bushels.
Shipped to Hotel's mill	142½	"
Amount on hand	724½	bushels
Amount winter wheat on hand	28½	"
Total winter and spring wheat now in college barn	753	bushels.

We have, also, 750½ bushels of oats on hand.

The corn was husked and stored in the barn, and has been used as fodder for the horses since September 15th.

The hay has been properly stacked. and, like the corn and corn fodder, has been set aside for the needs of the farm stock.

In conclusion, I take the liberty to make the following suggestions:

1st. There should be a thorough system of drainage adopted, to properly drain the low, wet, alkali ground running through the farm. At the earliest practicable time in the Spring, a suitable amount of tiling should be procured and laid.

2d. After a suitable amount of land shall have been set aside for an experimental plat, and a piece of ground sufficient for raising a small amount of seed in stock, and feed requisite for the needs of the farm, the residue should be seeded down in permanent grass, and let there be more good stock kept on the farm.

Respectfully submitted,

P. M. HINMAN,

Farm Manager.

Fort Collins, Dec. 14, 1882.

PAPERS READ BEFORE INSTITUTES

HELD AT

Boulder, Loveland, Ft. Collins and Trinidad,

DURING WINTER OF 1881-2.

FLOWERS, THEIR CULTIVATION IN THE HOUSE.

By Mrs. E. D. Armstrong, Fort Collins.

Nature is the great chemist of chemists. In her grand laboratory the earth, she is forever at work, knowing no weariness and needing no rest. From decay and death she brings forth life and beauty. The crucibles are ever at melting heat, and in them the work of analyzation goes on, and the separating and combining of the elements that enter into the composition of every part and particle of our globe. Here are brought together the materials that form the mighty rocks and the foundation and superstructure of the everlasting hills; and there she unites the constituents that form water, and makes a way for it to bubble forth through the piled up granite, and then it leaps down the mountain side and wanders in quiet beauty through the valley, and is gathered together in that great reservoir, the ocean. Here she sends to the surface a wonderful growth of vegetation, which in the course of the ages becomes imbedded in the soil. With her chemical forces she transmutes this vegetable matter into that useful article, the coal that warms our dwellings.

Now she calls to her aid explosive gases, and the solid rocks are rent, and she fills the seams and the fissures with beautiful cyrstals, and the pure, shining gold. A lump of

unsightly coal is subjected to the power of certain minerals, that cause it to harden and crystalize, and purify and refine, until it becomes the gem of gems, powerful to decompose the faintest ray of light, and send it forth sparkling in irridescent beauty. We look upon such gems with admiration, but an admiration mingled with the awe we ever feel toward the unattainable; for they must ever adorn the brow of royalty, or glisten on the forms of those financial kings who are able, with their abundance, to purchase regal splendor. But in this great workshop nature produces other gems as truly beautiful, and with her great loving heart she so disposes them that the rich and poor may alike enjoy them. Here she selects her materials and mixes her colors, and the green trees and the grassy carpet beneath our feet appear; and broadcast, over all, the myriads of flowers painted in hues that no lesser artist can hope to reproduce.

Leaving the cereals and the fruits and all the weightier productions of the earth which come within the province of this institute, to those who are more competent than we are to discuss them, we would call your attention for a few moments to the flowers, because we consider them as filling an important place in God's great plan, and as they are withal our favorite theme, we would not have them wholly left out in discussions like the present. We believe that to him who truly loves nature

> "The meanest flower that blooms can give
> Thoughts that do often lie too deep for tears."

And when these bright jewels of nature are so freely scattered over the earth, how they make the gray old prairies smile, and how they cluster in the nooks, and nestle among the moss on the banks of the stream, and are mirrored in the clear running water. The mountains are so thickly studded with them that they seem ablaze with splendor. They are very brave and hardy too, some of these delicate looking mountain beauties, for we have seen them lifting their heads right up through the snow, and blossoming there.

In an excursion through the mountains we camped at the close of a hot July day, on the summit of a pass by

which we were crossing the snowy range. The next morning everything in our outfit that could freeze was found badly frozen, and our fingers stung with the cold as we prepared our breakfast. The gloomiest outlook however, was to see the flowers and shrubs all stiff with frost. But when the sun shone out and touched them with his magic power, they emerged from their frost bath as fresh and bright as if they had taken a warm shower bath.

Those who are deprived of the luxury of feasting eye and soul upon flowers as they flourish in nature's wildness, or in the cultivated garden, have an unfailing alternative.

> "The most unfurnished with the means of life,
> And they that never pass their brick wall bounds
> To range the fields and treat their lungs with air,
> Yet feel the burning instinct; overhead
> Suspend their crazy boxes, planted thick
> And watered duly. There the pitcher stands,
> A fragment; and the spoutless tea pot there,
> Sad witness how close-pent man regrets
> The country; with what ardor he contrives
> A peep at nature, when he can see no more."

Upon the successful culture of plants in the house there are many theories, but practice and experience do not always sustain them. Indeed, in our earlier attempts, we confess to having tried, in our too great zeal, the theory of this one and that one until many a cherished plant went the way of the poor market man's donkey.

To make a healthy growth they requiret reatment akin to that you give your children; not spasmodic attention, but steady, uniform, kindly care. It would be cruel in us to say to that young mother bending with breaking heart over that little open coffin. "My dear madam, it was ignorance of the delicate organization of your child, and of the simple principles of hygiene that has brought this anguish upon you." And yet how often is it a strong, incontrovertible fact. The conditions on which house plants thrive are proper heat, light, water, pure air, cleanliness and healthy food. Of course we always give them the sunniest window and keep the temperature of the room as uniform as possible. One great essential is bottom heat, allowing the warm air to get under the flower pot. I have an oleander, not in a "broken pitcher" or a "spoutless tea pot," but in an

old paint keg. I could not find a proper place for it, and it did not do well. It stood on a thick block of wood, placed on the floor. At length it occurred to me to heat that block of wood as hot as it could be made without burning, and place my oleander keg upon it. By repeating the process every day, the effect has been satisfactory. My oleander is growing finely. In the manner of watering plants, I have no hesitation in saying that experience is the best teacher. By close observation one soon learns how much each particular plant requires. Pure, fresh air is indispensable, but this must be admitted to them with great caution, as a draught of cold air on many plants may be productive of fatal effects.

A year ago last fall a friend gave me a slip of begonia. It soon rooted and grew rapidly and became a fine plant, and all winter was loaded with its pendant wax-like blossoms. When the first warm spring days came on I thought I would treat it to an extra airing, so I placed it with some hardy geraniums out on the piazza and went about my work. On returning to my plants not long after, I saw that the leaves of the begonia were drooped and that the flowers were hanging their heads still lower. A slight change had occurred in the atmosphere, a perceptible chilliness pervaded it and my begonia felt the effects. Indeed, no subsequent petting or coaxing could restore it to health; it had taken its death chill.

The cleanliness of plants is just as important as personal cleanliness, and that we know is next to godliness. It is not enough to put water on the roots, the foliage also needs it. The leaves perform important functions and if pores are closed with dust and dirt collecting upon them, unhealthy plants are the result. Sprinkle them with warm water and see how fresh and bright they will look—they will seem to say, "thanks for that refreshing bath." The small quantity of soil in which house plants are kept, however rich it may be, requires frequent fertilizing. There are many kinds of plant food sold for this purpose which are good. If these cannot be obtained, a liquid made from well decomposed manure I know to be good, if applied with caution.

And now, though our homes may be lowly, no pictures by the old masters nor grand frescoing may adorn our

walls, still we may have them decked right royally with these gems, these pictures fresh from the hand of our Father in heaven. And when I shall have done enjoying the works of God here and shall be laid away in my mother earth, I would not that the marble or the granite should be raised to my memory. I would have the hand of affection plant there a simple flower. It will last longer than the stone, for when that shall decay it will know no resurrection, but the flower will continue to reproduce itself while the grand procession of the seasons shall move on, and thus shall my memorial be as lasting as time itself.

DAIRY FARMING.

By J. E. Washburn, Boulder Institute.

The advance in price of the dairy products of the United States made during the past six months, taken in consideration with the fact that there is a constant increase of that product in the States east of the Missouri river, as evidenced by the published report of the sales of butter and cheese for export at our principal seaboard markets, would seem to indicate that the dairymen of eastern and Mississippi valley States were keeping pace with other great branches of agricultural industry, both in the matter of increased product and profit.

But is this true of Colorado? When the market reports of our principal towns are made up almost entirely of Eastern Creamery, Elgin Dairy, Illinois, Wisconsin and Iowa butter and cheese, with an occasional quotation at the bottom of "ranch butter," or perhaps the remark that there is not enough Colorado butter on the market to warrant a quotation, I am led to believe that we are not keeping up with our eastern co-laborers in the struggle to supply the world with food. Such being the fact, it is eminently proper for the farmers and their wives assembled at this time as a "committee of the whole" on "ways and means" to take the subject under consideration and ascertain, if possible, why this state of things exists.

Having been a resident of Colorado for over twenty-one years, and having been thrown in contact with many of her people who are engaged in the various branches of agriculture, I have come to the conclusion that as a rule they are not farming for fun, but for profit, and are therefore compelled to adopt the theory that dairy farming in Colorado under existing circumstances is unprofitable. Yet when we see the dairy interests of New York, Pennsylvania, Ohio, Illinois, Wisconsin and Iowa advancing with such rapid strides, and find those engaged in it as prosperous as their neighbors in other pursuits, we are led to enquire why it is that here in our own State, with better natural advantages and a home market we allow the eastern product of the creamery, cheese factory and oleomargaine laboratory to take possession of the field.

I am confident there can be but one correct answer to this, and that answer may be condensed into one word—*Shiftlessness.* I mean by that a want of system, a neglect of the details of the business and a failure to secure the proper conditions for producing the best and most profitable results. I will at this time briefly give my views on this question of how to make dairy farming more profitable, with the fact staring me in the face that a majority of those whom I am addressing are better qualified to present this subject than I am myself, but hoping to be able to provoke others into discussing it, to the end that we may each gain some information from the experience of our neighbors.

There are three principal departments connected with this industry, namely: The production of milk for sale to the inhabitants of our towns and villages, the manufacture of cheese, and butter-making. Of the first two I will speak but briefly, not from their lack of importance, but because I have had less personal experience in those branches and therefore feel incompetent to do them justice. The first named, under the proper conditions of location, selection of stock, care of animals, generous feeding, and a convenient and ready market, is undoubtedly the best paying branch of the business. The second, the manufacture of cheese, has seemingly been almost entirely neglected in Colorado, probably for the reason that it requires a greater outlay of capital to embark in it, more attention to the details by the farmer himself, and from the idea that generally prevails

that it requires more skill to make cheese than butter. It is true the care and management of a cheese dairy cannot be shifted off on to the women and children as easily as a small butter dairy, but it is not true that cheese is an unprofitable product of a farm, that is, if put in proper condition under the care of a farmer who studies his business and gives that business his own personal attention and best thought.

The high state of perfection that has been attained in butter-making, on the creamery system, calls for greater exertion on the part of those engaged in the business on the dairy system. A late number of the *Colorado Farmer* quotes creamery at 40 cents to 50 cents per pound; dairy, at 25 cents to 35 cents, and cooking, at 15 cents to 20 cents. This would show that the average dairy farmer receives from 10 cents to 20 cents per pound less for his product than the owner of the creamery. Does not that ten or twenty cents per pound represent the difference between profitable and unprofitable butter-making? And is it not possible to make an article on the dairy plan that will command a price ten or twenty cents higher than creamery? Certainly it is; for we know that the makers of strictly "gilt-edged" find a ready market for it at from fifty cents and upward. The question of quantity as well as quality has to be considered in making up our balance sheets, and figure conspicuously in deciding which side of the sheet the balance will be found. In other words, we will find the profits greater at the end of the year if our cows have produced two hundred pounds of butter per head than if they have produced only one hundred. To produce the best results all that is required is system. The first thing to be considered is the farm, its condition and adaptability to the production of crops that will make the most milk, and of the best quality. It should consist of clean pasture, free from weeds and well supplied with pure water; meadow land that produces sweet, succulent grass; cultivated land that will grow roots, corn and other fodder crops. It should have roomy and convenient buildings for stabling stock and storing the necessary food for it; a well-arranged dairy house, so constructed as to secure as nearly as possible a uniform temperature, and entirely removed from the odors of the stable, pig-sty or kitchen; an ample supply of pure water for the dairy, and a good-sized ice house. The farm

should be divided into fields of convenient size so as to allow stock to be changed from one field to another at pleasure. A change of pasture makes fresh milk as well as fat calves. In the management of the farm grow such crops as will make milk and butter. Don't imagine we can raise wheat, sell it off, and the women and children run a successful dairy on the weeds growing along the ditches, wheat stubble, and the straw pile. Raise cultivated grasses, clover, alfalfa, millet, corn fodder, corn, sugar beets, mangel wurtzels and other roots. Let us harvest those crops at such a stage of their growth as will secure the most valuable qualities. All fodder crops should be cut and cured while they contain their natural juices, and when cured stored under cover.

The selection of stock for the dairy is of sufficient importance to warrant the most careful consideration. If the conditions are such that the sale of milk or the manufacture of cheese will bring us the best results, our cows should be selected with regard to the quantity; if butter-making is to be our business, quality more than quantity should govern us. Without the experience of those who have preceded us in industry we would be compelled to experiment for a long series of years to determine what type of cow was the best adapted to the different purposes required; but fortunately for us, we are not compelled to adopt that tedious process to develop and establish those desirable qualities. We can find easy access to knowledge for the purpose of improving our native stock, races or breeds, thoroughly fashioned by the hands of successive breeders, to meet our immediate needs. The power of transmitting those cultivated qualities is possessed by them to such a degree as to render it impossible to improve our stock from the start. The breeds that have been introduced into this country for their superior milking qualities are the Short-horn, Ayrshire, Holstein and Jersey. Some families or strains of the short-horns have been noted for being large milkers, but in the hands of the western breeder, who was more desirous of securing a large carcass than a full pail, they have gained little notoriety for their dairy purposes. The Ayrshire is one of the finest milking breeds, trained and clutivated for that purpose till in this respect it has become noted and its qualities almost unerringly transmissable. They have gained a reputation for quantity

rather than quality, and are therefore more valued in the milk and cheese department than for the butter-making. The Holsteins are a large, handsome breed, but are also remarkable more for the quantity than the richness of their their milk. The last (and least as regards to size) are the Jerseys. Bred in her native home for centuries for the one purpose, of producing the largest quantity and finest quality of butter, those traits have become fixed and transmissable to a certainty. For richness of cream, flavor, color and texture of butter, she is unsurpassed. Small in size, she is easily kept while not in milk, and possessing the power of turning the food consumed into butter fat instead of beef fat, she is admirably fitted to fill the place she has taken at the head of the list as a butter cow. Many persons object to the Jersey on account of her diminutive size, and give as a reason that her carcass will not make much beef when she becomes useless as a milch cow. The same line of reasoning would lead us to buy an old-fashioned heavy cast-iron plow that would nearly kill us and our teams, because it would sell for a few shillings more for old iron. I will try to demonstrate the point by the use of a few figures, and it is said that "figures won't lie." Every one must admit that, everything else being equal, it requires more food to supply the necessities of a large animal than a small one. After the necessary amount of food eaten by a cow has been appropriated to the support of the frame, tissues, blood, etc., the balance will be used for laying on of fat or the production of milk. Take for instance two cows, one a short-horn and the other a Jersey, each a fair sample of their respective breeds, and the Jersey will be about one-half as large as the short-horn. Give each one an equal quantity of food. The little Jersey will of course have the largest surplus after appropriating the amount necessary to sustain her body, to turn into butter. Under these circumstances it would be fair to presume she would make, say one pound of butter per week more than the short-horn for forty weeks in each year; in eight years (the average period of usefulness for a milch cow), she will have beaten the big cow by three hundred and twenty pounds, which at thirty cents per pound would be ninety-six dollars, an amount that the big short-horn will hardly be able to overbalance when sold to the butcher.

But we must pass to the consideration of other matters connected with this subject, some of which are of

greater importance than those already discussed. The question of feed figures more prominently in determining the profits of dairy farming than any other, and with me was the most difficult one to settle. What to feed, and how much to feed, to produce the best paying results, are problems that can only be solved by actual tests My own experience has satisfied me, that nothing short of a full, generous and regular supply of sweet, rich and palatable food, will bring a dairy cow to her highest point of profit. Of the various crops which can be grown on a Colorado farm for the use of the dairymen, I consider the following the most valuable: Upland hay, alfalfa, clover, fodder corn, oats, field corn, wheat bran, meadow hay, squashes, sugar beets, mangel wurtzels, parsnips and rutabagas. All the grasses as well as oats and fodder, should be cut early, to give the best results. Root crops to be stored through the winter and fed during the early spring months before grass starts. With the foregoing list we have a variety, that if fed judiciously, will keep our cows in a healthy condition, with keen appetites. The care and management of dairy cows is an art. That art can only be acquired by the practice of nearly the entire calendar of virtues. The successful manager of a dairy herd should at least be possessed of a large stock of patience, perseverance and ardor, and have sufficient executive ability to enforce the application of those qualities by every one who comes in contact with his cows. Gentle treatment and quiet handling have much to do with the quantity and quality of milk. Fast driving, dogging, loud and boisterous talk, and the wrong use of the milking stool, will interfere seriously with the profits. Of the management of the dairy house and the details of butter and cheese-making enough could profitably be said to occupy the time of this institute for an entire day, but as I am conscious of the fact that much more information can be elicited by a general discussion of the subject by the dairymen and women present, I will give but a brief and general outline of the operations connected with butter-making, and some of the essential points in the production of the best article. In the treatment of milk and butter the utmost cleanliness is especially requisite. From the instant the milk leaves the udder of the cow till the golden product is placed in the hand of the consumer, this important point must be kept in view. The dropping of filth in the pail

from the cow, the presence of old milk or cream or a taint of it in the pail, pan, churn or butter worker, will detract from its good quality. The milk room must be free from unpleasant gases or odors, the air kept pure and the temperature as near 60 degrees as possible. As to the value of different systems of deep and shallow settings of milk, and the various inventions for handling it, which have been brought into use in the past few years, the best dairymen disagree. In my own dairy we have used the shallow pans, but shall probably adopt the deep pan system the coming spring. Under this system, with a low temperature, the cream is kept sweet till near the time of churning, when it should be warmed sufficiently to develop a moderate degree of acidity before it is put into the churn, while some good dairy people advocate churning perfectly sweet cream. I believe the best butter is made from sour, for the reason that the acid assists in dissolving the sacks containing the butter globule, and separating the buttermilk and caseine from it, and destroys and carries off the objectionable animal odors. The churn should be such an one as will produce the least friction of the cream against the paddles or dashes, in fact the best churns have no machinery inside, but separate the butter by concussion alone, which leaves the butter in granules, which is very essential to a fine grain and texture. Too much churning and too much working makes wool grease of more butter than any other cause. The best apparatus for working it is some device for rinsing it thoroughly with pure cold water in which clean salt has been dissolved. The milk, caseine, and other foreign matter is thus washed out, leaving the grain unimpaired. After mixing carefully about one ounce of salt to the pound of butter, set it away in a cool place for twenty-four hours, when it should be worked over with some device that applies only pressure, I use the home-made lever butter worker and believe it is the best in use. It should at the second working be put up in some neat and attractive package that will admit of its being transported and delivered to the consumer without exposure to the air or heat. I have been using for the past season a convenient and cheap package that seems to meet the requirements better than any other that has come under my observation. I have with me a sample which those interested are invited to examine. While I have not been able to even touch

upon many important subjects connected with this industry, I hope to have succeeded in enlisting your attention, to the end that the discussion which I hope will follow may throw much light upon it.

ILLUMINATING OIL.

READ BEFORE THE FARMERS' INSTITUTE, FORT COLLINS, JANUARY 27TH, 1882, BY PROF. CHAS. F. DAVIS.

Of the phemonena presented by the human mind, none are more noticeable than the change which takes place in our manner of regarding a subject as our familiarity with it increases.

The road which, when first traveled seemed of interminable length, comes after repeated passages to be only a matter of a pleasant stroll. The tangled thicket through which plunges the murmuring brooklet, unattended by any dancing sunbeam, and into whose dense shade the timid child had not the courage to enter when first he discovered it, has come, from repeated visits, to be that child's very bower of bliss.

The task which is at first but clumsily performed, becomes in time so easy of repetition that the brain yields its controling function to a ganglion.

In many of the occupations of life, this confidence which comes from intimacy is of great advantage; but, when we are led by it to become careless in cases of real danger, it may prove a great evil. In this paper I wish to call your attention to a subject in which we are all interested, hoping to show that too great caution can not be exercised in the handling of our common illuminating oil.

It is the boast of modern science that she has carried into the humblest houses of our land luxuries never more than dreamed of in the sumptuous palaces of the Cæsars.

To the laborer she has given not alone works of art to adorn his cottage, dishes rivaling in finish those to be found in the lockers of a king of a few centuries ago, and food to fill those dishes of an excellence once in the reach of none but kings; but she has made it possible to illumine the rudest cabin in the long nights of winter with the full light of day.

From the secret recesses of old earth, science has called the sunbeams which fell a thousand centuries ago, that we of this day may enjoy their effulgence. Yet, in thus paving the way from barbarism, she has entailed upon us the necessity of an intelligent use of her bounties.

When, but little more than a score of years ago, it was discovered that from a black, foul-odored, oily substance found beneath the surface rocks of the earth, might be procured an almost transparent oil, capable of being used for purposes of illumination, yielding a light much more brilliant than that emitted by the then all but omnipresent candle, men were afraid to have it in their houses. Indeed, the substance was dangerous; explosions were not infrequent. As, however, improved methods of manufacture were adopted and more perfect lamps invented, the danger was diminished. Familiarity with the new material led to a gradual change from fear to confidence, until now it is difficult to find a house where kerosene, or coal oil, is not used. Still, though the fact is not always remembered, there is danger of violent explosion in handling the oil unless there is a due exercise of judgment. A brief review of the philosophy of illumination will serve to convince you of the tenable character of this position.

It is a familiar fact in the philosophy of liquids that they all give off a vapor at all temperatures. As the heat is increased, this emission of vapor becomes more rapid, until, at a temperature practically constant for each liquid, the change to a vaporous condition becomes so rapid as in many instances to cause a violent transition.

The study of chemistry has established the fact that many substances in nature have a strong tendency to unite with oxygen, one of the gases which go to make up our atmosphere. So strong is this tendency in some bodies, that if a slight increase of temperature be given them when

in the presence of air, they will unite with it with such energy as to produce most dangerous explosions. A bottle of benzine or naphtha left uncorked in a room at ordinary temperature will, by its rapid evaporation, soon fill the entire atmosphere of the room with an explosive mixture of its own vapor and air which will explode if a flame, as of a match or lamp, be introduced into it. In this manner kerosene oil, which vitalizes at a low temperature, will form a mixture with air which will explode.

The crude material from which our coal oil is prepared is a dark, tarry appearing substance called petroleum. When pumped from the earth, it is placed in large iron boilers, or retorts, where it is strongly heated The petroleum boils, when the portion which is most readily volatilized goes off as vapor. As the boiling continues, the heavier portions are in turn converted into vapor and carried off in pipes which, passing through cold water, condense the vapors.

The first product of the distillation is exceedingly explosive. Following this is the somewhat less volatile but still dangerous material known as naphtha. Then comes the vapor which, upon being condensed, forms kerosene; and finally there is driven over a heavy oil containing much paraffine.

The naphtha, which comes off in advance of the kerosene, is too highly inflammable to admit of its use in lamps; while the heavy paraffine oil possesses too low a degree of combustibility to warrant its sale as an illuminating material. It is, therefore, a matter of profit to the refiner to mix with the middle product, the true kerosene, as much of the naphtha and paraffine as he can.

The first of these renders the oil much more liable to explode at low temperatures, while the latter gives an oil which clogs the wicks of our lamps, has a low illuminating power, and becomes thick, or, as we say, "freezes" in cold weather. Prof. Kedzle, of Michigan, to whose investigations I am much indebted in this essay, recommends a very simple test for an excess of paraffine in oil. He brings the oil to the temperature of 20° F. for ten minutes, when, if paraffine be present, it will cause the oil to become thick and assume a white, lard-like appearance.

It is evident that by using greater or less quantities of naphtha, we may get an oil which will give off an explosive vapor at any temperature from 75° F. to above 150° F.

It must also be apparent that the higher the temperature required to volatilize the oil, the safer it is to use in lamps.

In many of the states of the union laws have been passed making it a crime to sell or use oil whose vapor is liberated at temperatures ordinarily reached in our common lamps, in quantities sufficiently great to cause explosion.

Such laws have called into use various methods of testing the volatility of oil; the test consists in slowly raising the temperature of the oil under examination until a lighted match plunged into the vapor will cause it to take fire. This is called the flashing point of the oil. At a somewhat higher temperature the oil takes fire from the lighted match; this temperature marks the burning point. Those oils whose vapor flashes at from 100° F. to 125° F. are said to be of low grade; while those are spoken of as high grade whose flashing point is higher than 125° F.

Scarcely a week passes but what we hear of an explosion resulting from the foolhardy practice of employing oil to kindle fires. Disastrous and expensive fires easily traced to this score are numbered by scores.

Not a few persons who have for months, perhaps for years, been in the habit of hastening the morning fire by this easy method, have tried the experiment once too often and died in the winding sheet of flame—victims of their own ignorance and folly. There is no mystery in such results; the only wonder is that accidents are not more frequent. The oil being in direct contact with the flame is rapidly vaporized, filling the stove and surrounding air. If the portion of vapor and air become such as to form an explosive mixture, the explosion is as inevitable as pain from a wound. For lighting fires, oil of a high grade even, is not safe.

If the explosion does not occur, it is owing to the too rapid dissipation of the vapor, or some other fortuitous circumstance.

It may be true that few of us here are in danger from the use of oil above referred to. But there is danger from the employment of oil in lamps.

A gentleman in one of our eastern states made a series of experiments to ascertain the temperature reached by a common lamp under ordinary circumstances. I wish to call attention to some of its results.

In a room the temperature of which was 72° F., a lamp was lighted and in twenty minutes the metalic collar of the lamp had become heated to 104½° F. When the lamp had been burning twenty-three minutes, the chimney was removed, in fourteen and one-half minutes from which time the metalic collar was found to be heated to 161° F when, upon the application of a match, the gas in the lamp exploded. The oil in the lamp during this experiment, became heated only to 85° F. The explosive vapor must, therefore, have been produced by the oil in the coming in contact with the heated metal. A number of experiments of the same nature, all made with fresh oil, new lamps and new wicks, but with oil of different degrees of proof, gave similar results.

From these experiments we may see that even with high test oil, there is a possibility of the brass cap of the lamp becoming so highly heated as to form explosive vapor in the lamp; especially is this true if the lamp is "turned down" or left to burn without a chimney. A lamp, the cap of which is highly heated, may, while left at rest, give no fatal results; when, if the lamp be moved, as to carry it from one position to another, thus throwing the oil against the heated metal, an explosion may follow. We see, also, the danger of leaving a lamp in a room burning where it is not liable to be noticed for some time. A current of air or fault in the annealing of the glass may cause the chimney to break and fall off in our absence, when in a few minutes the lamp becomes so hot as to explode. The danger from using low-test oil is not confined to its liability to explode from over-heating of the lamp. It not unfrequently happens that the lamp is dropped or over-turned, when, of course, the oil escapes. If the oil is readily volatile; that is of low degree, its vapors in a few moments fill the atmosphere of the room, forming with it an explosive mixture, which, upon coming in contact with a flame, as of the stove,

explodes with violence, shrouding the inmates of the room in a mantle of flame. If, however, the oil in such cases is of high test, and consequently less volatile, there is little danger of its forming an explosive with the air of the apartment.

No laws defining the grade of oil which may be sold or used have been enacted in this state, hence the dealer is left perfectly free to sell the most dangerous varieties. As you cannot always tell the grade of oil furnished by your merchant, you cannot be too careful to avoid, as far as possible, all chances of accident. I do not need to cite the case of Chicago's great fire as the result of an overturned lamp, for we have in our own State, in the ill-fated town of Kokomo, a very recent warning of what may at any time be the result of repeating once too often the mistake of disregarding the dangerous nature of our illuminating oils.

In closing, permit me to point out some of the conditions which render our lamps unsafe.

A lamp only partially filled is more apt to give trouble than when full of oil; for the space above the oil forms a true vapor chamber in which explosive gases may collect. An old wick that has become charred and gummy should be thrown away. Metalic caps should be as light as possible, and need to be kept always clean. Caps should never be used when so much worn as to be unable readily to turn the wick up and down.

Lamps, especially when only partially filled, should not be carried from place to place. We should avoid carrying a lighted lamp out of doors or into a cold room. It is unsafe to extinguish a lamp by blowing into the chimney.

Though we may have disregarded these cautions for years with impunity, it is well to remember that our safety has depended upon circumstances upon which we could not possibly have reckoned in advance, and that the next experiment of the kind may prove the one which will form the very climax to the series.

EGGLESTON ON DAIRYING.

BOULDER INSTITUTE.

I consider myself utterly unable to do justice to the subject, which I consider to be one of vast importance, as it is destined to be one of the leading industries of this young and prosperous State of Colorado. I have had no time to look up statistics, therefore I will be obliged to be governed by my own judgment in regard to the assertions I shall make relative to the consumption of the products of the dairy in our State at present, but will certainly put my estimate low enough. It is supposed we have a population of at least two hundred thousand, Now, we will say, each fifteen persons consume one pound of butter per day; this would make 13,833 per day, 4,866,545 pounds per year, or 2,433 tons 545 pounds. One quart of milk to each ten persons would make 5,000 gallons per day, or 1,825,000 per year. Estimating the butter at 25 cents per pound and milk at 10 cents per quart, we have the snug sum of $1,581,-634. Probably the cheese consumed would amount to $100,000 more, total products aggregating $1,681,634. What proportion of this is furnished at home? The milk and probably one-third of the butter. Why not produce it all? States east of us—Illinois, Wisconsin, Iowa, Missouri, Kansas, and Nebraska, in their early settlements had a surplus. Why not Colorado? This is a question I shall have to answer. One reason is, we, as a mass, are non-producers. In our State it is probable that not one-tenth of the population are engaged in agricultural pursuits, and probably not one per cent. of the population are exclusively engaged in dairying. In the early settlement dairying was carried on to quite an extent along the streams, and where good springs could be found to supply a sufficient amount of water for stock and domestic purposes, stock-raising was connected with it. The steers were turned off at three or four years old, adding considerable to the profits, taking it all together, making it a very good business for the capital invested. The winters being favorable up to 1863, led dairymen to believe it to be unnecessary to provide much food or shelter. The summer of '63 being unusually dry, and a

severe winter following, there was a very heavy loss in dairy stock, but the season of '64 being unusually wet, it afforded an abundance of grass, and dairymen did not make much of an effort to put up feed for winter. About November 1, snow fell in the valleys east of the mountains to the depth of from 20 inches to two feet, laying on the ground long enough to reduce the dairy stock fearfully; consequently butter took a rise in the market, bringing as much as $2 per pound before spring. One cause of the rise of the products of the dairy was the Indian troubles on the plains. Of course butter at $2 per pound was a great inducement, and the cow was milked as long as she could decently make a shadow. The spring of 1865 being unusually backward, hay very high, grain about out of the question, the dairyman had more hides than butter to sell as a result. If there was an extra milker in the herd, she was the one that was lost. This was my first winter in Colorado—'64–'65. I came, like many others, expecting to engage in the dairy and stock business, having been informed that it was unnecessary to provide either food or shelter. As some writers stated, all you had to do was to go out some pleasant morning in April or May, drive in your cows and calves, put the calves in a pen, and go to taking in 75 cents to $1 per pound for your butter. Well, things seemed to move along quite smoothly for three or four seasons, but presently the range began to fail, things seemed to take a different turn; some dairymen began to breed to the range, as they termed it, that was, to keep only those cattle that wintered the easiest—those that came out in the best condition in the spring. If this idea had been carried out to the letter, the milk for the dairy would have all been produced by goats in less than fifty years. This also affected the products of the dairy, as the cow that put on the most tallow invariably gave the least milk, and could stand the most severe weather. I suppose this thing is going on to-day in the new settlements of our State. The first settlements were on the bottom lands along the streams, those lands usually affording an abundance of grass, the grass coming earlier and remaining green longer than on the bluffs, extending the season six weeks or two months longer than if the animal had to gather its food from the higher lands. But one after another fenced up their lands. Side ranches were taken where water could be procured for

irrigation, until the man on the first bottom was obliged to abandon his dairy department, or pasture his cows on land that would produce from one to two tons of hay per acre, worth from $8 to $12 per ton. After the side ranches or second bottom lands were fenced, the cows were obliged to ramble over a greater number of acres to procure their food, and in many instances nearly cut off from water, often being obliged to drink from pools of stagnant water. Not dairy stock alone, but stock cattle, horses, and sheep, in many instances, were crowded onto the same range, until some of the most nutritious grasses have nearly or quite disappeared, weeds having taken their places. There has been a general neglect among the farmers in the dairy department. Twenty dollars have been expended for farm machinery to every dollar to keep up the dairy. While most farm machinery has to be replaced once in about three years with the reckless management it gets, or once in about five years with proper care, the principal utensils about a dairy will last from ten to fifteen. In many instances farmers that were in the dairy business a few years ago, now buy butter for their own tables. It is evident that we are about entering a new era in the dairy business. Herds are being cut down. Stock is being improved, feed and shelter provided. The dairy season is being lengthened by food or pasture being provided, as soon as the cows fail to get enough from the range to keep up the flow of milk. I have had no experience with alfalfa, but have with corn, and find no difficulty in keeping up the flow of milk until the severe frosts or first snow storms come. I was surprised at the amount of feed there was in an acre of corn cut and fed early in the season, and at the improvement in the stock as soon as I began feeding it, also in the quality of the milk and butter. I speak of butter more particularly, as I have been engaged in that branch of business. Colorado undoubtedly would have an advantage over the east in butter-making, providing it was necessary to feed five or six months in a year, where there is water for irrigation. Some of our advantages are, the pure atmosphere, cool nights, pure water, immense growth of vegation by irrigation, open winters, more or less open range, and excellent markets. In some of the States the flies are a great annoyance to the dairy stock; here they do not seem to suffer much from them. People begin to realize that a spring with an open

range does not constitute a model dairy farm. My idea of a dairy farm in Colorado, as well as in any other State, is, one capable of producing a great amount of green food during a great portion of the year; that food to be capable of making a large flow of rich milk that will make butter of a fine flavor and rich color. In order to get the growth here, fall irrigation is indispensable. Alfalfa, red clover, red top, timothy, oats, wheat and barley will all stand quite heavy frosts in the fall. It is a fact well known by dairymen that one pound of butter produced in November, will bring as much as one and one-half produced in June. It is not the butter or cheese that is produced that covers the whole profit, but the indirect portion, such as raising the calves on the skim milk or whey, the pork produced, the food for fowls, and also the manure. One farmer told me that he really laid awake nights thinking how he could keep up the fertility of the soil, as he had no meadow land and only a small amount of water for fall irrigation. At the same time he kept but one cow, and she was at the end of a picket rope. My impression is that necessity will compel the farmers in general to keep more cows, and turn off their products in the shape of butter, cheese, pork and beef. I have failed to hear of a single instance where a farmer has made dairying and stock business his leading pursuit, having to mortgage his farm. When the farmer can appreciate the animal that is to be found ever ready to contribute to the wants of all classes, the poor as well as the rich, a companion of the pioneer in all portions of this vast continent; when the cold blasts of winter sweep over those mighty mountains, he will have provided shelter that is so necessary for his warmth and sustenance. He can then sit by his fireside and store his mind with useful knowledge, in a happy home, with a clear conscience.

G. W. Eggleston.

SEEDS.

By Prof. A. E. Blount, Institute, Collins.

As very little is generally known about the quality of seeds we buy for our gardens and for field culture, and so

little information can be obtained from books or other reliable sources than actual experience, perhaps it will not be out of place at this time to state a few facts that have come under my observation and have been verified by the experiments I have made for the past ten years. Good seeds of all kinds constitute the prime factors in the problem of success in raising all crops. At least half the failures that occur, happen from the use of poor seed. Good seeds are of much greater importance to the farmer and gardener than they suppose. Good seed properly handled insures a good crop in almost any case. Pure, sound seed is just as important in producing good crops as pure-bred horses are in breeding good colts. Everybody should possess the facilities and faculty for determining the character of any seed they buy. It costs but little to qualify ourselves for such work, and it certainly pays well. If seeds must be bought, buy them from reliable houses. Seed circulars and seed catalogues announce many things we cannot take for granted. Every seedman says his stock is fresh and of the best quality. Testing is proof. Buy if you like from any and every one, but don't fail to test every kind before planting in order that you may satisfy yourself as to their genuineness. In every conceivable commodity now-a-days adulteration in some form constitutes a prominent part of what we buy. Powdered sugar and candies, cream of tartar and all white valuable commodities are sadly adulterated with barytas. Adulteration is the watchword of all tricksters, not only in the manufacture of sugar, etc., but in seeds, as I shall show before I am done. Hundreds of people send to New York, Philadelphia, Marblehead, Rochester, and even to Europe, hoping to obtain reliable seeds that will yield double the quantity and doubly superior to any they think they can raise in their own garden and field. It is hardly necessary to say that they are sadly mistaken sometimes. More care and more experience in raising their seed will do more invariably for farmers and gardeners than they are willing to admit. In the long run those who raise their own seed, select, save and improve it year after year are better off by 50 per cent, providing they improve it intelligently, scientifically and with an eye to improvement. Specialists in the seed business like Bliss and Henderson, of New York, Gregory, of Marblehead, Vick, of Rochester, Landreth and Dreer, of

Philadelphia, and some others, are all reliable seedsmen and have a reputation for good seeds and plants that is world wide. How they commenced this business and how they succeeded so well they are not inclined to tell us. There is a secret among many of them. For a number of years I was engaged in raising seed wheat, seed corn and garden seeds. The labor attending the business opened my eyes to the importance of putting good seed upon the market, as well did I detect fraud in the seed business of others in various localities. In this essay I will give an outline of the seed business and a few rules to assist any who may desire to raise, save, select and improve their own. If properly raised, selected and saved, the seed you raise yourself is much better than any you can buy or obtain from other sources. All seed raised on the ground, if properly improved, where it is used again, is much better than any imported. For a season or two imported seed may do even better but generally runs down much more rapidly than that raised on the ground. There are exceptions, of course, to the rule. Wheat, oats, corn, barley, potatoes, beets, beans, cabbage, clover, cucumbers, squash, pumpkins, tomatoes, turnips and some others can be raised on our own soil so easily and successfully that there is no doubt about the seed being better than those raised elsewhere. Of course I shall be met here by the remarks of some who say they "never had any luck raising and saving seeds and that they can buy cheaper than they can raise them." Such remarks are very true, inasmuch as but few know how to make selections after their seed is ripe. If a man understands farming at all or how to raise vegetables, he should be successful; understand all, not a part only. One of the most vital parts of his business is to know what good seed is and how to raise and save it. This part of his work must not be ignored. For instance, many farmers send off and buy seed wheat, oats, etc., because they, having become dissatisfied with their own, think seed from a different section will do better—enough better to pay. They spend one hundred dollars and more for seed really not as good in all respects as some they already have in their granary. Had they been careful to keep their own seed pure and clean, the seed bought would in no way compare favorably with their own and it would not cost more than one-fourth as much. When I speak of all seeds I mean those we use

most. Some seeds we are compelled to buy from foreign countries because they will not become perfect or mature in this country. Cauliflower, for instance, or celery, are very hard to raise in America.

It does not require capital to raise good seed, but it takes the cash to buy seed of any kind. A little head-work and hand-work done by the farmer himself in the line of raising his own seed will, in the course of a few years, accomplish much. One farmer cannot do the head-work and another all the labor of raising reliable seed. His own head must direct, control, save and select—it is an indispensable agent to success. Horticulturists tell us that not a single seed grown upon the apple, peach, plum or cherry tree will produce the same fruit in all respects. Grapes do not, nor potatoes. Corn mixes of itself. Squashes, melons, cucumbers and strawberries mix by the agency of insects, and broom-corn will cross upon sorghum. This cross, although in some plants very beneficial, is nevertheless ruinous to most seeds. Seedlings are poor things to say the least, while crosses and mixtures are not a whit better. Crossing melons, squashes, pumpkins or any other edible vegetable to make them larger is a mistake—it is not economy. The larger such fruit is made, even by cultivation, the coarser, and less fit for the table. Seeds should always be selected with reference to quality—not size. There is a limit in all fruit at which quantity and quality are exhibited in beautiful harmony. A deviation from this equilibrium renders the fruit of less value. When a certain size is attained by the natural laws that govern the plant, the highest quality is attained, but when quantity is increased from this point the quality is proportionately diminished. Our largest squashes, pumpkins, tomatoes, turnips, strawberries and such things are by no means our best. For instance, the Crookneck squash, when made to weigh more than four or five pounds, loses its flavor, and the Hubbard ceases to be the Hubbard when it is forced out of its natural size. The Strapleaf turnip becomes tasteless and pithy and coarse when it exceeds its proper dimensions. The Trophy tomato of a pound and a half loses its good qualities, is coarse and almost unfit for the table.

Rogers in his many experiments upon the grape succeeded in making about one good seedling in one hundred

trials. Pungler, as well as myself, failed at the first to make hybrid wheats of any value nine times out of every ten. Marshall P. Wilder, of Massachusetts, has improved the orchard perhaps more than any living man. His efforts with seeds and seedlings were at first abortive; but with experience came better fruit and better seedlings until finally the seed part was dropped and in its place budding, root and branch grafting upon native and foreign stalks brought out the finest fruit in the world.

In the vegetable garden are seen some very strange and curious transformations, which if observed cannot fail to open a door to great improvement so far as seeds are concerned. The bean, for instance, can be so crossed that the offspring will be a great improvement upon either plant. After crossing, if we select the first pods that ripen for seed and continue to do so a year or two on certain varieties, they will become dwarfed or bush beans. If, on the other hand, we select the top pods for seed for several years the plant will run mostly to vines. In selecting cabbage, mustard, radish, lettuce and beet seed very great care should be taken to retain all the good qualities. The common method is simply ruinous. The cabbage head is cut off and in the spring the stump is set out to go to seed, and to seed it goes with a vengeance—poor seed, without vitality or even substance enough to make a respectable plant. The mustard, radish, lettuce, etc., are gathered carelessly and threshed without regard to the branches that bear the best seed. Why not set out your best cabbage, head, root and all and let nature take her own course in its development? Why not, in selecting seed from the panicle, take that on the middle stems and not on the lower branch? Then your lettuce will retain its good qualities, your radishes be crisp and tender and your cabbage heavy, solid and bitter.

In quantity and value perhaps, in most localities, corn stands prominent among all other seeds and grain. It is of such easy and rapid growth, the stock so valuable for feed and so well adapted to all sections, that we cannot pass it by unnoticed. Almost all farmers take more pains in selecting seed corn than any other grain or seeds, and still but few understand its nature and demand. Generally the largest ears are taken from the crib without regard to cob, the stock, the blade, or the shape, size or growth of

them. Large ears by no means produce the best crop, because growing singly on the stock they are generally coarse and not prolific. Large and overgrown stalks bear large and overgrown ears, which when saved for seed produce again gross stocks and coarser grain. When we select a milch cow we always look for those points which characterize her for milking qualities—small bone, fine hair, yellow skin, placid eye, fine milk mirror and slim limbs, tapering from head uniformly. So should the farmer obtain all the points in the selection of seed corn. In the field is the place and the only place it can be seen and known to be fit for seed. The stock and ears can be here compared, examined and selected as to their qualifications. First, those stalks that have the largest number of ears; then those that are uniform in their growth; then those that have fine fodder; then those that are not too high and coarse; then those that have ears with short shucks, long fine husk, tapering ears well covered at the tip with the husk, and those that do not sucker, but have good broad roots. All these things can be seen in the field, which is the only place pure and proper seed can be selected. We cannot afford to raise poor, rank, and exhaustive corn. The top ear of those stalks that bear the largest number should always be taken to make it more prolific. It is the only ear that receives pollen enough to perfect it, and the true seed is found upon it. Its shank is shortest, the rows of grain are straightest, and the cob of better shape. Short, stubbed half-filled ears, with crooked rows and parti-colored grain should never be selected for seed. Corn intended for seed should always be planted separately, or the ears should be covered with muslin before silking, and then fertilized with the pollen of other tassels of like character. Covering fine ears prevents the pollen of poor and barren tassels from damaging the seed. Barren stalks found in any variety of corn are the worst enemy we have to fight. They will run out a crop of good seed in a very few years.

In saving seed wheat the best way to begin is to have a good variety. Only pick the highest head from the largest stools, because that is the one from which all the rest of the stocks grew. Plant them and culture on some choice land, about twenty pounds per acre. The seed obtained in this way will be entirely free from all other kinds

of wheat and foreign seeds, and will be much better in every way. This manner of breeding up wheat is called the pedigree system. The qualities of wheat can be greatly improved by this system, but not materially changed. A new variety cannot be made except by crossing one kind upon an other. Selecting the same seed from the same kind every year will so much improve a wheat that the heads will nearly double in length, the grain be much more plump, the stalk stiffer and much more healthy; and the whole plant better in every way.

I desire to call attention to the seeds we buy from the many seed houses all over the country and in Europe. I stated above that adulteration was the watchword of all tricksters. In the seed business it is alarming. In England, all over Europe, and all over our own country, it has so increased of late that but a few houses sell reliable seeds. In France the law against adulteration is very stringent, and it is most rigidly enforced. Had we a law in as great force there would be fewer failures and better crops made by those who depend on the market for their seeds. But few seedmen raise their own seeds. They sell what some others have produced. They depend upon parties not so reliable, perhaps, and upon sections better adapted to seed growing. I have known old seeds to be brought up, mixed with a few fresh ones and sold, "all our own, and fresh." I have known non-explosive powder mixed with onion seed and sold at fifty-three or fifty-four cents per pound. I can bring testimony to the fact that clover seed is adulterated over fifty per cent., and that weed seeds constitute a great part of some kinds of imported seeds.

There are stupendous frauds going on all the time in the seed business. Dr. Nobbe, of Europe, has for many years labored to expose parties engaged in this kind of business. He has proven beyond a doubt that over sixty per cent. of grass seeds sent him for identification were anything but like the label. He has tested over 5,000 samples sent him. In these only fifty-nine per cent. were pure and true to name—the rest, forty-one per cent., being adulterations. And still further, of this fifty-nine per cent. only eighteen per cent. of it was capable of germinating. Of the whole forty-one per cent. were foreign seeds, forty-one per cent. old, good for nothing seed, and only eighteen per cent.

of good seed. For instance, of 100 pounds of orchard grass seed he found forty-five pounds of weed seeds. In one hundred pounds of meadow grass he found ninety-five pounds of dead seeds. In three tons of red clover seed two tons of the seed were yellow clover. He says in one year Englishmen sold over ten tons of poor turnip seed, more than two-thirds of which were made up of fine sand-colored and weed seeds. He discovered in Bohemia and elsewhere factories for the manufacture of seeds from quartz, and sand colored to order, and sent to the warehouses of Hamburg and other commercial centers, which was sold at the rate of fifty dollars per ton, twenty-five per cent. of all the seeds being this colored sand. He found men, women and children regularly employed in Bavaria and Austria, to collect from the roadside, ditches and pastures, weed seeds of all kinds. These were sent to England for adulteration. I might quote from other reliable authorities, showing conclusively how extensively these adulterations are carried on, and how important it is for us to raise our own seed. I am personally acquainted with parties in Philadelphia who have imposed upon the public by selling wheat, oats, corn, and many other seeds under new and various names, to the amount, they told me, of about $3,000 yearly. I do not hesitate to give the name, S. Y. Haynes & Co. They put the Golden Grains wheat upon many unsuspecting farmers at a cent a grain, and if any of you have read the recent number of the *Rural New Yorker* you will find the Golden Grains to be the same as the Black Bearded Centennial. They once sold this common Giant, or mammoth rye of ours at one dollar per fifty grains, under the name of Diamond wheat; and the Pearl mitlet, representing that it made two crops a year, and sixty bushels per acre, and much finer flour than any we ever saw. Their frauds, as well the frauds of many other swindlers, have been exposed in the *American Agriculturist* and other papers of note. .

It is not a difficult matter to avail ourselves of the facilities for testing the seeds we buy. If buy we must, let us apply the tests in every case. They are as follows:

The seed of plants should not be gathered until fully ripe. Nature teaches us this. She never drops the grain nor plants the acorn until they have absorbed all possible nourishment from the parent stem. However, good

authority says that wheat, oats, corn and some other plants do better when the seed is harvested in the dough state. More vigorous plants are produced, it is true, but the grain is faulty and if this plan of sowing unripe seed is kept up for a few years the crop will be poor and the seed run out. In saving tomato seed it is necessary to select the best specimen in the first fork of the vine, provided it is perfect. Let it soften on the vine, squeeze and wash the pulp and take only the seeds that sink. Melon, squash, pumpkin, cucumber and all other heavy seeds should be put in water and only those that sink be saved.

Purchase seeds early, and plant a few in shallow boxes of sand and leaf loam, putting the boxes in a warm place by the stove. Sow ten seeds of each kind. This is one test. Another, put 100 seeds in warm water, and if they all sink quickly, look out for sand; if any swim about lightly, they are dead. Genuine, fresh and good seeds are shiny, smooth and plump, smell like the plant, and always sink if their specific gravity is greater than water. Poor seed smell musty, feel lighter, stick together, soil the hands, are lighter colored, float in water, rattle when shaken, and never leave the hot stove when placed upon it.

To detect the adulterations in foreign seeds we must use the sieve, water and microscope. Hot water dissolves powder and dirt, and washes off the coloring matter. The sieve makes the separation of the true seed from the impurities, and the microscope discovers the shape, natural indentations, protuberances and discolorations. To determine the vitality of the seed put ten or a hundred inside of three or four sheets of blotting paper, which wet and keep where it will be warm all the time, and in the dark. In ten hours the radish will germinate, your cabbages in eighteen, your wheat in twenty-six, and your corn in thirty-two hours. These rules are simple, and will cost you nothing. They may save you much.

Just one more feature of the seed business. Our fields are being overrun with noxious weeds which are becoming rapidly worse than grasshoppers, in some respects. The sun-flower, ox-eye daisy, the amaranth or pig weed in at least five different species, and a host of other annual as

well as perennial plants out of place, are becoming a bane to our crops and a nuisance generally. Many a wheat field is almost entirely destroyed by them. What shall we do to eradicate them? Shall we legislate and pass laws to compel every farmer to keep his fields clean, and ditches free from such pests? Or shall we exercise eternal vigilance, and let the ditches and fields of our neighbors go? Plowing in the fall and then in the spring will do much to destroy them. Thorough cultivation is another and the surest remedy. In our cultivated field, pasture, garden, and on our ditches are about 1,200 different kinds of weeds. One hundred and thirty are indigenous to our country; fifty-four belong to our cultivated lands; seventy-six to pastures and ditches. Of the 130, 110 were introduced from foreign countries, and only twenty are really native. Forty-two of the fifty four found in our cultivated land are from Europe; one from Central America; twenty-two are spring plants, and thirty-two are with us the season through; fifty-two come from the seed, and two from runners. The more noxious the weed the more prolific. The pig weed produces from one seed over 5,000,000; the poppy as many, and others in proportion to the nuisance they commit.

One year's seeding
Is seven years' seeding.

Overcome evil with good, but be not overcome with evil.

WHEAT.

READ BY PROFESSOR BLOUNT BEFORE THE FARMER'S INSTITUTES OF FORT COLLINS AND LOVELAND.

In presenting wheat to those interested in its culture, I desire to touch only upon those things connected with it that most interest the farmer now, and that will benefit him and the community hereafter. It is not within the province of this essay to relate its history, the amount exported, the annual yield in our own and other countries, the fluctuating

prices that rule the different corners, the demand made upon us to supply foreign countries, and a hundred other things that would be interesting should they be mentioned in their proper place. I say I will pass these by and proceed to discuss home topics and home interests connected with this important and most valuable cereal.

In wheat culture it is a very difficult matter to answer all the questions that agitate the farmers in all parts of the state. General information is very easily obtained, but specific and scientific truths are not so easily imparted, from the fact that a success or failure in one section may not be a success or failure in another; hence the same rules cannot always apply in different localities. The principal questions on which farmers ask information are;

What is the best kind of wheat?

How can the greatest yield be made?

What is the best method of making it greater?

How can the quality be improved?

How can sure crops be made every year?

How can rust be prevented, and how can wheat be managed to keep it from running out, etc., etc.

These are very important questions for the farmer. I cannot answer them all, nor shall I attempt only to open a discussion, so that in the multitude of witnesses and in the abundance of testimony, facts may be elucidated, truths established and correct conclusions arrived at.

The wheat problem is a difficult one. The best wheat for one section is not the best wheat for another. The wheat that produces most grain is by no means the best for the farmer and miller. In making our wheats yield more by cultivation and otherwise we are to apt to improve a variety that is of not very great value. It should be one whose characteristics and elements are of the best quality. The quality cannot be made better unless the laws of vegetable physiology are observed. A sure crop every year cannot be made unless we have control of the winds, air and sun. No variety exists that is *sure to never fail* under all circumstances.

Rust, smut, mildew, and other enemies to wheat can be in a measure prevented but never cured. Much can be done by every farmer to prevent his seed from running out. The best varieties for one farmer are not always the best for another, in other localities; neither is the best variety for the farmer best for the miller in every case, and *vice versa*. A wheat may have stiff, strong, well-glazed straw, a fine looking grain, and yield largely and still not be fit for the mill. On the other hand, a wheat may have splendid milling properties and be of no account to the farmer. There are but few wheats that suit both farmer and miller; and there never will be so long as there exists such carelessness in the selection of seed. Wheat is a very peculiar and sensitive plant. It accepts every favor so kindly and withers under the slightest injury so readily that to deal with it successfully requires a good deal of wisdom and skill. Wheat has many likes and dislikes, which attract almost every farmer's notice, but fail to persuade him to change his method of cultivation for the better.

Wheat likes high, dry and well packed soil. It likes to be sown early in a good soft well pulverized bed. It likes just enough moisture to germinate quickly—no more. It likes a temperature of 40° to 50°—not 70° to 90°, as most seeds do. It likes to be sown moderately deep, no two grains less than two inches apart. It likes room to spread itself and show its colors. It likes a loamy soil, made up of twenty-five per cent. sand, sixty per cent. clay, and fifteen per eent. alluvial matter. It likes cultivation as much as any vegetable and will thrive under it as much as corn, or potatoes or cabbage, and return the compliment four fold or more in giving more and better grain.

It dislikes low, wet ground, and too much vegetable decay for its plant food. It dislikes water in its raw state but when well prepared by percolation and reduction into a filmy moisture it flourishes as the green bay tree. It dislikes weeds and abhors the farmer that lets them usurp its authority. It dislikes a damp atmosphere, followed by hot suns. Most of all, it dislikes to be crowded by its own kind; in fact the greatest enemy to wheat is wheat. A crop of wheat often fails for reasons not well understood by the farmer. In low wet ground it frequently rusts and fails to

fill. The dampness and alluvial elements make a large, luxuriant growth of straw but furnish no plant food to make nice plump grain.

Wheat is our leading and most important crop. It claims our attention more than all the rest. The fact that we know so little of how to raise it successfully is certainly a question we should answer quickly by doing our work better.

Every man can not raise wheat for reasons too clearly set forth in his manner of selecting seed, preparation of soil, and many other things seen in the field, garner and market.

Wheat is no epicure. It indulges in no luxuries, nor does it demand anything it does not want. It never runs after other plants but rather wilts under the baneful influences of its coarser neighbors. It asks for no extremes; is not extravagant. It asks room and a good atmosphere, and enough of it. It cannot endure to be cramped either by plants of its own species or by noxious weeds. I do not overestimate the benefit nor do I overstate the fact when I say that *on the seed depends at least half the farmer's success* or failure. Not only is this true of wheat, but it applies to all other seeds.

The kind of seed to sow, the manner of preparing it to be sown, the method of sowing it, raising it, giving it space in the field, cultivating it, and again selecting, saving and preserving it are questions every farmer should study all the time, both winter and summer.

All seed wheat must be pure, free from its own bad and malformed grains, foreign seeds and other wheats, because no two kinds will grow as well together as they do when unincumbered with the presence of another. Poor grain grows rankest; hence its influence is deleterious. It chokes the finer, sapping it of its better qualities and life. Mixed wheats sown on our best soils always fail to make as good returns as when sown alone.

All seed wheat should be raised by the farmer *himself*. He should trust to no one to sow, cultivate or even harvest it, but should do it himself. He cannot be too particular in its management. It will save him many a failure and much

money. One or two acres of choice land, carefully prepared and well cleaned, should be sown in seed of his own picking. They will produce seed enough for his general crop. Then from these plats he should pick again and again every year, until he is convinced that he gains by it. In doing this his wheat grows better and more prolific, and will never run out. It is less liable to accidents and will be much better in every way.

Seed wheat should be selected and cared for with as much caution and foresight as the stockman exercises in breeding, breaking and selecting fine horses. In making an attempt to improve or breed up a wheat of his own choice, it is necessary in the first place for him to select a good variety, one that will do well in the field and make good flour. After making a selection to suit himself, he must look about for a suitable plat of ground, which he will never find in low alluvial soils, but upon some elevated land with a clay subsoil. After finding this, the next step will be to prepare it. It is not necessary for me to state that it should be well pulverized and mellowed. The seed should be drilled in three inches deep, at the rate of not more than twenty-five to thirty pounds per acre. When well up, the drill can be run over it the same way it was sown, to kill the little weeds between the rows. This is called cultivation, and costs the same as the drilling did. Two or three weeks later the drill should be passed over it again to finish killing the weeds. These two cultivations, costing double the expense of drilling, will not only kill weeds, but benefit the wheat as much as the same work does corn or any other crop. They enable the wheat to tiller more rapidly, that it may smother all weeds that may come up afterwards. The cost of two cultivations is only $2 to $3 per acre, which expense, I can assure every farmer, will be cancelled twice over by the surplus yield in consequence of the extra labor.

I will put this fact in another way: Let every odd acre across the field be sown with ninety pounds without cultivation, and every even acre with thirty pounds and cultivate twice. Now if the thin sowing and cultivated acres do not produce more and better grain than the thick sowing and uncultivated acres, it will be the first time in hundreds of trials I have witnessed that I have ever seen labor thrown away. I can assure you that it will turn out

just as I tell you if you will take the pains to make all conditions favorable. It will pay at the least calculation twice the extra expense in a greater and better yield, besides saving a bushel to the acre. Now this is practical farming. There is no theory about it. Every farmer can make the trial. It will cost but little to make the effort. Try one acre if not more. If you experiment on one acre this year, you will try two next year and the next will double your resolutions, and all your crop will be cultivated as is your corn.

The only capital required to carry out this system of wheat culture is persistent effort, care and tact. This method of treating your wheat crop will enable every farmer to have a pedigree wheat of his own, making it free from cockle, weedseed, bad grain and many other evils. Since the agricultural college was opened I have given wheat some attention. I have endeavored to find and make varieties that will suit our soil and climate better than the old standards. Up to this date I have twenty or more that are better for both farmer and miller than the Australian, Sonora and some others that have been raised and milled so long in Colorado. Although the millers call for soft wheats they in reality would prefer the hard kinds, because they contain more gluten and consequently are stronger. The fact is, the day of soft wheats is passed in Colorado. Just so soon as the miller can get the hard wheats in quantity just that soon will all farmers who hold to the soft kinds lose from not being able to sell. The kind of wheat we want is one than will make a good crop, good flour and a good deal of it. Where and how shall we get it? This is a matter I have been working up for some time, and according to all indications, success is about to attend my efforts. Next year I hope to put into your hands a wheat strong in gluten, with thin bran, fine grain, prolific, hard, with a strong, stiff straw. I made it by crossing two winter wheats, one upon the other. It is a native of Colorado—a child of the Centennial State. One I am a little proud of. It has been pronounced by experts in New York to be the best for milling of any ever analyzed in the city. It is the most prolific of any one of the 140 kinds I have raised on the college farm. I have over twenty more such wheats under the process of training now, some of

which I hope to distribute among you soon, and I do hope and pray that they will be obedient and do whatever you ask of them.

In conclusion, I wish to make a remark about the experiments in wheat on the college farm. Although it takes at least four to ten years to satisfy an experiment, what I say now is by no means conclusive, inasmuch as the experiments have been made but three, two and one years.

For three years I have experimented on thirty-six wheats, all different, with a view to finding *one* that will suit the farmer and the miller in all its characteristics, elements and properties. Of course this matter requires much time, patience and skill. Before I cross two wheats I must know the habits, characteristics, quality and proportional parts of each. After crossing I am compelled to select, trim down, train the offsprings, and frequently have to cross and re-cross until I obtain what I want. Stockmen do the same in in-and-in breeding. For instance, crossing a Short-horn upon a Jersey gives a half Short-horn and half Jersey offspring. It may or may not be what you want. If you crossed them to get more and better milk your efforts probably failed. If for less milk and more beef, your efforts again were abortive, etc. I assure you a stockman cannot make a perfect calf, colt, pig or sheep in a year or in ten. Nor can I or any other experimenter make a wheat to satisfy both farmer and miller in a year. I would like very much to give an outline of the labor it takes to make a new wheat, but time will not permit, nor is it proper at this time to do so. I will say a word about seed wheat, however. I have heretofore taken the ground that half at least of our success or failure in raising wheat is due solely to the seed we use. I have also asserted—and can prove it by one hundred instances—that every pound of seed can be made to produce a bushel the country over, and I will append to that statement another, viz: That it will do this in nine cases, or nine years, out of every ten, if the farmer will only select his seed wheat as carefully as he does his seed corn, and will not thresh it in a machine.

This leads me to another remark, viz: that we cannot afford much longer to thresh seed in these steam or horse threshers. Why? We loose too much. How? Let me illus-

trate. The force with which the wheat, in being threshed, is thrown by the concave or cylinder against the further end of the thresher, is so great that at least one-quarter and often one-half of the grain is either broken in two or fractured, consequently it is entirely unfit for seed. You ask how I can prove this. In two ways. First, take a handful of wheat just as it comes from the thresher, count the kernels and sow in a single row. When it is up, count the stalks to see how many came up. Or, if that be too tedious, take one hundred grains and plant as before. In many cases—I will say most cases—not sixty of the one hundred grains will germinate. Another way of testing the vitality of seed wheat: after soaking wheat over night, in a solution of sulphate of copper, we notice many of the kernels discolored—some at the end and others all along the seam. Now, whenever the bran is broken and the starch is exposed, the bluestone is sure to find it, and surely tells a bad tale; therefore, every grain considerably discolored is fractured and is unfit for seed.

An investigation of this kind will lead many a farmer to a more careful selection of his seed; and, *more;* it will teach him how to save and thresh it. I am not now advocating thin seeding, but the loss we annually sustain and the gain we can actually make by careful selection. Most farmers sow ninety pounds per acre, to get a good stand, to choke the weeds, etc. How much does this cost? $1.80. Now, supposing we take out of this ninety pounds all the cracked kernels and those that will not germinate and send it to mill, how much do we save by the operation? Thirty pounds at the least calculation, and sometimes fifty. When ninety pounds are sown then the thirty is thrown away—sixty cents gone! On one hundred acres $60—enough to feed any family the year round. The question now arises, what shall we do to get sound seed? Is it not more profitable to hire it flailed out or beat out over a barrel, at ten cents per bushel. Ten dollars per hundred? If we lose thirty pounds, or sixty cents, per acre, in sowing cracked wheat, and pay ten cents per acre for threshing by hand, do we not clear fifty cents in the saving? Not only in *this* saving, but another very important saving is made. When beat out over a barrel or board the seed will come only from perfect heads—those that stand up highest in the bundle—and no grain is found in the seed that grew on short stalks,

that never had vitality enough to grow more than a foot high. I have no desire in making such remarks, to influence any one contrary to his convictions. I am not now advocating thin seeding, but better seed, purer seed, and seed that we can rely on.

From what I have learned, experimentally, of our soil and climate, so far as wheat culture is concerned, *they are better than any in the country*, if I am to judge by the samples sent me and those I have seen. The department at Washington has four large cases, six by twenty feet, filled full of samples of different varieties from all nations and islands in the world. They are put up in show bottles, row above row, in square pyramids, in all I should think, three or four thousand. I had with me, while there, thirty-four kinds of those raised on the college grounds. The commissioner became interested in these products of our great American desert, and wished to compare ours with wheat he had. The remark was made, on comparison, that our poorest was better than their best. He gave me samples of the finest, and also some that had been sealed up for twenty years.

Inasmuch as ours is one of the finest wheat sections in the world, and, inasmuch as the Centennial state stands among the first in wheat culture, and *the first* now in weight, I trust every farmer will put forth every effort to retain our prestige and keep the belt. There seems to be no reason why we, as a farming community, or as an agricultural state, cannot successfully compete with any and all wheat growing states or countries. We want a better system of saving our seed; a better system of cultivation; and, some better machinery, or an improvement on that we have, for threshing and cleaning our grain.

There is one thing which some may call a fault among us. If it be a fault, every farming community is guilty of it, it is universal; that is we put too much land under cultivation—more than we can attend to, more than we have water to irrigate, more than we can harvest, and more than our own strength can cope with. Plowing the ground and putting in the wheat constitutes but a small part of successful wheat growing. When it is ripe for the harvesters, they cannot be found; when it needs water, force enough cannot be mustered to meet the emergency, etc.

I might extend such remarks, but think they should be made in the discussion.

One other item, and I am done.

You all well know the difficulty farmers labor under in procuring good seed wheat and good seeds of all kinds. Now, Dr. Edwards hit upon a plan, and we have been discussing it somewhat, as to the feasibility of establishing a few experimental stations in different parts of the state, the object of which will be to supply this very want. Station No. 1 might be at the college. Its duties would be something like they are now and will be, and also to supply pure seed the first year to stations Nos. 2. 3., etc. in different parts of the state.

Every one knows that some kinds of wheat will do better in one locality than in another; hence the importance of these stations. They will be under the charge of competent farmers—perhaps on their own land. The expense of running them would not be by taxation, but from a judicious sale of the products. Should there be a surplus from the sale, let that be turned towards improving the land or in the purchase of fine stock, etc.

UNDER-DRAINING AND RECLAIMING ALKALIED LANDS.

BY P. M. HINMAN SECRETARY STATE AGRICULTURAL COLLEGE.

BOULDER INSTITUTE AND STATE HORTICULTURAL SOCIETY DENVER.

The best use to which soil can be put is to work it so that it will give the greatest return for the labor expended. While this is true in all countries, how much greater is the necessity to have the land so conditioned in this state where we are so limited in the extent of the area of land that we cultivate by the amount of water we can get from our streams for the purpose of irrigation. You are well aware that this area compared with that of the Western

and Middle States is very small. What rapid strides the great resources of our State are making and the fast filling up of the towns and cities with teeming population of men and women. The rapid building of railroads opening up the vast mineral resources of our State. These facts are witnesses that we are destined to have a population far in excess of the most sanguine prophecies of a few years ago. And while all these evidences of prosperity and growth are apparent in regard to the mineral productions and the stock growing interests, how is it in regard to the increase of agricultural productions? With few exceptions we have reached very near the limit of land that can be farmed, from the fact that all the water of our streams has been exhausted. Have the productions of our farms been increased in the same ratio?

Let us see—in 1877 the crop estimate for wheat for that year was one million bushels, we then had an estimated population of ninety-one thousand. This year the estimate made is one and a half million of bushels, and we believe it a liberal one with a population of over two hundred and twenty-five thousand. You see that while the population has more than doubled in the past four years the amount of wheat (and that is the staple crop) is estimated at only about one-fourth more.

How about the value of the land that is farmed?

In almost all localities it has doubled in value; that is, good arable land. We are aware that there has been a large increase of new land under cultivation, but for some cause there has been a great falling off in the average yield. It is with the greatest reluctance that we admit this, yet we know that it is so, more especially on land that has been under cultivation for some time. Hence we say, that it is of the utmost importance that we utilize every acre of land that can be watered and have it give the very best returns for the labor bestowed upon it. We stated that there had been a falling off of the average yield per acre of wheat during the past four years, an assertion which we think no one will deny, especially in the older settled parts of the farming portion of the State. That there is land that has been cropped successfully for the last ten or twelve years and longer we know. But we notice the fact that the best

quality and the largest yield comes from the newer districts. There is a combination of circumstances that account for this. The older sections have more weeds, more of the enemies that follow the production of any crop for a long series of years. It has been the experience of most of the wheat producing States that for a period of from twenty to thirty years wheat would be a saving crop and that then it would hardly pay for the seed, because of the enemies that appear to follow a continuous cultivation of the crop; and no doubt this is partly the cause of the falling off of the average yield in this State. It is a fact well known to the old farmer that for eight or ten years such a thing as rust, injuring a crop of wheat, was unknown, no matter what time it was sown. We have seen wheat sown any time in May and as good wheat harvested as could be wished. But now to sow in May is about the same as throwing away the seed. And every farmer is in a rush in the spring to get his wheat in very early so as to evade this enemy. There are also other sources of failure, and one that is by no means small, is the amount of our land that has been under cultivation for several years and become alkalied. A stranger comes into this country and sees this white substance scattered here and there all over our land, and inquires, what is it? We find it here—there—everywhere on land that has been farmed for any length of time, and why? From the fact that the farming of land under the new ditches up on the bluffs and the percolation of the water to the surface carries this substance with it and the water evaporating leaves it precipitated on the surface. The vast amount of alkali that is stored in our soil cannot be estimated, but we know that it is unlimited, and we believe that where there is a reasonable quantity it is a good fertilizer and has some properties that are very beneficial to the growing crop, but like many good things, is very injurious when taken in too large doses.

Under-Draining has been in successful operation for over fifty years in subsoils that have a substratum of clay or that is not porous to a great depth, in fact most writers on this subject agree that there is but very little soil that will not more than pay for draining. If the soil is too wet it will carry off the surplus of water; if too dry, will cause to absorb moisture from the atmosphere that will circulate

through the soil by reason of the drain. It will change the character of the soil by allowing the free outlet of surplus water. The soil becomes sweeter, looser and more friable. The hard lumps of the stiff clay land gradually disappear. They crumble more freely, offer less resistance to the plow and are more easily and economically worked. These are practical benefits equivalent to a change of soil which only farmers of stubborn clay can appreciate. With permanent moisture the coldness of the many soils rapidly disappears, and on stiff clay soil well adapted for wheat when wet in the spring the farmer is often retarded for several weeks from plowing and sowing.

An efficient system of drainage carries off the surplus of water so rapidly that the land in a short time will be in a good workable condition and thus the farmer is not bound to the uncertain seasons. There are yet other reasons for drainage; it deepens the soil by removing the surplus water from the sub-soil, allowing the air to permeate the soil and diffuse itself wherever the water has been. The roots of growing crops freely descend into the virgin soil beneath and not only have they a larger space through which to spread for food, upon which to thrive, thus increasing correspondingly the productiveness of the soil, giving to the farmer a large yield of crops and reducing very much the cost of cultivation, repaying in a few years the cost of drainage.

We might mention another advantage, that by having the drains at least three, and better still, 3½ to 4 feet deep. There are some crops which send down deep roots that fail on soil with a hard pan for sub soil, whereas, if the soil is loosened up and made friable to this depth the plants do well, and wheat, which rarely sends down roots to any great depth will, where the soil is in good condition, send down roots for three or more feet in quest of nourishment. Now we have compact soil throughout this State. Soil so hard when dry that we have to use the crowbar to set a fence post. If we dig the hole over twelve inches we turn the water on and drench the land by irrigation, and in places the soil is so hard that the water runs over and does not penetrate to any great depth, leaving the soil still compact and hard when again dry, while there are other soils that become in a few years so penetrated with an

excess of water from the percolation of the surrounding land and having no drainage, can become dry only by evaporation and then the water has carried so much alkali to the surface that no crops grow. The amount of land that has apparently become useless by this seepage and alkali is not inconsiderable and is largely increasing each year. I will quote from a letter lately received from one who has had twenty years' experience as a farmer in this State, a man of good judgment and a close observer of passing events. He says: "I am not a little surprised that the chief representatives of our agricultural interests have not given this subject any public attention even at such a late day. This is a question that will involve millions of dollars of the farmer's capital in the near future. And many farmers yet unconscious of the approaching danger will find themselves unable to reclaim their land and yet too poor to abandon it. Now this is not the language of an over excited imagination. *No*, it is a long and sad experience with continuous observation and study."

This testimony comes from one who has had actual experience in the matter. Further on he says; I have reclaimed one piece of land by under-draining which proved to be a perfect success. I have produced heavy crops of wheat ever since, and it is improving yearly. This piece of land of which he speaks is one that I am well acquainted with, as it lies under a ditch that brings the water to my farm. It is a very "stickey, clayey" soil where water apparently would not soak away, only becoming dry by evaporation. He made a drain down through the middle of the strip of land which was about twenty rods wide and perhaps eighty or 100 rods long. The drain was dug three and one-half feet and formed by making a vault in the bottom of the drain and covering with a flat stone, then filling up for a foot or more with small boulders. This drain was put in five years ago and the land had become so badly alkalied that nothing would grow on it. The drain has worked well ever since and is apparently in good order at this time.

This same man has commenced draining another farm where he now lives, and says he will commence work on new drain ditches and work as long as the weather will permit during the coming winter. His experiments have been

with the strongest alkalied and where all traces of vegetation had disappeared. So far, his experience indicates that leached alkali soil is more vigorous than it was before it became spoiled by the alkali. It is evident that something must be done in the near future to reclaim and prevent vast tracts of land from becoming ruined, and what is more evident than that, the same agent that is bringing this scourge upon us may be utilized in such a way as to remove it, provided we give it a chance. Let every farmer, who has a farm that shows the slightest indication of being over run by this enemy, commence at once to make the necessary arrangements by laying out the necessary ditches to arrest the invasion of this silent destroyer.

The advantages of drainage may be summed up thus: It changes the soil by allowing the air to circulate through it. It deepens the soil by removing the water and allowing noxious ingredients to be washed out of the sub-soil which has prevented the roots of growing crops from descending. It is a necessary preparation to the many means of improvement that may be applied to the land. It will prevent the water from coming to the surface on a hard clay sub-soil, bringing with it the alkali in a white powder by evaporation, thus ruining many acres of our finest land.

By arresting this and carrying it off and taking the alkali with it along the drains, we not only save the land from becoming alkalied (as it is termed) but may in a short time reclaim land that is so far gone that it will not produce any kind of vegetation. This system of drainage also prevents the soil from forming such a hard crust after a rain, especially on heavy soil. It prevents the soil from becoming dry and sterile during a protracted drouth, because it gives a free circulation through the soil to the atmosphere, thereby causing moisture by decay. The kinds of soil that are benefited by drainage are as numerous as there are soils in existence. It is the common notion that only soil that is covered with water, or is too wet to work, requires draining, when the facts are as stated above, that land being too dry as well as too wet is a reason for draining it. This will, to a great extent, overcome drought as effectually as it removes injurious effects of too much water. The profits of under draining have been variously estimated, but the most enlightened English

farmers give it as their opinion that a thorough system of drainage will pay thirty-three and one-third per cent. each year upon the cost, thereby paying all costs of drainage in three years. Other authorities assert that two years will pay all the costs if it does not exceed over one dollar per rod for making the drains. The kind of drains made and the depth, size of tile, if tiling were used, would have a great deal to do with the cost. All the authorities that I have been able to consult agree that tile is the cheapest and best. I quote from Professor Carpenter, of the Michigan Agricultural College. He says as to cost of underdraining: It is commonly estimated that two inch tile can be made with good living profit at from ten to eleven dollars per thousand, I only give price for two inch, as from all that I can find I think that size here, where there is always plenty of fall, and where the drain is small, keeps clearer of all obstructions, less liable to fill up from the silts than the larger size drain and also cheaper. At this rate the tile would cost eighteen cents per rod at the kiln. The cost of digging, estimated by Waring, to average, for drain four feet deep, twenty-nine cents per rod, and for filling seven cents, when labor can be had for one dollar per day. The cost of preparing drains three feet deep is about two-thirds as much as for those four feet deep. The cost can be considerably reduced by using the plow and scraper for digging and filling where the land will permit. It is necessary that the drains be uniform on the bottom with an even grade, and time and money can be saved by having all drains properly laid out, and every step taken with the view of permanency, and at the same time accomplish the greatest possible results from the out-lay necessary. It may seem to most of you that we are going away out of all reason when we predict that the time is coming when large tracts of land will be drained, and as much or more capital will be used to drain the land than were formerly used to construct ditches for their irrigation. This is undoubtedly a question for the serious consideration of the legislators, for the time will come when this will be a question for their consideration. We hope it may not come too late, but that all may see the necessity in time to save themselves and the State from serious losses.

CULTURE OF SMALL FRUITS.

AN INTERESTING PAPER BY A. N. HOAG, READ AT THE FORT COLLINS FARMERS' INSTITUTE.

Mr. President, Ladies and Gentlemen:—

As I have been called upon for an article on "Small Fruits and Their Culture," I will say that I can only give my own experience, which is very limited, being but an amateur. I have succeeded well with raspberries, strawberries, currants, gooseberries, and a variety of other fruits. Six years ago the grasshoppers left me four plants of the Doolittle Improved raspberry, which were very much injured, from which I have propagated until I have a half-acre of as fine bushes as you will wish to see, besides selling about 2,000 plants. Those of my own setting have been very remunerative for the past two years. Although the hail of the 24th of last May cut me short at least two-thirds of a crop, I picked as high as 101 quarts of fine berries at a picking, which brought me 35 cents per quart at wholesale. My mode of setting has been varied. Some of them I set 6x8; others 6x6, and others 4x4 feet apart. Those set six feet apart are more easily worked and picked, and, on the whole, are more remunerative. Those only four feet apart are too much crowded, are unhandy to get among to pick or cultivate. Still, there are some advantages in close planting, as the bushes protect each other from the dry winds and scorching sun of July while ripening, and keep the ground shaded, which retains moisture longer than if exposed to the rays of the sun, thereby causing the fruit to fully develop while ripening, making large, fine, sweet berries, some being fully three-fourths of an inch in diameter. I should not recommend them to be set nearer than 5x6 feet, as the Doolittle is a strong grower. My mode of culture is to lay them down in the fall and cover with earth. Although quite hardy, it pays to lay them down and cover. In the spring (not too early) when all danger of their being killed is past, I take them up, manure at the foot if necessary, then let them stand until the weeds start, when I stake the vines to one side, and turned the

way I want to cultivate them. I run through as many times as necessary to mellow the ground with a double shovel cultivator. Should the ground be too dry I irrigate before plowing, This is all the plowing they get, but when they get weedy I go through them with hand and hoe. I irrigate as often as necessary, using my own judgment when to do so. Raspberries and strawberries require more water on my land than any other fruit. Raspberries do not require as much manure as other shrubbery. I also have the Greggans, Tyler and Mammoth Cluster for black caps. The latter are worthless on my grounds. I have the Brandywine and Turner for reds and like them more as I become better acquainted with them. Also have the Golden thornless which I cannot reccommend for general use; still, I say plant a few for a variety.

First and foremost on my grounds is the strawberry, which in its time has caused kings and princes to bend the knee as subjects to its glossy surface. At the same time that the "hopper" left me six years ago I had thirty-five Wilson and Duncan strawberries that I took great care of. Since that time I have purchased Captain Jack, Metcalf, Prouty, Golden Queen, Lennings, White, Sharpless, Crescent Seedling and Glendale, all of which do well with me. I had a great deal of trouble to get plants to live that were brought from the states, and I find it takes a good amount of labor to set and start a plantation of strawberries, but when once started they are very remunerative. At the same time they require constant care, and lots of elbow grease thrown in to make a success of it. Let no one think that he can set them as carelessly as he would cabbage and have them make a live of it; if he can, he can do more than I. I am partial to the Wilson, Jucunda, Sharpless, Captain Jack,, Crescent Seedling for profit, the Jucunda comprising about one-half of what I have, in all about an acre. Although the hail pelted them last season until what were left were one-sided, the price averaged 27 cents per quart for the season. I plant them four feet between rows, and from one to two feet in the row, according to the time of setting, throwing up ridges to set on so as to run water between rows. I always plant onions or early peas among them the first year, which pays for the first season's cultivating. Cultivate often to keep the weeds down. I generally cultivate as soon after irrigating as the ground

will permit, only while fruiting, at which time I do not cultivate any. I commence to market strawberries the first of June and continue up to the 4th of July, when my raspberries are ready and continue up to the last of August, at which time, if my strawberries need no manure, I sow oats, working them in as I go over with horse, hoe and hand, at the same time killing all weeds. If they need manure I cultivate up till fall. After the ground is frozen I cart on rotten manure, mulch with it, cultivating in the manure in the spring.

I also raise gooseberries and currants, planting them in rows 4x6 feet. I have the Houghton, Wentworth and Downing gooseberry, Red Dutch, White Dutch, Red Cherry, and White Grape currant. My Stoughton gooseberry is hard to beat; very hardy and prolific. My Red Dutch and White Grape currants are standard. The balance of my gooseberry and currants are not old enough to pass judgment upon. I cultivate the same as raspberries, with no protection in winter. Berries sell from first of June until the first of September.

My blackberries did well in growth this season; are ready for bearing the coming season. I cover with earth in winter. Have never fruited them, as I have never protected them and they killed down to the ground. Varieties—Wilson, Snyder, Kitelany, and Lawton.

My cherry trees are from one to six years old. The little sour Morello stands the climate very well. Want mulching to keep them back in spring. Some of my trees are 5 inches through and 10 or 12 feet high. The hail destroyed most of the fruit last year. The trees have borne for three years.

My grapes do not make as strong a growth as those on the lower bottom lands, but they are more hardy as far as my knowledge goes, and eventually I expect them to produce a superior article over those raised on the bottoms. I have three-fourths of an acre, mostly Concords and Clintons, although I have 20 varieties. They showed a good stand of fruit last season, until destroyed by hail, which cut foliage and new growth all off. A few protected by posts and braces, were good. My grapes are set 8 x 8

feet, and I cover with earth where the vines are small, but where too large I lay them on the ground, laying anything which comes handy on them to hold them down.

In pruning I sometimes rub off the collar sprouts, in summer, while my main pruning is done in December. My apple, pear, plum and forest trees are doing as well as can be. Such fruit trees as are living are all young, from one to four years old, my own growing doing the best of all. I have apple trees set all through my raspberries, 20 feet apart to 30 feet among my strawberries, as also my plum and pear trees. I set out 1,200 apple trees last spring, and a large portion of the 4-year olds had no roots. I lost twenty-two 2-year olds; the four and two year olds having been brought from the east. Of those of my own growing not one died. The hail knocked a great many of my root grafts loose after they had started. The balance did well and are standing the winter well so far, unprotected, and on the bleakest part of my farm. My land that I use for fruit lays to the south on quite a hillside, the soil clay loam with porous clay sub-soil, underlaid with shale. I irrigate by taking my water down the hill in sluices of lumber, with 2x2 inch gates to every row of fruit, with a cross-piece in the sluice to turn the water, my rows running parallel with the hill on a small grade. Raspberries and strawberries take considerable water, as also gooseberries and blackberries. Grapes take but little. I let them go very thirsty in the latter part of the season, until just before they freeze up, when I give everything a good soaking. Apple trees take a moderate share of water. Give them and pears too much, and it is a great detriment to them.

I would like to say something on forest tree culture, which is being too much neglected, but as I have already taken your valuable time without compensation, I will only say, plant trees, if only one, to break the monotony. Leave one living witness behind you to show to coming generations that you once inhabited the earth.

Thanking you for the courtesy shown me, I remain yours, in trying to grow trees.

A. N. Hoag.

TREE TILLERS.

INTERESTING PAPER ON THE SUBJECT BY J. K. PEABODY.

FRUIT CULTURE IN UNION AND GREELEY COUNTIES.

The object of our association is to advance the science of bee culture in the State of Colorado. Everyone knows the importance of consultation where there are so many interests to carry out. We have our agricultural societies, horticultural societies and a score or more of other organizations to look after and further the interests of our broad land. There is no class of industry that calls louder for assistance and consultation than bee culture. When we consider that a large proportion of the bee owners are ignorant of the simplest operations of the apiary, it behooves us to do all in our power to impart that knowledge by which we can prosecute the science of bee culture successfully.

Honey, as food for man, was of sufficient importance to be frequently mentioned in the sacred scriptures, though we get from them but a faint idea of the mode of bee keeping in ancient times. We read of Palestine as a land flowing with milk and honey, and travelers in the Holy Land tell us that bees are so abundant there that empty hives set out are immediately filled with bees and honey. Sampson appears to have been the first bee hunter, and found a swarm of bees and honey in the carcass of a lion. It seems he robbed the bees of their honey, but how he protected himself from their stings, whether he smoked them out or had a veil over his head and gloves on, no mention is made. Most of us are familiar with the old style of bee keeping which our fathers practiced. The old hollow called bee gum, and the large, hollow, box hive holding a barrel or more, and the brimstone pit, they used to kill the bees to get the honey, and the tin pans, and bells and horns which the whole family turned out with at swarming times. Then it would never do to buy or sell bees, if you did you would not have good luck, and if any of the family should die crape must be put on each of the bee hives to keep them

from leaving the hives and going to the woods. We have books on bee-keeping by Hunter and Huber, which refer us back two and three hundred years, but it was not until about the middle of the present century that new discoveries reduced bee-keeping to a science, by which it now occupies a prominent position in the world.

The first book on bee-keeping written in this country was by a man from the State of Vermont by the name of Weeks, some thirty-five or forty years ago. He also invented a hive and was the first to advocate small packages for comb honey. He was soon followed by Mr. Quimby, from New York State, who also wrote a book and brought out a hive. In this book all that was practical and of value to the bee keeper under the system then in vogue was well set forth, and bee keeping, as a source of profit, went steadily forward and rose to a high degree of perfection as well as profit. In 1852,

THE MOVEABLE FRAME HIVE

was invented by L. L. Longstroth, a clergyman from Ohio. He also brought out a book and secured a patent on both. This invention worked a perfect revolution in bee keeping. The moveable frame made it possible to control the bees and swarm them artificially, and learn all the interior workings of the hive and nature and instinct of the noble little workers. Then came the Italian bee—beautiful, gentle and prolific—the very bee for which honey was invented, (and called by ancient writers the banded bee of Palestine,) which was first imported into this country by Samuel Wagner, who established the "American Bee Journal." We all know what an immense business has sprung up all over our land raising queens, which are sent in small cages by mail for two cents all over the country for two thousand miles and more. A few years later Von Huscha, of Germany, invented a machine which would

REMOVE THE HONEY FROM THE COMBS

without injuring them, so they could be returned to the hive and refilled by the bees, thus saving a vast amount of labor for the bees in building combs. The history of the

invention is this: The inventor's little son tied a string to a piece of comb containing honey, and in play whirled it around—as the string wound up and unwound, the honey flying out. His father at once caught the idea, and hence the extraction, which though rude and clumsy at first, was brought to perfection in this country. Instances are on record where five and six hundred pounds of honey have been obtained from one swarm of bees in a season with this machine. The next great step which puzzled the minds of inventors and scientific bee men was to manufacture honey-comb from beeswax. The first attempt was by Mr. Wagner many years ago, but without success. Next Mr. Quinby constructed

SHEETS OF COMB OF METAL,

the cells being of full natural depth and coated with beeswax, but owing to the expense of construction it never came into general use. For several years there was a lull in the artificial comb business, but since 1875 there have been several machines brought out for the manufacture of what is called the foundation for combs by cooling or pressing thin sheets of beeswax and giving them the impression of the bottoms of cells. This being given to the bees they readily mark them out, which has proved very successful, and at present there is a large business carried on in supplying the manufactured artiele. There are many other useful articles that might be named, such as bellows, smokes, small section frames for surplus honey, etc., etc., We are but the pioneers in scientific bee culture, and it remains for succeeding generations to develop and perfect it, so as to reap the greatest amount of profit. The study of bee culture affords us pleasure, and the practice of it affords us both pleasure and profit, if intelligently directed, which should be the aim of all who embark in the business, and though drawbacks and discouragements and losses, (as in any other calling) will come, yet those who persevere will eventually see their labors crowned with success.

The paper was discussed at some length, quite a number of those present desiring further information, showing the great interest felt in the matter.

Mr. James desired to know how many colonies of bees can be artificially propagated from a single hive in a season, and was informed that in a favorable season from seven to ten new colonies could be produced from a strong hive.

Mr. Davis wanted to know why bees are crosser in Colorado than in the East. Mr. Peabody admitted the ill-temper of the Colorado bees, but did not believe that it was due to any innate propensity in the atmosphere to produce wickedness, but rather to the honey being thicker which prevents the bees from filling themselves readily. In answer to another question he stated that in his opinion moveable comb hives are the best, that in most cases artificial propagation is superior to natural, and that the Italian bee is altogether superior to the native or common bee, being gentler and more prolific and hardier, as well as being better provided to encounter the bee moth.

The afternoon session opened with the reading of an interesting paper by A. E. Gibson, of Greeley, on the

HORTICULTURAL PRODUCTS OF GREELEY AND UNION COLONIES.

It was as follows:

As fruit culture has received considerable attention on the part of the residents of Greeley and the Union Colony, this paper will be confined simply to a brief review of progress made in that particular branch of Horticulture.

Not a few of our citizens brought here with them an extended experience in fruit growing in the older states, and all recognized the fact that the ability to produce successfully the leading fruits in Colorado would go far towards determining the status of the state as an agricultural district. It may then be fairly said that the first attempts at subduing and testing the virgin soil, were by the setting of fruit trees, shrubs and plants. This beginning was of course largely a matter of experiment. Little was known of the capabilities of the soil, and still less of the adaptability of the various fruits to the new locality. Apple trees were selected at random, so to speak, as were plum, pear, peach and cherry trees. Hence, many of those who first planted met with reverses and numerous losses.

From the first, some were hopeful of ultimate success, others doubtful. Of the latter class a few, and among them one or two of our leading cultivators, went so far as to predict that even strawberries, at best, would prove but a partial success, and that grapes, raspberries, blackberries and the larger fruits were out of the question, by reason of adverse climatic influences. About the second season one of our leading citizens and well-known farmers became disgusted with the prospect for fruiting of his raspberry and blackberry canes, and proceeded vigorously to remove them root and branch from his garden. But a neighbor of larger faith and more patience, on seeing these by the roadside a few days afterwards, gathered a number, planted them and has since been rewarded by successive crops of luscious berries. Each season has revealed something of value to the grower of fruits, and after the lapse of twelve years it may be fairly stated that some things have been demonstrated with reasonable certainty.

Our present knowledge with changed conditions and more favorable surroundings, contributes towards assuring success in many directions, where such was impossible at the time the Union colony was founded. Then scarcely a man had a right to an opinion concerning what might or might not be accomplished in fruit culture. But our experience thus far has not been essentially different from that of many other newly settled States and localities. Patient, persistent, intelligent effort is needed to develop the capabilities and possibilities of our young commonwealth, and we may only be justly disappointed if time does not bring us wisdom with reference to things of which we know little. This may be said of successful fruit culture, at the outset, that next to selecting the right varieties is the desirableness of having the soil properly prepared and cultivated. Failures quite as often result from neglect to observe this precaution as from any other, and perhaps all others. This thing, if nothing more, is pretty well understood by those who have best succeeded in Weld county. Too much good cultivation is hardly possible. Results in horticultural work, for the first decade in this country have been such as to justify large expectations.

The vegetable garden has not only yielded bountifully, but the choicest small fruits have responded generously to

good culture. Our berry product, both in quality and quantity, would not suffer in comparison with that of any clime, and it is doubtful if the strawberry grown in Colorado has anywhere an equal in general excellence.

THE VARIETIES MOST GENERALLY CULTIVATED

in this vicinity are the Jucunda and Wilson, but recently the Sharpless has come into great favor and is being largely planted. The Crescent yields well, but the fruit is not so good in average quality nor in size as the others mentioned. The Bidwell promises to be a formidable rival to all of the others, and I shall not be surprised if it proves among the very best of strawberries for general cultivation.

Raspberries and blackberries, especially the former, with good care do exceedingly well. The Clark is best known, but the Turner is considered hardier. Both need some winter protection, however. The Cuthbert is being introduced, and is highly recommended by those who have tested it.

The leading black caps are the Gregg, Mammoth Cluster and Doolittle, and they rank in the order named here given. Among the promising new varieties being tested are the "Lost Rubies" (red) and Shaffer.

Currants and gooseberries yield handsomely under good treatment. Of the former the Old Red Dutch, White Grape and Cherry are grown, while the gooseberries are represented by the Houghton and Charles Downing.

SEVERAL VARIETIES OF GRAPES

have fruited and quite a large number are being tested. So far the Concord, Hartford, Delaware, Martha and Iowa have done reasonably well.

The blackberries cultivated are principally the Kittatinny, Snyder and Wilson's Early, each of which does well under proper treatment. Experiments thus far with cranberries have practically failed.

The apple crop of the county this season probably amounted to 500 bushels, largely crabs. Of these M. J. W.

Parker, of Greeley (whose crab orchard of 1,000 fine trees is coming into bearng) raised about one-half. The varieties in cultivation—Hyslop, Transcendent, Brier Sweet and Tetofski, if the latter can be classed as a crab.

Of the standard apples, the Ben Davis, Red Astrachan, Duchess of E. and Fammuese are in most favor. Some of these are beginning to fruit.

Pears give promise of being

A MARKED SUCCESS,

and one of our leading fruit growers recommends a general planting of this fruit. The Flemish Beauty is a general favorite, but the Duchess and Bartlett seem to do well. Cherry trees thus far have failed to do anything worthy of mention. Plums of the hardy varieties are succeeding, and by careful protection peach trees have been made to fruit in several instances.

As to the value of the aggregate product of fruits within the limits of Union Colony this past season I have no accurate knowledge. Probably $5,000 would be a very low estimate of the same. From other parts of the county I have no information.

But enough has been demonstrated to give our people encouragement and hope for better things and more abundant success in this important industry.

The hedge question came in for a brief discussion. Several gentlemen had successfully experimented with osage orange as a hedge plant. It was advised to plant locust for this purpose, sowing the seed and thinning out the growing trees in preference to transplanting.

Professor S. H. Short, of the University was then called on and delivered a few remarks in reference to the best means of neutralizing the evil effects of alkali in the soil.

Mr. N. DeVinney moved that Prof. Short be invited to deliver a lecture on the subject before the society on Saturday, January 21. This was adopted and the Professor

signified his willingness to gratify the wishes of the society in the matter. The lecture will take place in the chapel at 10 o'clock a. m. on the day mentioned.

The convention then adjourned to Saturday, January 21, when it will meet at the same place. At this meeting the report of the executive committee on the lists of fruit and shade trees and flowers best adapted to Colorado will be read. The report of the finance committee will also be acted upon.

The members of the convention and those in attendance generally express themselves well pleased with the work done, and only regret that the attendance was not larger. This is attributed largely to the fact that the Patrons of Husbandry were in session at the same time, and it has been decided to guard against this in future.

FALL VS. SPRING PLOWING.

BY D. L. TRACY.

As the A B C is to learning, so is plowing to the prosperity of the farmer. Perhaps some may think I have asserted more than can be proven, but we hope to make good all we assert.

Since the rude contrivance used by Job's plowmen until now such an improvement has been made in the plow, that it is not in the fault of the plow, if the plowing is not done as it should be.

There are many ways and styles of plowing. A few of these we will mention: The first will be a benefit to the renter or tenant; his plowing is according to circumstance, and that circumstance means two or three inches (there are exceptions to this). He calculates to get one crop (that is about the time the farm is occupied by the same man), and for fear he may leave the land in a condition that the next renter may have a better crop and get the praise

of being a better farmer, why he lets the plow skim the ground, for at the same time it saves horse flesh. The next is the haphazard mode of plowing; this is a mixture of deep and shallow. Cut and cover edgewise and over, and as the Irishman said "first out and in again."

The next kind of plowing is that that will result in the best returns for the labor, a uniform depth of 4, 5 or 6 inches for spring plowing, and a uniform width of furrow and completely turned over. Too often the mode of plowing can be described when the grain is growing, the cut and cover made by a 10-inch plow leaving a furrow 14 to 16 inches wide, can be told by the stress of weeds that can be traced the length of the furrow, no matter if the plowing has not been seen in the spring.

Plowing or summer furrowing is practical in many of the states with success, but it cannot be here in Colorado. My reason: Plowing cannot be done in the summer without irrigation as a general rule. And water is so scarce that it cannot be thrown away to summer fallow. But we can do better than summer fallow by plowing in the spring and planting corn and by cultivating the land thoroughly through the summer the ground will be in good condition for a crop of wheat the next spring, while the corn crop will pay easily for the labor of the cultivation and irrigation.

I have said that good spring plowing should be 4 and 5 or 5 and 6 inches deep. This must be taken in connection with the corn ground; if your corn has been thoroughly cultivated a better crop of small grain will be realized by not plowing but drilling, or shallow cultivating in, than by plowing the land. The next season plow 4 or 5 inches, and the third season 5 or 6 inches. The three seasons noted are for small grain; but for corn—(When Horace Greeley said "Go west, young man," he meant to go a good ways west; so when I say plow deep don't be afraid of getting too deep) plow deep and let every 4th year find your ground in corn.

I have and do not advise spring plowing deeper than 6 inches, but fall plowing should be deep, and I would say do not stop at any given depth but plow just as deep as your lever can stand it, no matter if it is a foot. In a

country where irrigation is practiced deep plowing is essential for a profitable mode of farming; but this deep plowing must be done at the right time. If one wishes to plow deep let it be done in the fall, so that the new earth brought up from the bottom of the furrow may have the action of the air with freezing and thawing to make it in a condition ready to cause the seed to germinate when it is put into the ground. The soil of our country is such that by a proper mode of cultivation it will always last and produce beautifully. All that is required is to know how to cultivate it. We have all noticed upon the excavated banks along our railroads that after a year or two our common weeds flourish upon the earth that has been taken out, eight and ten feet below the top of the ground. They will not grow the first year, but after that they grow thriftier each year. Now the question is left with you, "What causes this?" My answer is that nature has made this earth ready for the seed by the action of the different elements in the air. Now I claim that our deep plowing must be done at such a time that it may receive all of these actions, and when is this if not in the fall? Before I proceed to show the relative value of fall and spring plowing, I wish to refer you to page 517, Vol. 4th, Liber VI., Universal Knowledge, under the head "Agriculture." After saying many good things, it says, "the soil in the first place should be as carefully inverted as possible, since it is an important object to smother or worry the surface plants and permit them to decay within the soil and yield food for plants to be sown. In the second place it should be rendered as loose and comminated as possible for the earth in this State, both because it allows an excess of water to pass through it more easily, and it also retains a larger supply with it for the wants of vegetation when the weather is dry." But I will only refer to many of the writer's evidences, that I should like to present to you.

I will now show the relative cost and value of fall and spring plowing. You are all aware and know it to be a fact that until the last fall labor could be had for one-third less in fall than it could be in the spring, and I assert that a farmer can feed his team one-third cheaper in fall that he can in the spring. And there are a number of minor points I might yet bring before your mind. But the one main thing in fall plowing is that it tends to an earlier crop, and now since our climate has changed so that if wheat is sown

after April that it is about sure to be struck with rust, we must try to advance everything that will tend to earlier maturity of our own main product—wheat. To get the full benefit of fall plowing, fall seeding must be resorted to, and I make the assertion here, having some experience, that fall wheat can be raised for two-thirds what spring wheat can be raised for. You will please pardon me if I deviate from my subject, for I wish to show that by fall work both in plowing and seeding the farmer may be benefited thereby. Fall wheat is from one to three weeks earlier than spring wheat. I would now ask you, is it not the fact that the price of wheat is very much higher two to three weeks before the general harvested crop is ready for market. You all that are farmers or dealers in not only wheat but all of our grains, know that the prices often fall one-half in the length of time stated. I have known wheat to fall from $1.20 per bushel to 75 cents. Many farmers of this country know this to have been the case to their disadvantage three or four years ago. If at that time fall seeding had been resorted to it would have been to their advantage, but not so much so as at the present date.

I ask you to take into consideration the mode of cultivation in all of the older countries where irrigation is practiced. Countries where the different modes of cultivation have been tried until their farming has become a science, and you will find them to practice a full cultivation. Not only in these countries, but take the matter of plowing in our own country, and fall plowing has the preference.

Fall plowing is becoming more and more practical, as will be seen by consulting the agricultural and forestry reports of the United States. But for fear of taking too much of your time and being too wearisome with a few remarks I will conclude.

That water is becoming very much like money, will be acknowledged by the price ditch stock has assured. Now if by fall plowing, taken into connection with fall seeding we can lessen the quantity used, will it not be a benefit in general to the farmer. Again fall plowing helps to lighten not only the work in spring but if fall seeding is practiced with the plowing the harvest will be in such a condition that instead of the harvest pushing the farmer it will be

vice versa, a position in which the prosperous farmer is always in. A few points that I have tried to speak of I should not have touched and many points that I should have mentioned I have passed by, thinking they could be brought up here with much more profit than by being written upon by such a rustic as now leaves the subject for those assembled here to discuss.

AN IDEAL GARDEN.

READ BEFORE THE FARMER'S INSTITUTE IN FORT COLLINS.

By Albina L. Washburn.

Without a binding sense of the value of a promise, this paper would have become a minus quantity and might properly have been named an imaginary essay, so difficult is it to withdraw one's self and one's thoughts from the family circle and the family cares.

However, due regard for the promise, and for the welfare of our farm organizations, bids me make the attempt, even if I fail to take the place in your regard originally hoped for it—the place a woman is expected to fill—that of lightening the labor of our brothers, of lifting up, of throwing light in dark places, and of displacing frowns of care by smiles of mirth. Though reason tell you afterward it is moonshine, you are better for the momentary respite from your care. There is too little of "moonlight, music, love, and flowers" in this world; and we women folks are too apt to forget that our smiles and light wit are needed as much at a reunion of horticulturists and farmers who are struggling with the knotty problems of "what apples are hardy?" "How many raspberries to the acre?" and what to do with the Colorado winds and the cut-worms,—as they are in the home circle and within the limits of our ancient "sphere." That sphere is now conceded to be as

large as we can make it, and may all women find it out before their tongues are palsied with age, and their hands crippled with unnecessary drudgery.

The garden is slowly but surely assuming its proper place in the regard of farmers, and coming to be looked on as a necessary adjunct, like the family cow. Year by year the true farmer who lives near to nature's heart and loves his calling, desires more and more to see realized his ever enlarging plans and aspirations toward perfection, and as the imaginary must precede the real, time must be given during winter to plan for the coming summer. We shall build these plans for the family garden on the spot already in use for it, or we shall lay out, mentally, beds in a new one. Some general rules we may follow for convenience, beauty, or economy. Who knows but we may secure all these advantages at once? Whether the garden be in the form of a circle, a square, or a parallelogram let us have first a substantial fence all about it If tight and rather high all the better. Let us make a bed six, eight or ten feet wide all around next to the wall, except at the roomy entrance gate. Then a walk before the bed and all around the garden going in and coming out again at the gate. Now a tool-house and summer house combined, exactly in the center. Suppose we build a neat, pagoda-like structure, with rustic porch and seats on one, two, three, or the four sides. Inside tables for preparing vegetables for market. and scales for weighing; the walls furnished with shelves, hooks, nails, or whatever we like. Outside we may have, beside benches, tables and chairs for strawberry and ice cream parties, which give pleasure and bring in cash in return for labor. Under the tool house and arbor may be a cistern, or we may have a romantic pond near, fed from secret sources of irrigation. If the center of the garden be a trifle lower than the sides, judicious drainage, in connection with the California system of underground irrigation would keep the pond full. Here water lilies grow, and there are banks of pansies and ornamental shrubs which love to see themselves reflected in the watery depths. Just within the tool house we have a portable suction pump with hose attached with which to draw water from the pond and sprinkle the beds at will during a very dry time, or for hydraulic cleansing of vegetables. From the summer house run the main paths north, south, east and west, wide

enough for a wagon, if we choose, with ample room to drive around the tool house. From these main walks we may have smaller ones in any direction, be they many or few. They will be wide enough for the wheelbarrow and little hand wagon of the children. The walls of the enclosure will be useful for training up all sorts of vines and vegetables in the way they should go. Even peach trees, apricots, tomatoes, cucumbers, squashes and melons may thus be raised out of the way, and they love to climb. The rural mind staggers and wanders amid the possibilities of this modern garden of Eden. Here, trained upon the wall is that ancient plant, the cucumber. The Israelities longed for it in the wilderness— the Emperor Tiberius by the aid of artifical heat had it the whole year round to keep him cool. (What a boon it would be to the office-seekers at Washington.) We will have none of those serpentine monstrosities six feet long, reminding us of the fabled interloper in that traditional Eden, and that "by Adam's fall we sinned all." Let us have the smaller kinds which we pickle, eat raw, or stewed (for weak stomachs) or make them into French pomades!

Here, along the southern wall, are rows of currants, (which like a little shadow,) named for the small grape or raisin from Corinth, and the name corrupted by common use. Native to northern Europe and Asia, improved by the Dutch, we will try still more to improve it by kindly soil and situation. Black currants in Siberia as large as hazel nuts are nearly matched in size by the wild black and yellow current of Colorado. Let us try a few as small ornamental trees for the lawn also. What jellies we'll have for the sick; what summer drinks, harmless and cooling, for the weary, and, if you please, a cup of green tea from the leaves. We'll bottle some of the fruit when full grown but still green, after drying but not withering the surface, and bury the bottles to the neck in sand or earth in the cool cellar. The wine is best when very old, in fact, the longer it is kept without opening the better—for us!

Gooseberries too! The English "Manchester Gooseberry Book" used to be issued annually and perhaps it is yet, telling of prize gooseberries two inches in diameter, weighing one and a half ounces! Once considered an indispensable accompaniment to a roast goose, only 700 kinds

of gooseberries had taken prizes thirty years ago. We fear that now there are not roast geese enough to serve as sauce for the berries.

The grape, too, can grow upon the wall and run upon the roof of the arbor. It is the grape of the old world, descended from the "vitus vinefera" of Persia, land of the peach and of song and story! Query: Can this be the tree of knowledge whose fruit, hanging too long on the branches in the autumn sun, fermented and caused our first parents, on partaking thereof, to become slightly intoxicated? A charitable supposition, much needed to excuse Adam for saying, "The woman did it."

In an angle of the wall we may have a tiny arbor for a quiet hour at noon. It is covered and interlaced with the hop-vine which mounts and surmounts the wall. What beautifully shaped leaves, and what a healthful smell they have. In 1525 we read:

> "Hops, heresy, pickerel and beer
> Were brought into England in one year."

In 1528 parliament was requested to prohibit the use of hops as an "unwholesome weed which would spoil the taste of the beer." Later it has been thought that the beer may be more unwholesome than the hops and may spoil those who drink it. A curious fact in connection with beer is that hops belong to the same family as the nettle and hemp.

Here, too, we have in a fine bed, rather damp, horse-radish, which being a sprightly assistant of digestion and good for hoarseness, rheumatism and palsy, is, as Ike Partington remarks, a "very smart horse" and worth keeping, especially in view of its fine keeping qualities.

Now, the post of honor must be given to the corn, "the yellow, yellow corn"—not the little stunted, sickly corn which looks "yaller, because dad planted the yaller kind"—but the noble, free, emerald-green maize; tossing its silk mane in the wind, holding aloft the white cockade, and gently rustling its long ribbon leaves about its jointed stalk. Out in the sunlight give it a spacious bed. Long ago the disciples walked through a corn-field, and being hungry,

plucked and ate, and though it was the Sabbath, they were held guiltless, for "mercy and not sacrifice were desired." What can we not do with our corn? It is good to boil, to roast, to stew, for imitation oysters, for pudding, to dry for winter and to make into succotash and corn bread, and mush and soups and vinegar. And then the smooth polished joints for winter ornaments, and the husks for beds, mats and baskets. Hail, King Corn! By the way, a friend of mine was once lost in a forest of corn. With her little girl by her side and a great fat baby in her arms she took a short-cut from her house to a neighbor's about a quarter of a mile away to spend the day. Walking between the rows of tall corn for some time no house appeared. They took another row and walked again—no house. They went diagonally—still no house. All day long, a hot summer day, they spent in the cornfield, and at dark, worn out with fatigue and hunger, came out to the lights in her own house, thankful enough. This story seems large, but the cornfield was larger.

The nasturtium, from South America, vain of its rich flowers, climbs the wall to show them, but the prudent housewife, seeking what she may devour, seizes the leaves for salad, the flowers for garnishing and the fruit for pickles, not forgetting to take "tithings" of dill in passing, and juice of garlic to cement her broken china and glassware. Shall we have artichokes? I fear their namesakes, the Jerusalem artichokes, are too hardy, as they have the hardihood to stay year after year, and have the seeming of a Colorado weed,—but some guest from Italy may like the buds of the artichoke proper dressed as a salad with oil, salt and pepper. An Englishman will have them boiled plain and dipped in butter and pepper. In France and Germany the stalks are boiled and pickled (how very economical they must be there.) The flowers have the property of rennet to curdle milk, and the juice of the stalks and leaves with bismuth will color wool a gold color, and to add to its general utility, it is also used with white wine to cure dropsy. The bed of asparagus must have extra care in preparation and setting, for it will last from ten to fifty years. A Roman farmer raised it so large that three of the shoots weighed a pound. He was the "noblest Roman of them all."

Beans, too, we have. They are good, in season and out of season. Probably it was in India, their native land,

that the bean stalk Jack was climbing grew so very fast, while he mounted higher and higher, singing, "hitchety, hatchet, with my little red jacket, and up I go."

Beds of beets with their smooth glossy leaves, will form an agreeable feature in our garden. Found wild on the southern sea coast of Europe, they have been used since 1656, the roots being made into beer and sugar, and the leaves used for nitre; but we shall use these for the dinner table and to pickle. For winter use we sow them rather late, even up to the first of August.

Here are rows of broccoli, from Cyprus, and cabbages and carrots. By the way, what pretty, fine leaves the carrots have! In Queen Elizabeth's time the ladies wore them in their hair. We might now, but people would talk, for the carrot, you know, is six times as nutritious as the potato. We would dare, however, to slice off the crown of one, set it in water and keep it on the mantel shelf to grow and furnish a pleasant contrast to the snow outside. The cauliflower must not be forgotten. It is highly esteemed for a table dish and for pickling. Since its introduction from Cyprus, at the beginning of the 17th century, it has been immensely improved.

Celery, once a rank weed called smallage, growing in marshy places and along the ditches of Great Britain, now takes front rank as a choice table dish. Let us be thankful that the trenching so laboriously practiced for blanching the stems, may be superceded by the easier method of placing a winter supply in tight boxes containing a little water, in the cellar, the plants, roots and all being placed in them upright and close together, when they need no further attention than to keep the little water in the boxes. Physicians have discovered that celery, stewed and dressed with butter or cream for the table is a remedy for nervousness. Let overworked housewives try it. Probably it will cure hunger too, if assisted by bread and butter.

Pepper grass (from Persia or Cyprus 1548) makes a pretty bed or border, but if you attempt to write your name with it, only an occasional plant will appear. Nature likes to play such jokes on credulous humanity. Leeks were used by the Egyptians before Mark Twain ever saw

any. A Welshman wears them in his hat on the first of March. The balance of the year he wears them in his stomach.

Lettuce was first cultivated in England, about 1652, and is improving fast, very compact heads now being grown. Its botanical name, "Lactuca Sativa," is said to come from the Latin word "Lac" for milk, as the plant exudes a milky juice of mild narcotic principle which, with age, becomes strong, bitter and decidedly sedative. It was long ago found that a lettuce supper was highly conducive to repose. We suggest that this accounts for the touching motto of the late confederacy: "Lettuce alone." The muskmelon was brought into Europe by the Romans, and, it is said, distributed wherever they carried their arms; and to this day fine patches of them are subject to "raids" from small boys with jack-knives. The other old plant, the mustard, mentioned as the "least of all seeds," which grew so large that 'the birds of the air would come and lodge in the branches thereof,' must have possessed drawing qualities even greater than at the present day, to have enabled historians to "draw the long bow" like that. Though the seed of our mustard is not very small (nor the plant very large), when freshly ground it will draw better than a temperance lecture; and when mixed with a little warm water, will enable a man to throw up an unprofitable contract.

The onion has many private friends who, from false pride, do not parade its virtues in public. In this respect it is somewhat like Josh Billings' "yaller dog," which, for lack of pedigree, fell into disrepute. From Asia and Egypt (probably by way of England) it has emigrated to this country, and has obtained an especially strong foothold in the land of wooden nutmegs, and has, in fact, since the denuding of forests and the degeneracy of Yankees, rather superceded that economical, if not popular, commodity. In Colorado—in grasshopper times—we see fine beds of them scooped out like saucers, and the air redolent with the breath of the consumers. To the latter (the 'hoppers) we would recommend chewing a few leaves of parsley afterward, or a liberal dose of ozone.

Peas are pretty, wholesome and nutritious, though even the dwarf varieties are very high in the spring. Although grown for many centuries in India, China and

Japan,—and the Virgin Queen had but few, brought from Holland, which "came so far and cost so dear"—their origin is involved in mystery, for, "where oats, peas, beans and barley grows, you nor I nor nobody knows." Since the war the Tom Thumbs, the Daniel O'Rourkes, the Blue Peters, and others of the family, have had a great run, for did not one of our valiant generals say, "Let us have peas?"

The potato, found growing wild in South America, and domesticated in Virginia by Sir Walter Raleigh, was carried to Great Britian in 1586, and cultivated on his estate in Ireland. We are told that, for a long time, the tubers were eaten as fruit with sugar, or baked into pies with wine and spices. Queen Anne ate a few at two shillings per pound. There was great opposition to their introduction, some people arguing that what was not mentioned in the Bible, was not fit food for man. However, this objection faded away, like others, when it was found that they were good. It is now said that the discovery of the potato has been of more benefit to mankind than the discovery of gun powder. This cannot be, because their "blow" does not amount to much. Nothing is said about dynamite, but it may be surmised that the Czar, of all the Russians, prefers potatoes.

Yonder exaggerated vine, a single specimen running along the wall, with leaves as large as elephants' ears and golden cups, from whose half-concealed depths the busy bee is sipping honey or nervously filling his baskets with pollen, and from whose reed-like stems the rustic swain, with rude art fashions a flute, whose dulcet notes charm some village belle—*that* is the "encurbita pepo," whose globes of yellow fruit make very nice pies. It is sometimes vulgarly called "punkin," and the pies are called "punkin pies." In old times, when fairies were fashionable, "punkins" were shelled and little girls in glass slippers rode to balls in the shell. These were very good little girls, who invariably married the prince and lived happily ever after. There was also an impecunious gentleman named Peter, who, for want of a better habitation, was obliged to rent a "punkin shell" for his bride. History adds that "there he kept her very well."

Sage has been cultivated to keep death away, as it was once an adage, "Can a man die in whose garden there grows

sage?" But it having failed in several instances, it is now used in sausages, which are better for the purpose. But enough of nonsense.

May we all come into possession of real gardens, whose fruits, in due succession in their freshness, purity and sweetness shall supply every want of those temples of ours and furnish forth the mind and the affections with like qualities.

THE HOME OF THE FUTURE.

READ BEFORE THE FARMER'S INSTITUTE, JAN. 27, 1882.

By Mrs. Harris Stanton.

President Edwards gave us last year "The House of the Future." Is it not well to prepare the home to fit it? Is there in the hurrying life of Americans enough thought given to the home life of the present, as well as the future? Are we not almost criminally negligent in forming our home life, so that members, both old and young, go forth to the enticing lures of the public without enough thought, care and loving teaching to avoid the snares that are laid for them? One of our number has written of the "Ideal Garden," The successful growth and cultivation of the home circle, training minds to withstand the temptations of prosperity, as well as the more visible rebuffs of adversity, might well take much more thought and study to the advantage of all. Is there one, in a home however small, that can say *I* have nothing to do; my family circle needs no cultivation; *we* have no weeds to eradicate, no flowers to look after, either for our own pleasure or for the admiration and pleasant example of others? It was well said by our Essay on Flowers, last year, that they were a refining and purifying influence,—is not a well trained child much more so? Can even the least act showing a higher train-

ing in moral life, higher aims of love to our brother, through principle, fail to show to others that there is something good in a pure life? I think false delicacy as well as thoughtlessness and selfishness has much to do in neglecting the full confidence there must be in order to help each other in the home life.

In order to be a successful florist I think it is admitted one must love the flowers. We surely have the incentive to cultivate our home members—our very love for them should be their safeguard, it would make us work for them, strengthen them and help them in every way. Cultivate pure thoughts and actions in ourselves, to show them by example as well as precept. Fathers, let no false delicacy or negligence keep you from cultivating your son's confidence. It strengthens him when transplanted from the protection of the home to the exposed life of the public, with its many temptations. Mothers, by every means secure the confidence of your sons, as well as of your daughters. There is no subject, either of amusement, habits, tastes, society, friends, or ideas, that a mother cannot safely converse upon with her children to their profit. In successful agricultural pursuits, one must learn from the experience and the teachings of the best scientific writers to take advantage of all kinds of soil and seeds. So we must watch and adapt the best writers and teachers to suit the different minds in our charge, not forgetting that the bow must be unbent at times—that if we do not encourage the right kind of amusements and recreations they may select those not so beneficial.

We often think, in view of our own failures, that one should live two lives in order to benefit in the last by the teachings of the first; can we not live again in our children, or some one that we can help by our experience? The home of the future should be so loving that all should be done for the good of the whole; not only the physical health, but the fullest, freest growth of purity, principle and highest mental growth. Let us then remember that in the perfect *house* of the future, with all its excellent appointments, the best cheer of it all must come from its occupants. A sweet, loving word and a warm clasp of the hand will do as much for the mental well-being as the highest

perfection in the modern science of building and location could for the physical health of the household. Bishop Mantz says :

"Aim at the highest prize ; if there thou fail,
Thou'lt haply reach to one not far below.
Strive first the goal to compass ; if too slow
Thy speed, the attempt may ne'er the less avail,
The next best post to conquer."

SCIENCE AND AGRICULTURE.

PAPER READ BEFORE THE FARMERS' INSTITUTE, BOULDER.

By Professor C. F. Davis.

When, fifty years ago, a speaker addressed a body of farmers upon the relation of education to agriculture, he found it necessary to show by a line of argument that even an elementary knowledge of reading, writing and arithmetic could serve a farmer in any other way than as a mere polish. The idea that his children were to be "nothing but farmers," led the agriculturist to reason that if the boys could plow, hoe, and perform the other parts of the farm routine, while the girls learned to sew sufficiently well to enable them to make the awkwardly fitting garments which the boys were to wear, and at the same time became skilled in the processes of the dairy and kitchen, he had performed his whole duty to his family as well as to the state. This condition, however, is of the past. Few farmers now question the necessity of a slight drill in schools for both boys and girls. But they are not yet willing to admit that a higher scientific education would be of benefit to their sons more than proportional to the amount of time required to attain such knowledge. If, therefore, I make little reference to the primary schools, it is not because I ignore their importance, but rather that I believe the willingness of farmers to patronize these schools may be taken as so much vantage ground.

If asked, then, how the study of science can aid the farmer, I reply, first, by such study he is made to become more systematic in all his manual and mental operations. No experiment can be successfully performed unless each detail receive careful attention at the proper time and in the appropriate place. The experimenter, in laboratory or in field, who goes about his work in a slip-shod way, satisfying himself with results which are "almost correct," can never arrive at conclusions which can be trusted. In science, as in heaven, order is the first prime law. The habit of scientific accuracy once attained is necessarily carried into all the minutiæ of farm work. Tools have a place provided for them, and are found in their places. Doors, gates and windows are kept in repair, for to a systematic man nothing is more annoying than a broken hinge. The various operations of planting, hoeing, harvesting, etc., receive methodical attention, thus leading to a cheaper production of crops.

An investigator, wishing to thoroughly understand some natural object, must needs examine carefully its physical properties, the relation of its parts to the whole, the time of its formation, together with the effect produced by the application of heat and chemical substances upon the material studied. Finally, when all is done, it may be necessary for him to rest satisfied with mere generalizations. But has he not by the study been highly benefited? Facts have been adduced, general principles established, his insight into the workings of nature increased, while in every way his powers of observation and of reasoning have been heightened.

The farmer finds himself dealing with two of the most complex of the varied materials of nature—the soil and the vegetation which it nourishes. If to thoroughly understand a simple natural object there is needed such close scrutiny of principles and relations, how much more is it essential that, to intelligently use them, the farmer should have a perfect knowledge of his more complicated substances. What is the plant upon which are staked so many interests? How is it developed from the seed through all its varying phases of germ, majestic verdure, fructification and decay? Whence comes its food, from the gentle breath which fans its leaves, or from the spurned clod that seems but to act as a place of footing?

If from the soil the plant is found to procure much of its nourishment, what is the process by which so gross a fabuluna is made to enter and circulate through its delicate tissues? These and a myriad other similar queries which can be answered only by a scientific, that is, a systematic, investigation of all involved principles, should be matters with which the farmer is familiar. Without such knowledge he must often work blindly. The mere fact that wheat will grow if properly sown upon suitably prepared land, under appropriate conditions of climate, is not enough. *Why* wheat requires a certain character of soil and climate, needs to be fully understood; for from such knowledge naturally grows the fitting remedy for lands which refuse to yield the desired crop.

Knowing the character of a certain soil and its requisites for the production of a certain crop, the husbandman is able to calculate upon his chances of success when the seed in question is applied; while an understanding of the reasons for the modifying influences of various manurial agents aids him in judging of the advisability of applying them to his soil. He learns, for example, that in some countries lime is found to be highly beneficial to wheat. To be able to determine whether it will be of equal benefit on his farm, he must know in what form of chemical combination lime is most available to growing vegetation; whether his soil already contains lime in sufficient quantity and whether it is in a condition to be readily appropriated.

As the dealer in stocks who has made himself familiar with the effect of all the ins and outs of the money markets of the earth, can more safely count upon financial success in his operations, than can the one who merely takes his chances, as in a game of hazard; so that farmer who gains a knowledge of all the varied qualities and needs of his soil and crop, together with the reasons for the effect of certain appliances, can more safely calculate upon financial security than can his misinformed neighbor who, from a lack of such knowledge, must needs try the unprofitable crop to become aware of its unfitness. Hence, it is safe to affirm that the application of science to his work, by introducing more systematic methods and insuring a better understanding of the materials acted upon, must render the farmer more certain of financial success.

If, however, we wish to thoroughly know the power of our own soil, it is not sufficient that we limit our investigation, be it never so thorough, to our farm or locality. We must be able and willing to read understandingly the investigations of others who have studied soils of a character different from our own, in different climates and under varied conditions; for in this way only can we arrive at those broad generalizations which form the underlying principles of any science. Thus the scientific farmer must be a reader in a great field. He should become familiar with the labors of the many French, German and English students who have spent long years in patient toil in examining most minutely the various functions and constituents of plants, the sameness of their food and their manner of procuring it from the soil or atmosphere. Nor can he afford to overlook the investigations of his own countrymen in the same direction.

The chemist may, by his study of the soil and its vegetation, in the laboratory, arrive at valuable general principles; but he can not do all. There remains for the practical farmer to test these principles in the field with all its variety of weather, soil and cultivation. By thus cooperating with the scientist of the laboratory, who is earnestly laboring to aid him in solving his complex problem, the scientist of the field is carried beyond selfish considerations, becomes more cosmopolitan, makes a grand step toward raising the agricultural classes from practical serfdom. The truth of this is illustrated in the life of Boussingault, a French farmer and chemist. Of him Geo. Law, of England, writes: "His title to consideration is recognized wherever letters and civilization have extended their influence." Would our farmers but recognize the need of this scientific culture, there would soon grow an appreciation of those periodicals which, like the *Country Gentleman* and the *American Agriculturist*, are striving to elevate them and their truly noble calling. We should less frequently hear these and similar papers condemned because they are too scientific to be comprehended.

One of the most difficult tasks of the student of science is to limit himself to a given field of study. As he plods along his appointed path there appear on either side subjects teeming with interest, to examine which there is

constant temptation. Nothing to him can be commonplace. Every object bears marks of the great planner's skill. The farmer, once imbued with the spirit of investigation, cannot fail to find beauty on every side. The insects in his path cease to be mere "bugs and worms." He observes with interest their liliputian wars, their social habits and systems of architecture. He soon learns to know which are his friends and which his foes. To such a man the tiny flower is more than a mass of color. He sees its symmetry of arrangement, its mode of fertilization, its relation to the coming seed, its dependence upon the fallen distributing insect. When by chance he turns the little beauty into his furrow, he thinks with the poet:

"Wee, modest, crimson-tipped flower,
Thou'st met me in an evil hour;
For I must crush among the stoure
Thy slender stem.
To spare thee now is past my power,
Thou bonnie gem."

All nature is replete with beauty, symmetry and law. Step by step he learns the inter-dependence of all her parts; day by day he is led to inquire into the harmony of all her works. "To him she speaks a various language; for his gayer hours she has a voice of gladness, and a smile and eloquence of beauty, and she glides into his darker musings with a mild and healing sympathy which steals away their sharpness 'ere he is aware." Becoming thus an admirer of nature, the farmer learns to imitate her beauty in his home. Neatness takes the place of neglect; works of art adorn his walls; flowers are cultivated, and under the benign influence of beauty and order the man is raised to a higher moral plane.

The worker on the farm is not isolated from his fellows; with them he must share in the duties of government. The elective franchise is to him as sacred a trust as to any of the race. The duties of citizenship are laid as heavily upon his shoulders as upon those of any in the land. It is of importance, therefore, that he be a good citizen. Can any man be a better citizen than our scientific farmer? His financial outlook is a bright one; his liberal views render him eminently a social being, while his refined methods of thought tend to make him more moral.

Prosperity, sociability, morality—what higher qualifications of good citizenship can we ask? The man thus situated has no fear that his children will be "weaned from the old farm" if allowed to get an education at some college. With books to read, parents capable of comprehending the longings of their young souls for sympathy and beauty, and their homes rendered attractive by the embellishments of art, few children have any desire to leave the family hearth, with its thousand attachments, for the cold welcome of the crowded city. It is those children who go out from homes where the one great law has been to labor; from homes in which no pains have been taken to furnish food for the growing mind or objects of beauty for the expanding soul, who become intoxicated with the gaudy show of luxury so diffusely scattered around them in the city, and leave the hum-drum of the old life in hopes of finding a better.

I am led here to ask, what are the essentials of happiness? Is it not, in the higher sense, secured to the one who has a complete knowledge of his own faculties; who can reason connectedly to logical conclusions, and who realizes the need of every individual's striving to alleviate the woes of those about him less fortunately circumstanced than himself? If so, the man of science on the farm may certainly be the happiest of mortals.

One notable element of happiness which lies in his possession is not to be lost sight of; it is that the study of science will lead him to so order his home, that his children will love to linger around the sacred haunts of childhood and to lighten the journey of their piously revered parents on the down hill of life.

Having thus shown, at some length, the effect of science upon the man who studies it zealously, and without zeal it hardly deserves the name of science, I wish before closing to point out some of the direct applications of science to the operations of the farm, and to show how, by the labors of the chemist, farmers may be benefited.

When, early in the present century, Sir Humphrey Davy gave a few lectures upon the chemistry of the soil, few, even among chemists, were prepared to believe that any great gain was to come from such study. Now, however, hundreds of chemists and intelligent farmers in

Europe and America are searching out the connections between the plant, on one side, and the soil, atmosphere and climate upon the other. And though the problem is far from solved in all its intricate parts, many valuable facts have been discovered; many wonderful and important relations have been pointed out. Once the farmer believed that the roots of plants needed but a due supply of moisture, and did not recognize that stagnant water is as injurious as no moisture. He was afraid to hoe his corn in time of drought, for fear that loosening the soil would hasten its drying. Investigation has shown that the roots of crops, as much as the leaves, require to be constantly supplied with fresh air, rich in the life sustaining elements; and that the soil, instead of becoming more parched from hoeing, actually receives moisture from the decay caused by the chemical action of the freely admitted air upon the organic matter in the soil.

Notwithstanding the countless forms in which matter presents itself upon our earth, it has been determined that there are in all the realms of nature with which we are familiar, but about sixty-five really different kinds of matter. That is, it is known that all bodies may be resolved into two or more of these sixty-five varieties of matter, the wide diversity of forms being produced merely by the combination in greater or less proportion of several of these primary materials. From his inability to farther separate the sixty-five forms of matter the chemist has given to them the name of elements or elementary bodies. As the result of a large number of careful analyses, it is known that all the vegetation of our globe is essentially made up of but fourteen of the elements; four of which occur in nature in the form of air or gas, while the remaining ten are solids which enter into the composition of the solid crust of our planet. When you burn a plant you have left a volume of ash which varies from a fraction of one per cent. to about twenty per cent. of the original material. This contains all of the ten solid elements, which went to make up the plant; all of the remaining portion of the vegetable substance having been composed of the four gases which have mostly escaped in the process of burning. There is needed but a slight examination to ascertain that a plant is made up of three principal parts, the root which holds it in place and lies buried beneath the soil; the stem or trunk; and

the broad expanse of foliage which is bathed by the ever shifting atmosphere. But nearer study acquaints us with the fact that all parts of the vegetable body are made up of minute cells or sacks. The leaves are found to be so many small laboratories for the assimilation of the food derived from the earth and air, especially are they found adapted to the appropriation of the substance known to you as charcoal, but which the chemists call carbon. The roots act as agents to select from the soil the proper material for the nourishment of the living plant, while the stem furnishes a means of connection between leaf and root. These are by no means all of the functions of the various parts of the plant, but will suffice for our present purpose.

As so large a portion of vegetation is seen to be composed of the gaseous elements, and as the atmosphere is known to carry all of the four gases, either free or in a state of combination, while it circulates freely through the soil about the roots, or kisses the leaves spread upon its soft bosom, it becomes at once an interesting and highly important question to determine which portion of its food the plant acquires through its leaves, and to what extent it is nourished through the agency of its roots. I say this question is important, because upon its solution depends the value of many of our manures.

Again, knowing that the solid portion of the plant, which, though small, is far from unimportant, must be taken up by the roots, it becomes desirable to know in what proportion these various elements should be present in the soil to produce the best results in matured crops; for it is found that substances which, if present in small quantities, are of the greatest benefit, become sources of serious harm if too freely applied. Some of the ingredients of the ash of plants exist in nature in forms of combination which, owing to their insolubility, are unavailable to the plant, while in various other forms they act as poisons. Hence there arises a query concerning the form in which they are to be applied.

It is believed by botanists that the extreme ends of new roots are the only portions of the plant lying in the soil which have the power of absorbing nourishment. If you examine these soft, delicate portions of the root you will hardly be willing to believe that they can take from

the rocks among which they spread, the various solid parts necessary for the support of a plant; still this they do. One experimenter, wishing to establish the fact of roots acting corrosively upon the rocks of the soil, planted seeds in vessels in the bottoms of which had been placed smoothly polished plates of the various materials, marble, dolomite, phosphate of lime, gypsum and glass. As the seeds germinated and the plant developed, the roots spread out in the vessel and, coming in contact with the polished plates, extended horizontally along their surfaces. After a few weeks the plates were removed. The plants thus studied were the bean, Indian corn, squash and wheat. Upon examination it was found that the marble, dolomite and phosphate of lime where they had been in contact with the roots, were so clearly corroded that the paths of the roots across their faces could be traced without difficulty. By similar experiments it is found that even sandstone is thus made soluble by the roots of growing plants. Should you take marble, chalk, carbonate of soda or other carbonate, and act upon it with any, even very weak, acid—that is, any sour substance, it will be noticed that there is set free a large amount of air or gas. This is carbonic acid gas, and comes from the decomposition of the material to which the acid has been applied. Much or all of the carbon which enters into the composition of the plant does so in the form of this gas, either through the roots or leaves. All spring or river water contains more or less of the gas, which, besides being thus conveyed to the roots in the soil, gives to the water the power of dissolving many rocks found in nature.

The time has been when a stagnant swamp or miasmatic bog could stand within a few rods of the farmer's door, breathing forth its death-dealing poisons to dilute the atmosphere in which the man and his family lived, and no suspicion arose that in these places was to be found the true explanation of the lingering disease and too frequent deaths so conveniently ascribed to a mysterious providence. But the chemist has detected the subtle germs of disease floating in air, and has traced them to their origin, finding it to be the decaying matter in which stagnant water ever abounds. Having pointed out the cause of malarial fevers, little skill was required to suggest an effective preventive;

so that now, if about the farmer's door are found those dangerous cesspools, it must be from choice and not from a want of knowledge of their potential evil.

A farmer of this State may observe that his soil, which he is accustomed to plow to a depth of but from four to eight inches has the same general appearance to the depth of eighteen to twenty-four inches. He is lead to reason that, if shallow plowing gives rich returns, much more rich should be the crop if the soil, when to some extent exhausted at top, is turned up from below. The experiment is tried; the rich looking sub-soil is brought to the surface; the wheat is at once sown, and, when harvest time comes, the crop quite likely proves a failure, and we have one more advocate of continued shallow plowing. Let him look, however, to the chemical condition of his sub-soil, and he will learn why his first crop upon the newly-turned land is poor while the second and third increase in value. Our soil is compact, the air does not freely circulate below the bottom of the old shallow furrow and the sub-soil must needs be allowed to lie inactive for a time after turning to give it a chance to become "weathered," or, as the chemist says, oxidized, before it is fit for cropping.

Many of the compounds found in plants in different stages of their development, have almost or quite the same composition, being made up of the same elements in the same absolute proportion. As the plant develops, the properties of one class of substances give way to those of another In most vegetable substances there is a time in their development when the maximum of value as articles of food is attained. If allowed to remain for a few days after this time before harvesting, they lose much in value. It is of importance, then, that the farmer know from chemical investigation when to most profitably gather his crop. In the feeding of stock, the farmer may derive much profit from the investigations of the chemist. By knowing the adaptability of certain forage crops to lay on fat, of others to give strength or power of endurance, he is able to economize by adapting his food to the object in view, whether it be to prepare his animal for the harness, the dairy or the shambles. I can not, in the time allotted me, exhaust the extended list of benefits to be derived by the

farmer by the application of science to his daily business. Nor is it necessary that I should do so. Enough has been said to show wherein the wisdom of such a course lies.

It has not been my design in this address to teach you a lesson in science which you could upon going home put into immediate use: I have sought rather to lead you to feel a need of more knowledge on the subject of science, and then to induce you to study and to allow your children to study deep in the matter so nearly pertaining to your worldly prosperity. Do not leave the matter with the mistaken notion that it is all a baseless theory. So few farmers of our land have tried to apply the principles of science to their business that we are obliged to admit that the matter has a theoretical appearance. But scientific theory is not baseless. It is, as Johnson says, "a deduction from facts; the best facts in our possession."

The objection may be offered that farmers have no opportunity to become versed in science; that they cannot take up the subject alone at home, and cannot afford to leave their families to get the necessary start at an institution of learning. This, I admit, is in most cases true, but there is a remedy. The State has founded and supports a college for the express purpose of imparting the knowledge you require. Though you cannot yourselves attend this school, you can at least send your sons and daughters to your agricultural college, and thereby give them the opportunity of getting the drill of which you feel the need. Let the young men go to the college; they will bring back to the farm new ideas, new methods, renewed zeal.

You are not to expect them to return fully prepared to cope with all your problems of practical science off-hand. But they will come to you, if they attend to their duty while at college, with their senses trained to observe, their minds cultivated to follow the scientific developments of the age, with head and heart and hand prepared to co-operate with the trained scientist. In four years, much of which time is necessarily devoted to the minor departments of education, we can not expect to make a young man in any sense perfect in a science; but we can get him well grounded in the principles of his chosen science, and prepared to continue alone on the farm the work commenced in the class room.

Colorado stands among the foremost of the states in our Union, in her natural wealth of minerals, in the enterprise of her business men, in the fertility of her soil. Can we not also add to these laurels a thoroughly energetic, wide-awake farming class, a trophy of which no state as yet can boast?

We are toiling to raise your occupation and yourselves to the place which belongs to you in the scale of men and deeds in our land. We ask you to lend a hand. Will you be like fossils amid the great rush of life about you, or will you *live* and enter with a will into the struggle for intelligence and worth?

AGRICULTURE IN COLORADO—IRRIGATION.

HON. J. S. STANGER, DENVER, COLO.

READ BEFORE AGRICULTURAL CONGRESS, CHICAGO, ILLINOIS.

The discussion of agriculture in rainless countries necessitates the consideration of methods different from those adopted in countries not so fortunately situated. The lucky inhabitant of Colorado does not interest himself in the rise and fall of the barometer, nor does he have to carefully scan the weather bulletins published daily by the Signal Service bureau. The farmer there contentedly seeks his couch at nightfall, confident that the morrow will bring sunshine, and his daily work will be unimpeded by storm or rain. He is not anxious about the clouds, for he knows from them he will rarely get moisture, either in the seed time or in the harvest, but that the supply of water that is needed for his growing crops will be furnished by the melting of the great snow banks that cover the sides, and fill the great crevices and gulches and canons of the towering mountains. He knows the sun will shine, and the snows will melt, and that millions of little rivulets will find their way down the mighty mountain sides into the creeks

and rivers of the plain, and he can tap the stream, and by proper gradients and levels, through canals and ditches conduct the fructifying waters upon lands richer in the elements that produce food plants, and more lasting than the best of those that lie within the geographical lines that mark the State of Illinois.

Having said this much for the soil and climate of Colorado, we are compelled to explain why so little is known and written of her agricultural resources. If any of my hearers have visited Colorado, and I know scores of you have, you will confirm me in the statement that where and when you heard or read one word about the state's agricultural or horticultural productions, you have heard and read ten thousand about the mines of royal metals within her borders; when you were once importuned to buy an acre of agricultural land, you were importuned a thousand times to invest in some hidden Golconda. The chances were the host with whom you dined knew not whether the bread, the meat, the vegetables, and the fruit you ate was the product of a Colorado farm or of Kansas, and if you were thoughtful enough to ask him, the chances were he would say: "Colorado is no farming country." The fact is, people did not come to Colorado to follow farming, but to make a living by a different way, a way which, when investigated, would likely prove less honorable, less sure, and less remunerative. Facts are facts, and in this case we must acknowledge them. Methinks my hearers are mentally asking, whose fault is this? For one, I plead guilty, and answer, our own; from the highest to the lowest of our citizens we have paraded our glittering baubles before the enquiring crowds, and placed in the background the more useful and lasting; there have been a few exceptions to this sweeping indictment, but not enough to resist or turn aside the popular current of thought and expression. I am pleased to say there is now a glimmering of daylight ahead, and soon the full rays of intelligent information will reach the thousands of agriculturists who would like to make their homes under Colorado's cloudless skies.

Another reason existed why Colorado was not thought an agricultural State, and that was because crops had to be raised by irrigation. Living in countries where rainfall was abundant, almost too abundant sometimes, people did

not understand the methods of irrigation, and the literature on the subject printed in English is scarce; and a doubt was in the minds of those who had a desire for the cultivation of the soil. Although methods of irrigation are as old as the world, yet they were only known in a dim, undefined way by the farmers of this country, and they were afraid of the method. And again, Colorado had the reputation of being a desert of plain, and a fastness of mountain. All of us who are approaching or have passed the meridian of life, were taught in our school-boy days that the great American Desert was that part of the country which lies within the boundaries of the State. These things being true, is it any wonder that Colorado has not attracted to her an immigration of farmers? But a better time is coming and is almost here. Ten years hence will see an hundred waving fields of grain, and blooming and bearing orchards and vineyards where there is but a straggling dozen to-day. Our valleys will be as famous for fruit and golden grain as are the irrigated plains of Lombardy or Piedmont.

EARLY HISTORY OF AGRICULTURE IN COLORADO.

In 1858 and '59, there prevailed throughout the Eastern States, extending to some of the Southern, and also those of the Missouri Valley, a tide of emigration to that part of the Rocky Mountain country which is now called Colorado; then it was called Pike's Peak—not a very euphonious name, but one that has made the humble lieutenant famous for all time to come. This emigration was not for the purpose of finding farm lands, but the object was gold, which, rumor said, was hidden in the rivers and creek beds and gulches and canons of the fabulous Pike's Peak country; gold was found, but many miles north of this famous mountain, and where one dollar's worth of it was secured, ten were spent in getting it. Tens of thousands of people sought this Eldorado, but only to find what was, compara-

tively speaking, a desert waste of land, cloudless skies, pure air, and pure water. Disappointment was almost the universal lot of the seekers for gold, but with true American grit, genius and perseverance, many made up their minds to stay in the country; the more timid and doubting turned their faces eastward, and tramped their way back to the settlements on the Missouri.

To stay, necessitated the production of something to eat; even if the persevering gold hunters made a successful find, food they must have. Gold dust they could not eat, and to haul potatoes, onions, cabbage, and other necessary garden vegetables with ox teams five hundred miles across plains infested with hostile Indians, was practically impossible. Among the pioneers were men who had been to California in the rush to that land of gold, ten years before. They there had learned that men could make more money selling vegetables to gold hunters than they could make hunting the gold itself. They also had seen these products raised by irrigation. Where now stands the depot of the Colorado Central railroad, in the city of Golden, at the mouth of Clear Creek canon, D. K. Wall, in 1859, planted the first garden ever attempted in Northern Colorado. At Bent's Fort, on the Arkansas river, and at Fort Collins, there may have been some vegetables raised by the soldiers of those forts, but there is no record of the fact. By irrigation this gentleman, who, by the way, is a much respected citizen of Denver to-day, raised a magnificent crop of garden vegetables, two acres in extent, which brought him, in gold dust, $7,000.

The next year half a dozen gardens flourished on the bottoms of Clear Creek, and in this year the first irrigating ditch was taken out for the exclusive use of farmers; the name of the ditch was "Jefferson," now the "Table Mountain;" and permit me incidentally to remark, the stock of this company is worth about as much, and pays as great a per cent. of profit as do the best street railways of Chicago.

In those early days of gardening in Colorado, it was no unusual thing for potatoes to fetch 35 cts. per pound, and cabbage and onions 50 cts. It is recorded that W. A. Rand sold a two-horse wagon load of potatoes for $1,100. Ten cabbages were sold by Mr. Lee for $100. The first

field of wheat was raised in 1862, and was kept for seed; the next year the crop from this seed fetched 10 cents per pound, or $6.00 per bushel. I recount these facts, to call to your mind that this was truly only twenty years ago. Since that time Colorado, then a *terra incognito*, has become the Centennial State, and the most notorious of the sisterhood. Since then four great trunk lines of railroads have penetrated her boundaries, and Denver, with fourteen lines radiating from the commercial center of her 75,000 people, has become famous to the known world, and Leadville the greatest silver producing camp in the world. Since then two thousand miles of irrigating ditches have been built, and twenty million dollars' worth of the products of the farm, garden and range have been raised in one year to increase the wealth of the State; and the beginning is only here. Railroads now penetrate the canons that twenty years ago were considered inaccessible to the sure-footed mule. Silver and gold are found on every mountain range. Iron, lead, copper and coal are found in inexhaustible quantities. The smoke from smelters of the royal metals, and from blast furnaces, and iron, steel and nail factories, and from coke ovens is continually ascending to the skies. Colorado is just arising from a cloud of misapprehension and misrepresentation, and the day is not far distant when she will be as famous for homes of the farmer, the operator in iron and steel works, the miner and the mechanic, as she has been for the speculator, the expert or the mining sharp. A new era is upon our young State, and the day is not far distant when, instead of annually importing twelve millions of dollars' worth of the productions of the soil of other States, we will raise sufficient at least for our own population, and we will sell steel, iron and nails to Kansas, Nebraska, Dakota, and to the States and Territories west and south of us.

PROGRESS.

The progress in agricultural pursuits was slow for several years after it was demonstrated that the soil of Colorado was the best in the world. There were many reasons for this: The breaking out of the war turned the thoughts of men from the pursuit of wealth, to that of pursuing and being pursued by armed men; a check was put

upon the development of the country, and the world knew as much about the wealth and possibilities of Colorado in 1861 as it did in 1866. The immigration to Colorado from '61 to '64 consisted chiefly of people who left their homes for reasons that they do not now care to have discussed; but most of them have made excellent citizens in their new homes. After the war there came a flood of adventurous men who had followed the pursuit of arms and were restless under the restraints of civil life. The wild, grand scenery of the Rocky Mountains suited them, and they settled in Colorado. Naturally, these settlers drifted into the mines and mining camps, and gradually settled into business; a few tried farming and stock raising, with universal success. But it was not until Greeley, that grand character in American history, who by his teachings has added a lustre to agriculture and all kinds of honest labor, conceived, and in December, 1869, promulgated the idea of founding a colony on principles original, practical and co-operative, somewhere in the Great West, and had sent a committee of practical men to find a suitable location, who, after a thorough investigation of the resources, climate and possibilities of Kansas, Nebraska, Arkansas, New Mexico, Wyoming, and Utah, finally selected Colorado, and settled a colony on the banks of the Cache La Poudre river, in the northern portion of that Territory. Until this time but little interest had been felt in Colorado's agricultural resources, either at home or abroad. The discussion of the founding of this colony, in the columns of the *New York Tribune*, attracted the attention of the world, and Colorado received an agricultural "boom."

The result of this agitation was the founding of a colony and that there was gathered, from the four corners of the earth, a motley assembly of men and women, who were drawn together by an affinity of ideas, to settle the great philosopher's new Elysium. A scoffing public criticised unfavorably the movement, and newspapers wrote it a failure in advance of a trial. But on Plymouth's rock there was not landed a braver, truer, more virtuous, or intelligent assembly of men and women than they who met under the shade of the cottonwoods that lined the banks of the beautiful mountain river, on the 25th day of April, A. D. 1870, to hold their first town meeting.

From the date of the founding of the Union Colony, better known as the "Greeley Colony," commenced the real agricultural development, and scientific irrigation in Colorado. It must not be understood that these people have had no hardships. They were located in a wilderness, far away from centers of civilization, in a country with the resources of which they were unfamiliar, and also ignorant as to how to take advantage of the opportunities at their command; but they soon learned. Although a few wearied of the trial and sought their old home, yet the majority stayed. They constructed the Union Colony Irrigation Canal, and adopted methods of dividing, measuring and distributing water for irrigation on principles superior to any in use in this country, and taught the people of the Territory the duty of water. After many trials and disappointments, they succeeded in making the settlement a complete and unqualified success, and Horace Greeley and N. C. Meeker could wish for no greater monument than Union Colony.

The seed grown at Greeley increased amazingly, and settlements in other agricultural portions of the State grew and prospered contemporaneously. Longmont kept pace with Greeley, and Fort Collins was not far behind, until now, in 1882, only twelve years since the first sod was broken in the Union Colony, the annual product of the farms and ranches of this State, known only to the world as a mining one, is fully $20,000,000; and this is only the dawn of the beginning. As our mining and manufacturing interests increase, the business mind of the State awakens to the fact that without home produced bread, meat, fruit, and vegetables, the other industries are comparative failures, and much interest is at this time felt in the promotion of new lines of irrigating canals, to open up new bodies of land, and to adopt better laws, for the more economical and equitable appropriation and distribution of the waters of the State.

IRRIGATION.—HISTORY AND LAWS.

I have before remarked that inhabitants of countries where the natural rainfall was sufficient to produce crops did not take kindly to artificial irrigation. Naturally they do not take time to think of any other method than the one

they are accustomed to, and believe it the only safe and sure one. But they have failed to read the agricultural history of the world aright. The most productive and most populous portions of the earth are those which have relied from time immemorial, upon artificial irrigation to grow the food to sustain their people. Egypt, Africa, India, Asia, Italy, France and Spain have had recourse to this method, and some of them know no other. The laws concerning irrigation date back to that indefinite period in law making, known as the time of "unwritten laws;" custom made the law. There are found in Italy, Asia and Africa, traces of these canals, of the origin of which tradition tells nothing whatever. In Mexico the same is true. Yet the farmer of Illinois looks doubtingly upon this sure method of raising crops.

In countries where irrigation is practiced, the laws pertaining to the use of waters of the natural streams are different, necessarily so, from those in force in countries where crops are raised by water from the clouds. To make these laws equitable and uniform, to adopt regulations and units of measure has employed the talents of the best engineers and ablest statesmen of the world. Italy, hundreds and hundreds of years ago, grappled with the question, and her orators, statesmen, and engineers, whose names to day are familiar to the scientific world, studied and wrote of it in all of its details. Laws were made then that stand to-day; methods of measuring and distributing water were adopted then that have not been improved upon by the genius of the nineteenth century.

The Colorado Territorial Assembly of 1861 discussed the matter, and so, also, did every subsequent legislature, until the adoption of our constitution, in 1876; since then biennially, our irrigation laws have been improved and amended, and to-day some of the ablest legislators, together with the best hydraulic engineers in the country, are giving their attention to the necessities of the subject.

The last three years have been an era of great improvement, not only in irrigation legislation, but also in canal building. Canals have been projected and finished that carry bodies of water eighty feet wide, and eight feet deep; rivers of themselves, the waters of these canals are being spread over tracts of land that a very few years ago were

the grazing grounds of the buffalo and the antelope, and next spring Colorado can offer immigrants opportunities offered by no State or Territory in the United States. Farm lands will be offered to people with a market for their products at their very doors.

The extent of lands that can be irrigated is limited only by the quantity of water in our streams; perhaps, when I say there are in Colorado 1,250,000 acres of land that can be cultivated; I have put it high enough, but there may be a few rivers and streams in the western portions of the State of which we have not yet a thorough knowledge.

In farming in Colorado there has to be reckoned the cost of water. This varies very much; sometimes an individual or a community constructs its own canal, then the water only costs them the price of the labor expended in its construction, they pay the State nothing, not even taxes, on the value of the ditch; the cost of the irrigation by this means can not be exactly estimated, but under favorable circumstances it does not cost fifty cents an acre. Again, individuals or corporations build a canal and sell water to farmers; the price is fixed according to the amount consumed. A cubic foot of water per second, during the irrigating season, will irrigate about fifty-three acres; under this arrangement, water costs from $1.00 to $3.00 an acre, depending upon the location of the canal, price of land, crops raised, and nearness to the Denver market.

The quantity of water necessary to irrigate an acre of ground in Colorado is about 650,000 gallons.

To the Illinois farmer it may appear that an annual rental of $1.50 per acre for rain is a heavy expense, but when he learns that by this method he can defy all droughts and all floods or excessive rains; that he never needs to lose a crop from either of these common causes in the Mississippi Valley; that this irrigation annually manures his farms, and that there are farms in Colorado that have produced twenty crops of wheat in that many years, and not a harvest has yielded less than twenty bushels to the acre, and some of them have been as much as forty-five and further, that the price obtained by the owner never wa:

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lower than seventy-five cents per bushel, and often as high as $1.50, he will change his opinion; how gladly would the Illinois farmer give the prices if he could control the clouds in seed time and in harvest.

The cost of labor to spread the water over, or run it through the growing crops, varies with the lay of the ground; land that lies smooth and comparatively level requires less labor than hilly and uneven ground, but the general lay of the farm lands in Colorado is gently sloping, and it is safe to say that one man can irrigate ten acres of any cereal crop per day, with a quantity of water equal to one and one-half cubic feet per second; grass and corn lands are easier irrigated. One man can easily irrigate eighty acres of ordinary crops during the season.

Generally, during the early part of the season there is moisture enough in the ground to germinate the seed, and the irrigating season begins when the grain is high enough to shade the ground, and ends when the wheat is in bloom. Two or at the most three irrigations is enough.

AGRICULTULAL OPPORTUNITIES IN COLORADO.

I have before stated that possibly there are in Colorado a million and a quarter acres of available, irrigable land. Gannet and other theorists of the United States Government surveys have written that there are over four million of acres; to justify them in this statement, it is necessary to claim a duty for water four times greater than twenty years' experience in Colorado has demonstrated it is. I prefer actual, practical experience, to any theoretical statement. Practical engineers have measured our streams; the average flow in irrigating seasons is approximately determined; this data furnished, and it is not a difficult arithmetical problem to figure out the number of acres that can be irrigated. Some of my patriotic neighbors would rather have me accept the larger calculation, but my preference, at this time, is to tell the truth, and in telling the truth I satisfy an element of selfishness that you may discover if you closely follow and heed my remarks.

Colorado soil and climate will grow every crop that can be produced in the Middle States. Our vineyards and our orchards will grow the most luscious fruits, and without the danger of failures from frosts that those of Illinois are subject to. I know of orchards that have not failed of a crop for the past five years, or since they first bore fruit. There is not a forest tree that does not thrive if planted here. By reason of our assured seasons of sunshine without frosts, and our assured season of moisture, by the aid of irrigation, crops never fail. Our only serious danger yet developed, by either insect, worm, or seasons, is the locust: and danger from that source is reduced to the minimum, because, by the aid of our irrigating ditches, we can keep them out of our fields; and if, by chance, they should get in, we have learned how to destroy them. Can the Dakota, Iowa, Nebraska, or Kansas farmers say the same? Not alone of the Rocky Mountain locust, but of the chinch bug or the army worm.

The yield of all kinds of crops in Colorado is very uniform; of course, good farmers raise better crops than poor ones, and there are many more poor farmers than good ones. Yet, a farmer of either kind can generally calculate his yield when he has planted his crop. Wheat does not yield them, as here, only from five to twenty bushels to the acre, but for ten years past it has averaged twenty, and oats and barley in like proportion. For hay we can raise all the cultivated grasses, but they are inferior in quality to our natural ones. Clover we can grow in enormous quantities, especially alfalfa. I have seen four crops of the latter cut in Northern Colorado in one season, that produced seven tons to the acre, and sold for eighteen dollars per ton. An acre of Alfalfa will keep a cow the year around. Good butter sells in Colorado for fifty cents per pound. An item for the dairymen.

The markets for all kinds of farm produce in Colorado are the best in the United States. The Denver market is better than that of Boston or New. York. Compare the market reports for a day or a year, and find the proofs. The reason is we are a long distance from competition, the nearest points of supplies being Kansas and Nebraska, from which a long and costly railroad haul intervenes. Again,

Colorado has not been considered an agricultural State, but a mining one and a sanitarium; latterly she is looming up as a manufacturing one; to-day we are making our own steel, iron, nails and coke, and we are only entering upon the beginning of a grand industrial future in that direction; of our 300,000 population not one tenth are farmers, therefore agricultural production has not kept pace with other pursuits; there is a deficit of not less than twelve millions of dollars annually between our production and consumption of agricultural products, and were it not for the annual yield of twenty odd millions of gold, silver, copper and lead, and the annual unloading into our coffers of the money of eastern and European investors in our mines, and of pleasure and health seekers, we would soon be bankrupt; but as it is, we are to-day the most prosperous people in the world, and also the most profligate in our expenditures.

The knowledge of what I have recited has awakened in our State an interest in canal building. The State owns over 500,000 acres of the best agricultural lands in the world, and is now, for the first time, offering them for sale; and next spring 100,000 acres will be ready for the lucky men and women who first come. There is no danger of overstocking our State with farmers or their produce. Liverpool has no effect upon the price of Colorado wheat and corn. Every pound of wheat, corn, oats, barley, rye, potatoes, or other vegetables, fruit, hay, butter, eggs, poultry, or pork will be consumed by our own people; production will never catch up with consumption, and prices will be what competition from abroad will effect.

The honest tiller of the soil is asked to come; broad, fertile acres are awaiting you beneath a sky that is almost cloudless and in an atmosphere that is laden with health. We ask you to come from your malarial and consumption generating haunts, to a land of grander proportions and productions than this continent has yet offered to you for homes, where fortunes are awaiting you, and beckoning you to come and take possession.

CONCLUSION.

I have claimed, and you have indulged me with your attention while I have outlined the agricultural developments and hinted at the possibilities of agriculture in our State. I have not attempted to particularize, or to compare directly onr methods with your methods; I have not assumed to lay down any new rules for planting wheat, feeding poultry, or applying manure; I have not done this because I had nothing new to propose, and I do not believe you expected me to do so. You did not expect anything of this kind from Colorado; you have not considered our State an agricultural one. Neither did the gentlemen who invited the wheat growers of the world to exhibit their best varieties at the exhibition in New York, in 1881, expect Colorado to show them anything new or startling. Yet Prof. A. E. Blount, of our Agricultural College brought home from that exhibition the first prize, from 2,500 competitors from all parts of the civilized world; he could have done the same with oats, barley, or potatoes.

I have claimed your attention for another purpose. Some critic among you may say it has been for the purpose of advertising my State. So be it if he insists; but yet, if I have drawn your attention to a new home for farmers, where they are needed, and no class will receive from our people a more generous welcome, where health and prosperity await them; where institutions and provisions for education are on a par with the best of those of any State in the land, you will admit my talk has not been altogether selfish or in vain.

No great railroad corporations are, for the sake of selling their land grants, advertising the advantages of Colorado, as they are advertising and colonizing the lands of the northern regions of the United States, and I hope their schemes of colonization will not prove so disastrous to the poor emigrant as were those that followed the settlement of the dry, parched plains of Western Kansas a few years ago. Our State authorities do not advertise, although they ought; and you will excuse me if I have diverted your thoughts from the technical details of *how* to grow crops, to the more

comprehensive one of *where* to grow them. I know my audience is the best that possibly could be obtained. I have improved the opportunity.

A National Agricultural and Mechanical Exposition held in some central place would be a grand thing for the agricultural and live stock industries of the United States.