
The State Agricultural College

EXPERIMENT STATION.

BULLETIN NO. 4.

REPORT OF EXPERIMENTS WITH

POTATOES AND TOBACCO.

FORT COLLINS, COLORADO.

FEBRUARY, 1888.

The Courier Print, Fort Collins.

Report of Experiments with Potatoes and Tobacco.

BY JAMES CASSIDY,
Professor of Botany and Horticulture.

EXPERIMENTS WITH POTATOES.

Experiments have been conducted at this station for the past four years with garden crops in general, and with the potato in particular.

The scope of this work with the latter is indicated by the following synopsis of experiments:

First—A comparative test of varieties.

Second—Originating new varieties.

Third—Methods of seed cutting.

Fourth—Potatoes under mulch.

Fifth—Potatoes without irrigation.

Sixth—Application of fertilizers.

Seventh—Crosses.

The time at which this bulletin is issued precludes the consideration of that important element in determining the value of different varieties, *i. e.*, their cooking quality. A variety to rank high should stand well in this particular regard. Shape and color are to some extent important, but in a less degree than the quality mentioned.

The claim of best for each new kind is perhaps not altogether devoid of reason, because some varieties do better under certain conditions than others, and some kinds, too, seem to have their peculiarities so well fixed as not to be seriously affected by the most adverse conditions. There are probably some soils, too, in which particular varieties of the potato deteriorate, or, like some fruits, they are adapted only to the surroundings in which they originated. This would seem to be the case with some old varieties, like the Neshannock, which have lost their

ability to bear tubers, unless grown under the most favorable conditions.

The soil on which these varieties have been grown continuously for three years is a clay loam. It has been enriched annually, and very liberally, with manures calculated to improve its tilth and fertility.

The varieties in competition were treated as nearly alike as possible, in regard to soil, seed, cultivation and irrigation. Theseed pieces were confined to one eye sets of good substance, cut from large tubers, and were planted May 15th, in rows three feet apart, the sets one foot apart in the row. Ten hills of each kind were experimented with.

The best potato soils are loose, sandy loams, and if so situated as to be contiguous to irrigating ditches, as on side-hills, maximum crops may be raised with the minimum of labor and attention. Loose, friable, moist and cool soils are most congenial to the tubers of this plant. Its nature would suggest this, because the tuber must push the soil from around it during the process of growth, and if the soil be hard and lumpy, the tuber will be misshapen, and its vital forces seriously impaired. We irrigated three times, the frequency of which would depend upon such contingencies as the slope of the land, its position in reference to seepage, character of the soil, rainfall during the growing season, from all of which will be seen the difficulty present in attempting to estimate the quantity of water necessary to mature any given crop. The tendency of all irrigation is to bind more solidly all adhesive, fine-grained soils, so that the first requisite of success, as regards soil, is to see to its mechanical condition, and that no flooding of the soil occurs, as the potato is extremely impatient of this. The most prolific varieties are uniformly so from year to year. If they are not so, such result may justly be attributed to the accident of location, which so frequently results in their getting too much water.

The blight which attacked all varieties of the potato three years ago has reduced the average yield for three years, particularly of the late kinds. The following table exhibits results in detail. The varieties are arranged according to yield, to better facilitate a determination of comparisons:

Table No. 1.

Number.	NAME OF VARIETY.	Weight of Table Potatoes—lbs.	Weight of Small Potatoes—lbs.	Yield per Acre— Bushels.	Average Yield for Three Seasons — Bushels.
1	Watson's Seedling.....	39	8	1,304 1-15	717 1-10
2	Perfect Peachblow.....	40	.....	968	925 3-5
3	Rase's Seedling.....	38	.....	919 3-5	769 3-5
4	Red Elephant.....	34	4	919 3-5	475 14-15
5	Junkis.....	38	2	968	.....
6	Knapp's Snowbank.....	36	.....	871 1-5	641 5-10
7	Cayuga.....	31	4	573	578 1-20
8	Jones' Prize-Taker.....	28	6	822 4-5	490 1-20
9	Weld's No. 4.....	30	3	798 3-5	882 3-10
10	James Vick.....	28	5	798 3-5	499 14-15
11	Alpha.....	29	5	774 2-5	570 1-10
12	Carpenter's Seedling.....	26	6	774 2-5	460 4-5
13	Cap Sheaf.....	31	2	798 3-5	494 1-5
14	Chicago Market.....	27	3	726	429 4-5
15	La Plume.....	25	5	726	436 3-10
16	Early Kent.....	25	5	726	454 3-15
17	Parson's Prolific.....	24	6	726	392 3-10
18	Corliss' Matchless.....	24	8	774 2-5	503 3-10
19	Early Rose.....	25	3	677 3-5	447 2-10
20	Queen of the Valley.....	22	4	629 1-5	509 1-20
21	Newton's Seedling.....	28	.....	677 3-5	.....
22	Enos' Seedling.....	28	.....	677 2-5	.....
23	Ranel's No. 42.....	23	3	629 1-5	.....
24	Charter Oak.....	28	.....	677 3-5	451 3-15
25	Brownell's No. 55.....	21	4	605	.....
26	Churchill's Seedling.....	25	.....	605	.....
27	Belle.....	26	2	677 3-5	415 1-4
28	State of Maine.....	22	6	677 3-5	433
29	White Elephant.....	21	3	653 2-5	394 3-5
30	Early Sunrise.....	24	3	653 2-5	427 3-5
31	American Giant.....	41	.....	629 1-5	435 3-5
32	Perfect Gem.....	20	6	629 1-5	444 4-10
33	Silver Skin.....	24	2	629 1-5	335 3-10
34	Jordan's Russet.....	23	3	629 1-5	431 3-10
35	Beauty of Hebron.....	20	5	605	483 3-15
36	Mammoth Pearl.....	20	6	629 1-5	338 4-5
37	Dakota Red.....	20	4	580 2-5	506 3-5
38	St. Patrick.....	20	4	580 2-5	303 3-10
39	Morton White.....	20	4	580 4-5	354 14-15
40	Kennedy.....	20	4	580 4-5	384 4-5
41	Home Comfort.....	22	2	580 4-5	280 4-10
42	Arizona.....	24	.....	580 4-5	428 1-15
43	Clark's No. 1.....	20	2	532 2-8	319 14-15
44	Lee's Favorite.....	23	.....	556 3-5	422 3-10
45	Crawford's Seedling.....	17	6	539 14-15	472 2-10
46	Salt Lake Queen.....	18	5	539 14-15	400 1-2
47	White Star.....	16	7	556 3-5	250 1-15
48	Butter Ball.....	15	8	539 14-15	308 3-15
49	Brownell's No. 31.....	18	4	532 2-5	.....
50	Burbank Seedling.....	22	.....	532 2-5	.....
51	Carter.....	21	.....	508 1-5	.....

Table No. 1—Continued.

Number.	NAME OF VARIETY.	Weight of Table Potatoes—lbs.	Weight of Small Potatoes—lbs.	Yield per Acre—Bushels.	Average Yield for Three Seasons—Bushels.
52	Manhattan.....	18	3	508 1-5	490 1-10
53	Bliss' Triumph.....	18	3	508 1-5	.....
54	Puñnam.....	16	4	484	.....
55	Champion of America.....	14	6	484	317 14-15
56	Breeze's No. 6.....	17	3	484	339 5-10
57	Grange.....	16	4	484	391 1-2
58	Collum's Superb.....	17	3	484	367
59	Cook's Suberb.....	18	2	484	320 1-4
60	Compton's Surprise.....	16	4	484	320 1-4
61	Jordan's Russet.....	17	2	459 8-10	431 3-10
62	Boston Cracker.....	15	3	435 3-5	433 3-5
63	Irish Cup.....	18	.....	435 3-5	335 2 5
64	Rhode Island.....	18	2	435	484
65	Paragon.....	14	4	435 3-5	.....
66	Boston Market.....	17	.....	411 2-5	471 14-15
67	Baker's Imperial.....	17	.....	411 2-5	302 1-2
68	White Whipple.....	15	2	411 2-5	343 5-10
69	Bonanza.....	16	.....	387 1-5	189 3-5
70	Diamond.....	12	4	387 1-5	368 14 15
71	Landreth's Garfield.....	16	.....	387 1 5	368 3-5
72	Orange County White.....	15	.....	363	258 3-15
73	Howard.....	15	.....	363	411 1-10
74	Alamo.....	15	.....	363	202 4-10
75	Early Telephone.....	14	.....	338 4-5	429 3-10
76	Early Harvest.....	12	3	363	385 1-5
77	Peerless.....	15	.....	363	463 4-10
78	Neshannock.....	14	.....	338 4-5	177 3-10
79	Crandall's Beauty.....	12	2	338 4 5	.....
80	Portage.....	7	6	314 3-5	.....
81	Eclectic.....	10	2	290 2-5	326 1-2
82	Early Snowflake.....	12	.....	290 2-5	371 1-5
83	Wall's Orange.....	7	3	242	281 1-3
84	Early Kent.....	8	2	242	434 3-15
85	Rubicund.....	7	4	266 1-5	275 1-15

The following notes on the most prolific varieties are submitted :

Perfect Peachblow—Tubers somewhat roundish, eyes few in number, and shallow. The most prolific late variety grown here.

Rose's Seedling—Tubers cylindrical, eyes few and shallow, color light red, foliage light green, much curled. A very prolific medium early variety.

Watson's Seedling—Tubers cylindrical, color light rose, foliage erect, light green and curled. A prolific medium early variety.

Charter Oak—Is a late variety with irregular, oval tubers, skin white, eyes large and shallow. Invariably a good yielder.

Lee's Favorite—One of the best earlies; stems decumbent, strong; tubers cylindrical, skin light rose.

Early Ohio—A very early variety, sure cropper, but inclined to be scabby on rich land. Tubers oblong, skin light, smooth to roughish.

Junkis—Have grown this variety but one season. It proved to be one of the most prolific. Tubers cylindrical, skin smooth and white.

Knap's Snowbank—Is a prolific late variety, vines of great vigor, tubers roundish, large and borne close in the hill.

Weld's No. 1—Vines vigorous, tubers large, skin light pink, smooth, borne scattering in the hill.

Early Rose—Vines of medium vigor, tubers long and smooth, skin brown; early and prolific.

Jones' Prizetaker—Tubers long and smooth, skin brownish red, vines of medium vigor. An early variety of merit.

Jordan's Early Russet—Tubers long and flattened, eyes deep, skin white, russeted. A good second early sort.

Sunrise—Tubers long and smooth, skin brown red. An early prolific variety. Vines of medium vigor.

White Elephant—Tubers long, skin smooth and white. A medium early sort and prolific on loose soils.

Burbank—Tubers long and somewhat flattened, skin smooth, white in color. Vines vigorous. Medium early.

Big Benefit—Tubers purplish, smooth; eyes shallow. A prolific, medium early variety.

Cap Sheaf—Vines very vigorous, tubers long and smooth, skin light colored. A prolific, medium early variety.

Beauty of Hebron—A standard variety of great merit. Tubers of good size, shallow eyes, skin rose color. Vines of medium vigor.

Dakota Red—Tubers of medium size, very irregular deep eyes. A coarse, prolific, late variety.

Vick's Prize—A strong grower, tubers smooth, good size; skin light russet. A medium early variety of merit.

Clark's No. 1—This variety originated in New

Hampshire. Tubers long, of good size, skin white. A desirable very early variety.

Chicago Market—An early variety, resembling Early Rose. Skin flesh color. A heavy cropper.

Belle—Tubers quite large, slightly russeted, color rose. A strong grower and heavy yielder.

Manhattan—This variety originated in Kansas. Vines of medium vigor. Decumbent; tubers oval oblong, skin flesh color. A heavy cropper.

Queen of the Valley—Vines vigorous, erect. Tubers long and somewhat flattened; skin light rose. Borne close in the hill.

Perfect Gem—A variety of medium vigor and earliness. Tubers nearly round, skin white russeted. A good market sort.

Cayuga—A strong grower, medium early. Tubers cylindrical and some flattened; skin white. A very productive variety.

Salt Lake Queen—Medium early. Tubers quite long; skin white, and very smooth. Quite productive.

Corliss Matchless—Medium early. Tubers long, light pink. Handsome and productive.

Boston Market—Quite early. Tubers round to oblong, skin light pink. Very productive and of excellent quality.

James Vick—Medium early. Tubers long round, color nearly white, handsome and of excellent quality. A superior variety.

Baker's Imperial—Medium early. Tubers very long, flattened, color light red. A productive variety of good quality.

Early Telephone—Tubers oblong, considerably flattened. Color russety white. Moderately productive.

Early Kent—Tubers oblong oval. Color white, a little russeted. A strong grower and productive.

Parson's Prolific—Tubers oblong to round. Skin nearly white with pink eyes. A prolific variety of good quality and appearance.

SEEDLING VARIETIES.

Two thousand two hundred and ten seedling varieties of the potato were raised from seed sent out by the Department of Agriculture two years ago. Ninety-six of these varieties were saved for trial another season, with the results as exhibited in the accompanying table. The soil, treatment and general conditions were as nearly identical as possible with those surrounding the named varieties. As will be seen some of these varieties yielded fully as well as the best of the named kinds :

Table No. 2.

Number.	Weight of Table Potatoes—lbs.	Weight of Small Potatoes—lbs.	COLOR AND SHAPE.	Yield per Acre. Bushels.	Number of Hills Planted.
1	10	3	..... Roundish flat; color white.....	393 1-4	8
2	16	4	..... Cylindrical; color white.....	403 1-3	12
3	24	2	..... Round; color light.....	524 1-5	12
4	26	2	..... Flattened; skin white.....	376 1-2	18
5	10	4	..... Oblong; skin purplish.....	440	8
6	12	6	..... Oblong; skin purple.....	272 1-4	16
7	32	2	..... Cylindrical; color light.....	685 2-3	12
8	42	6	..... Oblong; color light pink.....	528	22
9	18	2	..... Oblong; skin light.....	816 2-3	6
10	5	2	..... Cylindrical; blue.....	211 11-12	8
11	17	3	..... Long; skin white.....	484	10
12	4	4	..... Irregular; color purplish.....	193 3-5	10
13	7	7	..... Oblong; skin light.....	338 4-5	10
14	8	4	..... Round; skin blue.....	290 2-5	10
15	12	4	..... Oblong; skin light.....	327 2-3	12
16	16	.....	..... Oblong, flat; color white.....	327 2-3	12
17	11	4	..... Roundish, flat; white.....	453 4-5	8
18	16	3	..... Cylindrical; skin light.....	574 3-4	8
19	18	4	..... Round; skin much russeted.....	532 2-5	10
20	12	2	..... Roundish; color white.....	440	8
21	28	5	..... Oblong; skin white.....	584 5-6	12
22	6	3	..... Cylindrical; skin white.....	217 4-5	10
23	11	2	..... Oblong; skin light in color.....	524 1-3	6
24	10	3	..... Cylindrical; color light.....	154	22
25	20	2	..... Roundish, flattened; red.....	443 2-3	12
26	10	.....	..... Roundish; skin blue.....	403 1-3	6
27	24	.....	..... Cylindrical; color red.....	585 4-5	10
28	20	4	..... Oblong; skin white.....	580 4-5	10
29	36	.....	..... Roundish flattened; purple.....	871 1-5	10
30	12	.....	..... Oblong; color light.....	580 4-5	5
31	14	10	..... Cylindrical; color white.....	264	22
32	10	.....	..... Oblong; color light.....	242	10
33	10	6	..... Oblong; skin white.....	327 2-3	12
34	18	2	..... Oblong; skin red.....	484	10
35	8	4	..... Oblong; eyes few and shallow; white.....	363	8
36	8	3	..... Roundish flat; skin blue.....	443 2-3	6
37	14	6	..... Round; skin light in color.....	403 1-3	12
38	12	.....	..... Oblong; color purplish.....	303	8
39	30	.....	..... Oblong; color white.....	726	10
40	12	6	..... Oblong; skin purple.....	435 2-5	10
41	16	4	..... Oblong; eyes few and deep; white.....	484	10
42	40	3	..... Cylindrical; color light.....	1,040 3-5	10

Table No. 2—Continued.

Number.	Weight of Table Potatoes—lbs.	Weight of Small Potatoes—lbs.	COLOR AND SHAPE.	Yield per Acre. Bushels.	Number of Hills Planted.
43	8	6	..... Oblong; skin white in color.....	242	14
44	5	4	..... Roundish; skin purple.....	272 1-4	8
45	25	4	..... Cylindrical; color white.....	701 4-5	10
46	18	10	..... Roundish; flattened; purple.....	338 4-5	20
47	26	6	..... Roundish; color red.....	484	16
48	20	4	..... Cylindrical; skin purple.....	580 4-5	10
49	38	4	..... Roundish, flat; skin white.....	847	12
50	17	8	..... Round, smooth; blue in color.....	504 1-6	12
51	7	4	..... Oval, eyes few and deep; red.....	266 1-5	10
52	12	.....	..... Cylindrical; color white.....	363	8
53	8	3	..... Flat, irregular, eyes deep; rose.....	332 3-4	8
54	6	6	..... Cylindrical; color light.....	363	8
55	14	4	..... Irregular; color red.....	435 3-5	10
56	18	4	..... Roundish; skin light.....	532 2-5	10
57	20	3	..... Oblong; color purplish.....	556 3-5	10
58	6	4	..... Cylindrical; skin red.....	242	10
59	10	4	..... Oblong; color white.....	423 1-2	8
60	14	3	..... Roundish; skin white.....	514 1-4	8
61	10	4	..... Roundish; color purple.....	338 4-5	10
62	16	4	..... Cylindrical; color reddish.....	605	8
63	12	3	..... Round; smooth, light skin.....	363	10
64	14	6	..... Oblong; color white.....	484	10
65	8	4	..... Oblong; color light.....	290 2-5	10
66	18	4	..... Oblong; color white.....	380 17-60	14
67	12	.....	..... Much flattened; skin purple.....	484	6
68	10	.....	..... Cylindrical; color red.....	302 1-2	8
69	18	4	..... Oblong; color white.....	443 2-3	12
70	13	3	..... Cylindrical; smooth white.....	484	8
71	5	2	..... Roundish flat; skin light.....	847	2
72	12	4	..... Round; skin smooth and light.....	387 1-5	10
73	6	6	..... Cylindrical, color purple.....	242	12
74	14	4	..... Much flattened; skin light.....	435 3-5	10
75	24	8	..... Roundish; color purple.....	258 2-15	30
76	30	4	..... Irregular; color white.....	822 4-5	10
77	14	4	..... Round; color red and white.....	435 3-5	10
78	16	4	..... Cylindrical; color red.....	484	10
79	26	.....	..... Oblong; skin white.....	629 1-5	10
80	32	.....	..... Roundish, flattened; color light.....	774 2-5	10
81	20	4	..... Roundish; skin white.....	580 4-5	10
82	13	2	..... Oblong; color white.....	453 4-5	8
83	8	2	..... Oblong; light red.....	1,110	2
84	14	4	..... Cylindrical; skin red.....	574 1-2	8
85	16	4	..... Irregular; color white.....	403 1-3	12
86	6	4	..... Oblong; color red.....	302 1-2	8
87	6	.....	..... Oblong; skin light in color.....	181 1-2	8
88	12	2	..... Cylindrical; skin purple.....	440	8
89	16	3	..... Roundish; color white.....	574 3-4	8
90	23	4	..... Much flattened; color red.....	774 2-5	10
91	22	4	..... Roundish, smooth; skin light.....	629 1-5	10
92	6	2	..... Oblong; color white.....	963	2
93	33	2	..... Shape oblong; color white.....	605	16
94	5	2	..... Cylindrical; color white.....	169 2-5	10
95	6	4	..... Round; skin white.....	201 2-3	12
96	108	14	.....	492 1-5	60

METHODS OF CULTURE.

Table No. 3 gives the average yield for three seasons of various methods of seed cutting. Whole seed pieces give, from this brief trial, the largest aggregate yield, and the small cut seed (one eye) gave the largest individual tubers

with the minimum of small ones. It is a well established fact that small cut seed has a lessened vitality, a factor not always recognized in considering conditions of growth and the probabilities of success. The large tubers that result from this method of cutting are due to the presence of but one or two stems during the growing season, instead of a great many, as in the case of the larger seed.

The small cut seed is, however, not practicable anywhere on a large scale, as usually the fertility and mechanical condition of the soil are not such as to assure the single eye the necessary conditions which result in a good stand.

The small yield of two separate eyes was due to an accident in watering, and which resulted unfavorably for this method of cutting last year.

Table No. 3—Average Yield of Three Seasons for Methods of Seeding.

	Whole Potato— Large.	Whole Potato— Small.	Seed End.	Stem End.	Two Separate Eyes.	One Eye to Hill.
Table potatoes.....	296 2-5	254 1-5	284.15	242	157.18	314.36
Small potatoes.....	115	121	60.30	48.24	24.12	36.20
Depth of planting...	4 inches	4 inches	4 inches	4 inches	4 inches	4 inches
Total yield.....	411 2-5	375 1-5	344 3-15	290 2-5	181 1-2	350 14-15

POTATOES UNDER MULCH.

The potato has been grown in this way for three seasons, with results as exhibited in table No. 4.

Large and small whole potatoes show the highest average yield for three seasons, as in table No. 3, and the single eye next. The latter we have always cut from the largest potatoes, so as to assure a sufficiently vigorous growth that would break through the mulch, the latter always exercising a retarding influence on the growth of the top until the tuber is well above ground.

Mulch culture is only practicable on a small scale and in localities, soils and seasons unfavorable to the proper development of this plant under ordinary culture.

The best mulch is composed of either partially decayed materials or of clean oat straw.

The yield under mulch is ordinarily greater than without, especially in uncongenial soils, the shading of the ground furnishing the proper conditions of temperature and moisture at the root, as well as assuring the necessary mechanical condition of the soil, so desirable in securing uniformity and the greatest possible development of tuber.

A mulch, to be of any value in a dry climate, should be quite a foot thick, using large seed pieces, however, to enable the tops to push through the cover.

This year, instead of placing the mulch on the surface of the ground, we ploughed furrows three feet apart and placed whole tubers therein, of medium size, and one foot apart. The mulch, four inches thick, was placed in the furrow and earth to the depth of three or four inches on top covering all.

The area devoted to this patch was 0.17 acres, yielding 54 bushels, or at the rate of 324 bushels per acre. Neither the yield nor size of the tubers was equal to that secured from having the mulch on the surface of the ground.

Table No. 4—Average Yield of Potatoes Under Mulch for Three Seasons.

	Whole Potato— Large.	Whole Potato— Small.	Seed End.	Stem End.	One Eye to Hill.
Table potatoes.....	363	369.3	266.12	254.5	387.12
Small potatoes.....	145.12	187.33	139.8	96.45	48.24
Total yield.....	508 1-5	556 3-5	405 2-10	350 5-10	435 3-5

POTATOES WITHOUT IRRIGATION.

A piece of side hill land, 0.27 of an acre in area, was planted to potatoes of mixed varieties, May 14th. The soil was naturally moist from seepage, in fact quite a third of it too much so for the best culture of this plant. The yield was 57 bushels, or at the rate of 220 bushels per acre.

The rows were opened with a plow, four feet apart, and the seed pieces placed about one foot apart and covered in the same way. The tubers were the largest and finest we have grown this season, and, where the soil was not too moist, entirely free from scab. The land had never been manured or in crop before.

The most profitable potato lands on old farms in this State are such as are so situated on side hills as to be sufficiently moist to mature a crop without irrigation. Such soils are loose and open, never bake, and maximum crops are raised with the minimum of labor and expense.

APPLICATION OF FERTILIZERS.

A knowledge of the special needs of our soils is an important factor in all profitable land culture, and this knowledge is only acquired by carefully conducted and oft-repeated experiments that shall determine the efficacy and profitableness of commercial fertilizers on Colorado soils.

Very early in the history of the culture of garden crops on our upland soils the necessity for the application of fertilizers was readily made apparent to the market gardener, so that to-day feeding the soil for garden crops is as necessary, desirable and profitable as anywhere else.

This necessity of the market gardener is as apparent and is as forcibly expressed on the older farms of this State by the crop returns, in comparison with earlier pioneer farming, as in the older States of the Union.

The fertilizers employed in this trial were manufactured and sold in this State. The soil, a clay loam, rather poor, had never been in crop before.

Whole seed pieces, of medium size, were planted in trenches dug eight inches deep; the fertilizers were mixed with 4 inches of soil and the sets placed on top.

The following table shows the fertilizers used, number of hills planted and the yield per acre:

Table No. 5—Application of Fertilizers.

• Kind and Quantities of Fertilizers Used.	Name of Variety Grown.	Yield of 45 Hills —lbs	Estimated Yield per Acre— Bushels.
150 lbs Merie's Bone Superphosphate	Morton White	62	333 1-2
200 " plaster	"	68	365 1-2
200 " Mo. clay kalsomine	Ruby	60	322 2-3
250 " bone meal	"	117	629 1-5

The plat treated with bone meal exhibited a very decided advantage the whole season, and ripened its vines first.

The superphosphate plat had vines nearly as vigorous as the latter, but fell far short in yield of tubers.

The plaster plat gave the second best yield, but bore vines of only moderate vigor.

The experiment needs to be tried more fully and elaborately than has yet been possible here. The experiment would seem to show a slight advantage from the use of plaster, a very decided advantage for bone meal and but little gain for the other two.

THE WILD POTATO—CROSSES.

We have grown one of the native potatoes of this State (*Solanum Jamesii*) for the past two seasons. It did not prove fertile, however, until this season, which was due to our having grown it in rich soil. In procuring tubers of this species from the Montezuma valley last spring, a form with blue flowers and of compact habit of growth was secured at the same time, which has since been identified by Prof. Coulter as *Solanum Tuberosum* var. *boreale*, not hitherto supposed to be indigenous to Colorado. From J. H. Gregory we purchased another wild potato, which the same authority pronounces *S. Jamesii*. Having grown these three forms side by side the past season, and under exactly similar conditions, we fail to see more than a general resemblance between the two, and both are very distinct from *S. Tuberosum* var. *boreale*. In fact, neither would be recognized as a potato at all except by a botanist.

We have succeeded in obtaining two seed balls of *S. Jamesii*, three of *S. Species*, and eleven of *S. Tuberosum* var. *boreale*, pollenized by cultivated varieties, and three of the cultivated varieties Morton White and Ruby, pollenized by *S. Jamesii*.

Over two hundred crosses were made, *S. Tuberosum* var. *boreale* setting fruit freely when pollenized by the cultivated varieties, but our efforts to make some of the latter the seed parent when fertilized by this indigenous form, were not successful.

Some of the crosses for a time seemed to be successful, owing to the ovary attaining to quite half its full size before indications were observed that they were hollow within.

The tubers of *Solanum Tuberosum* var. *boreale* are quite large relatively to the other forms, oblong in shape, and of a dark brown color. We had only three plants of this type, and in consequence made no estimate of the yield. The tubers of *S. Jamesii* are next largest in size, and of the same color and shape as the last mentioned, while those of the form obtained of J. H. Gregory are small in size, roundish, color light, and extremely numerous, as will be seen by the yield. The usual care was exercised in effecting a cross, as both the cultivated varieties and the wild forms are capable of close fertilization before the corolla opens. In a few cultivated varieties the pistil is early protruded through the corolla, in some cases long before the latter has colored, hence early attention is indispensable, to ward off the presence of foreign pollen. The yield was as follows:

Table No. 6—Yield of Wild Potatoes.

Name.	Number of Hills Planted.	Yield in lbs.	Estimated Yield per Acre—Bushels.
<i>Solanum Jamesii</i>	16	4	60 1-2
" Species.....	36	24	161 1-3

RESULTS.

1. That for late potatoes, the best time to plant is about the middle of May.

2. That the best crops are raised on loose, moist side-hill lands, that need little or no irrigation.

3. That in regard to methods of cutting seed, our experience so far justifies the use of large seed pieces for field culture, and of small cut seed when tubers of exceptional size are desired, where exceptional care can be given the crop, and when the soil is in the best condition of tilth and fertility.

4. That the best culture of this plant requires that it be kept doing its best during the growing season, and not allowed to suffer a check, the result of which is supertuberation and the presence of ugly excrescences on the tubers.

5. That it is of importance in the care of seed to avoid its starting into growth too early in Spring, and the shriveling of the tuber before planting. Keep intact the main shoot from each eye.

6. That no rule can be laid down as to quantity or frequency of irrigation needed to mature this crop. Each must decide for himself, according to the character of the soil, its location in reference to seepage, the rainfall during the growing season, etc.

7. That in regard to varieties, the most desirable are such as produce medium-sized tops, bear their tubers close in the hill, necessitating deep planting, and showing a breeding in favor of the maximum early development of tuber, with a minimum vigor of top. The kinds making a good exhibit this year may be depended upon as being prolific croppers, particularly on soils adapted to the best culture of this plant.

8. That the fertilizer experiment exhibits nearly a doubling of the crop in favor of bone meal. That the use of land plaster gave an increase of over thirty bushels per acre over the bone superphosphate and clay kalsomine.

EXPERIMENTS WITH TOBACCO.

Experiments have been conducted at this Station for the past two years with varieties of tobacco sent out by the Department of Agriculture, Washington, D. C. The work done in 1886 was on too small a scale to determine definitely the question as to its availability as a farm crop in this State.

Eighteen varieties were grown the past season, all of which ripened thoroughly before the end of August. The first to ripen was the White Burley; the Improved Havanna and Vuelta Abajo, or low-land tobacco, next; then General Grant, a form of Big Orinoco, and Missouri Broad Leaf. The remaining varieties ripened about together.

The varieties grown may be distinguished into those with upright or horizontal leaves, as the Orinocos, and such as have drooping leaves, as do the various forms of Havanna tobaccos.

DESCRIPTION OF VARIETIES GROWN.

Isabella—This variety was imported from the Province Cayayan, in Luzon, one of the Phillipine Islands, in 1886. It is said to possess a delicate flavor, and is used exclusively in manufacturing cigars.

Caboni—This variety is grown in Virginia and in Cuba, where it attains a height of fourteen feet. It has a broad, ovate, thick leaf, developed from nodes very wide apart, and for this reason is not so well suited to this altitude as varieties that produce their leaves closer to the ground.

General Grant—This variety is said to be the earliest variety in cultivation, but did not prove so here this season. It produces immense leaves of fine texture, small veined, and very elastic.

Cienfuegos—This variety of cigar tobacco has been cultivated in Virginia since 1883, from seed imported from the Fiji Islands. It is early, of medium size, and of fine flavor.

Flanagan—Originated in Henry County, Virginia; is much used for making sweet fillers and mahogany-colored wrappers. It is a variety of the old sweet Orinoco, having broader leaves, a finer flavor, and of more vigorous habit.

White-Stem Orinoco—This is one of the best yellow varieties cultivated in the tobacco belt of Virginia and

North Carolina. It is of good size and weight, and early to mature.

Big Orinoco—A variety of great vigor; fine for mahogany and red wrappers.

Little Orinoco—This variety has long, tapering leaves, of fine texture, which stand up well, and is said to be the sweetest variety grown. Used principally for plug work and smokers.

Vuelta Abajo—Or low-land tobacco, is among the earliest varieties to mature here. Recommended for its delicate flavor.

Elkerson's Yellow—This is a very vigorous yellow variety, with thick, upright, ovate lanceolate leaves.

Havanna Saqua Le Grande—This variety was sent to the Department of Agriculture by the Consul General at Havanna in 1886. Used for wrappers, of medium vigor, drooping leaves.

One-Sucker Virginia—An early variety of vigorous habit and upright foliage. Needs but one suckering, and on this account desirable.

Improved Havanna—An early variety of but moderate vigor. Used for wrappers, and will bear quite close planting.

Missouri Broad Leaf—A standard sort of great vigor. Valuable for cigar wrappers, and very early to mature.

Yara—A variety largely grown in Virginia. Remarkable for the fineness of its foliage and great delicacy of flavor.

Golden Leaf—This sort resembles the Missouri Broad Leaf in its habits of growth and general vigor. Used for bright wrappers.

White Burley—This is a standard sort, very highly thought of at the West, of unrivalled vigor, carrying its leaves near the ground, from short internodes. It was the earliest variety grown, being ripe on the hill August 16th. Used for bright wrappers.

Connecticut Seed-Leaf—This is a standard variety, similar in habit to the Burley and others. It proved to be vigorous and of a desirable habit of growth. Used for cigar wrappers.

Wilson's Prolific—Of this variety we had but a few plants. Its habit of growth and shape of leaf is similar to the Broad Leaf. It did not ripen so early as some others, because the plants were quite small when set out.

Fiji Oronoco—This variety of the Orinocos has a long and quite pointed leaf, very early, and of good habit and vigor.

SOWING SEED.

The different varieties were sown in a moderate hot-bed March 26th, and from here transplanted to the open ground May 25th. It is desirable in this climate to sow in a moderate hot-bed, because of the dry air and brisk winds at that time of year. Nor is it desirable to sow too early, because of the liability of the plants to damp off. Sow about April 1st, and very thinly; this will insure not only a roomy seed bed, but will also give stout plants of nearly equal vigor, and which will tend to uniformity in ripening. If sash are used, shade the glass slightly during the heat of the day, and this will render the necessity for watering less frequent than if the soil were exposed to the sun's heat.

The soil in which the seed is to be sown should be quite rich; it will push the growth of the plants. Thick seeding should be avoided, for two reasons: The first is, that weak, spindling plants is the result; and second, plants crowding each other in a hot-bed are very liable to damp off in the night, to avoid which, refrain from watering the seed bed late in the afternoon. It is important to observe that if plants are grown in a hot-bed, it is imperative that they be hardened off before setting out in the open air, which is attained by giving plenty of air, and inuring the plants to the sun's full power before transplanting.

SOILS.

The finest tobacco is raised on light, rich soils. If not naturally rich enough, it must be made so. Our unmanured upland soils will grow a fine leaf of any of the stronger growing varieties. The deeper the plowing, the larger the crop; sub-soiling would be better still. If the object is weight of leaf, use old, rich, heavy lands; the product, however, will be coarser, and bring a lower price in some markets than that grown on lighter and warmer soils.

VARIETIES.

There are as many varieties of seed-leaf tobacco as there are of Indian corn. Of all the kinds tried, the White Burley is the easiest to manage and earliest to mature. It becomes yellow on the hill, if not irrigated, by the middle of August, and when taken to the barn will quickly take on a rich brown color before losing its surplus moisture. Other varieties nearly as easy to handle are the General Grant, Connecticut Seed Leaf, Vuelta Abajo and Missouri Broad Leaf—all cigar tobaccos.

PLANTING OUT.

We planted out May 25th, in rows six feet apart, the plants three feet apart in the rows. This is too far apart even for the more robust kinds; a better disposition of the plants would be, for the large kinds, rows four feet apart, plants three feet in the rows. The Havanna varieties, with drooping leaves, rows three feet apart, and plants two feet.

Before planting out, remove all covering from the plants, to harden them, and then thoroughly soak the bed with water.

CULTIVATION.

When the plants have become established, cultivation must be begun, and be kept up until the plants show a disposition to ripen. Frequent use of the cultivator will render less necessary the operation of irrigation, and will hasten the maturity of the crop.

IRRIGATION.

The tobacco plant, while a great feeder, is very impatient of too much moisture in the soil. We irrigated but twice,

and believe that once would have been sufficient. Rich land, with efficient and timely cultivation, will go far toward maturing a crop of this plant in this State. In fact, if irrigated much, it will not ripen. No crop is so effectually destroyed on wet lands as tobacco, and none is so little affected by drought.

INSECTS.

The insects particularly injurious to tobacco are the caterpillar of the tobacco moth, which appeared here June 21st this year, but not in large numbers, and a cut worm. The latter attacks the plants as soon as set out, their mutilated condition suggesting its presence. The only remedies are vigilance and industry on the part of the grower. The early part of the day is the best time to find the cut worm; later in the day they retire deeper into the soil, and are difficult to catch. All plants injured by the cut worm should be replaced from the seed bed. The tobacco worm is also injurious to the potato and the tomato, but prefers the tobacco plant, perforating and eating the leaves. When at rest it lifts up its head and the fore part of its body, remaining in that position, apparently lifeless. From its resemblance, while in this position, to an Egyptian sphinx, Linnaeus gave to it the name Sphinx. The larva should be diligently sought for during the entire season, as much of the value of the crop depends upon how well this is attended to in this regard.

PRIMING.

Priming is another operation to be attended to, and consists in removing such leaves as lay on the ground. If left on, these produce an inferior quality of tobacco, called "lugs," because they get soiled and blackened.

TOPPING.

Topping the plants is had recourse to when the top of the flower stalk is large enough to be taken out. There is no particular height to top at. The usual topping, however, leaves twelve to sixteen leaves, the result of which is to throw the whole strength of the plant into the remaining leaves, and induces the growth of leafy shoots from the base of each leaf, called suckers.

SUCKERING.

Suckering follows as the result of topping, and is done for the same purpose—to concentrate the whole strength of the plant in the remaining leaves, and must be attended to diligently until the crop is housed. The operations of priming, suckering and topping must not be done during a rain-storm, or when the plants are wet at any time, or the result will be rust spots on the leaves, which will ultimately destroy them.

CUTTING AND HARVESTING.

The plant is ripe when the leaves assume a mottled appearance, and when in doubling up the leaf it breaks, instead of bends. It should not be allowed to get overripe, or it will cure up spotted, instead of a solid color.

The plants in this experiment were split down the center while growing in the ground, and then cut off close to the latter, and left on the ground to wilt. We found that one hour was as long as it was safe to allow the more vigorous kinds to so remain without scorching, and about half that time for the thinner-leaved Havannas. It is best, however, to cut either during a cloudy day or in the morning or afternoon, not allowing the plants to remain out over night.

Having cut and wilted the plants, they are now ready for housing, first placing them straddled across sticks for convenience in hanging up to cure. Tobacco sticks are round, or are split out like lath about one inch square at one end, and generally a few inches longer than the distance between the joints of the tobacco house.

BARN.

In this structure the tobacco is hung up to cure. It should be strong enough to carry the plants and to resist storms. The inside of the shed is divided up by rails into widths, to accommodate the laths, and also into tiers, far enough apart to allow the different tiers to hang free of each other.

CURING.

It is during the process of curing that the chief differences occur in the management of this plant from that which obtains at a lower and moister altitude than this. It will not do to allow drafts of air to strike it, or it will dry up very quickly, when it will be found impossible to color it. The drying of the leaf is due to our very dry atmosphere, and must be counteracted, or the leaf will not color. To get over this difficulty, we lay the tobacco in thin layers on the ground, and cover with straw or sacking, watching it frequently, and turning it to prevent its heating. This will partially color the leaf, when it is taken to the barn and crowded somewhat closely together, where the coloring is completed. As the leaves dry, it will pay to keep crowding it together, for the best colored leaf will be found in the center of the tiers of sticks. If the shed is dry, wet the floor, and keep it so until the leaf is completely finished, which will be accomplished by the latter end of October. The Havanna tobaccos require most care to get the leaf to color. The Burley and General Grant will take on a bright color in the barn, by simply keeping it close, and without piling it in layers in the field.

STRIPPING.

When the leaf is thoroughly cured it is ready for stripping, which consists in stripping the leaves from the stalks and tying them in bundles, called "hands." Before doing this, it is necessary to dampen the floor, to get the leaf pliable enough to handle. In tying into "hands," the leaves are sorted according to color and size. The bright colored, large and perfect leaves are of the best quality, and are tied by themselves. The second quality is a grade below this, and is the red or brown tobacco. The third grade is called "lugs," and consists of the lower and damaged leaves, and is also kept separate. The "hands" are tied on sticks until ready for sweating.

SWEATING.

The plant is not tobacco until fermentation has taken place, commonly called sweating, and is accomplished by laying the tobacco side by side in a conical heap; the butts of the "hands" outside, about as wheat is stacked. The process of sweating must be conducted with care, for on this depends the color of the leaf, and to a great extent its flavor.

BOXING.

The leaf having been sweated, is now ready for boxing, in which shape it is sent to market. The "hands" are packed, and pressed firmly by means of a lever.

If tobacco should become too dry for boxing or baling, it may be brought in "case" by sprinkling it with warm water by means of a small corn-broom, but it must not be wet, or it will be ruined if it has to remain boxed or baled very long.

This ends the round of attention and labor experienced in the management of this crop. The following tables exhibit results in detail in regard to the varieties grown :

Table No. 1—Tobacco on Manured Land.

Number.	Name of Variety.	No. of Plants Ex- perimented With.	Weight in lbs.— Green.	Weight in lbs.— Cured.	Estimated Yield per Acre in lbs.— Green.	Estimated Yield per Acre in lbs.— Cured.	Average Weight of Plants.
1	Connecticut Seed Leaf.....	13	44	9 $\frac{1}{2}$	7,568	1,720	3.40
2	One Sucker Virginia.....	7	24	5 $\frac{1}{2}$	8,295	2,070	3.42
3	Fiji Orinoco.....	14	63	15	10,884	2,581	4.5
4	Vuelta Abajo.....	14	30	6	5,162	1,032	2.14
5	Isabella.....	18	51	10 $\frac{1}{2}$	6,834	1,892	2.83
6	Improved Havana.....	14	30	7	5,162	1,204	2.14
7	Golden Leaf.....	14	63	12 $\frac{1}{2}$	10,836	2,065	4.5
8	Big Orinoco.....	14	54	11 $\frac{1}{2}$	9,288	2,064	3.85
9	White Burley.....	10	66	16 $\frac{1}{2}$	15,972	3,872	6.6
10	Yara.....	8	28	7	8,456	2,114	3.5
11	Gen. Grant.....	8	50	11 $\frac{1}{2}$	15,100	3,322	6.11
12	Caboni.....	6	26	5 $\frac{1}{2}$	10,478	2,015	4.33
13	Elkerson's Yellow.....	6	20	5	8,060	2,015	3.33
14	Flanagan.....	15	18	4	2,898	644	1.20
15	White-Stem Orinoco.....	33	70	13	5,110	949	2.12
16	Fiji Golden Leaf.....	13	34	7	6,324	1,302	2.61

Table No. 2—Tobacco on Unmanured Land.

Number.	Name of Variety.	No. of Plants Ex- perimented With.	Weight in lbs.— Green.	Weight in lbs.— Cured.	Estimated Yield per Acre in lbs.— Green.	Estimated Yield per Acre in lbs.— Cured.	Average Weight of Plants.
1	Improved Havanna.....	20	28	6½	3,388	726	1.36
2	Golden Leaf.....	14	30	6½	5,220	1,044	2.32
3	Isabella.....	23	30	5¾	3,300	660	1.48
4	Fiji Orinoco.....	13	37	7½	6,882	1,392	2.82
5	Fiji Golden Leaf.....	6	16	3½	6,448	1,299	2.66
6	White Burley.....	5	18	5¾	8,712	1,936	3.06
7	Sagua Le Grande.....	10	28	6	6,776	1,452	2.80
8	Vuelta Abajo.....	17	34	7½	4,828	994	2.00
9	Caboni.....	17	44	12	6,248	1,704	3.17
10	Missouri Broad Leaf.....	10	47	11	11,374	6,248	4.70
11	Connecticut Seed Leaf.....	8	32	9½	9,664	2,718	4.06
12	Big Orinoco.....	15	36	3¾	5,796	644	2.40
13	Elkerson's Yellow.....	24	66	13¼	6,666	1,313	2.75
14	One-Sucker Virginia.....	8	22	5½	6,644	1,510	2.75
15	Yara.....	12	20	6½	4,040	1,212	1.66
16	Cienfuegos.....	4	16	4	9,680	2,420	4.00
17	Flanagan.....	13	20	8½	3,720	1,488	2.20

The varieties in the above tables were planted about equally on land that had been well manured for two seasons and on land that had never previous to this season been in crop, but which, from the gardener's standpoint, would be considered poor land.

The tables emphasize in a marked manner the superiority of a few kinds, whether on manured or unmanured land, for general cultivation. The yield of both green and cured leaf is very much larger than is claimed for the older tobacco growing regions. In fact, the yield may be said to be phenomenal for the method of planting—rows six feet and plants three feet apart.

In regard to high winds, we would say that the only varieties affected in the least were the Improved Havanna and Caboni. The latter is a large variety that yields heavily, but not suited to this climate, because too tall, and it carries its leaves too far apart on the stem. It would be advisable, however, we believe, to plant a few pole beans, or some other quick-growing plants, if one had a very exposed situation and were growing the Improved Havanna or other thin-leaved kinds.

The ideal varieties of tobacco for this region are the Burley, General Grant, Connecticut Seed Leaf and Missouri Broad Leaf—all of which are of close, compact habit, with leaves close together on the stem; they are really self-protecting.

The following letter from a well-known Denver cigar manufacturer speaks for itself. There is no market, apparently, in Colorado, for the shipping or cheaper grades of tobacco, as yet. Messrs. Thies & Gonzales are, however, willing to purchase Colorado grown Havanna seed-leaf at current market rates:

OFFICE OF FRITZ THIES,
MANUFACTURER OF CIGARS, }
DENVER, COLO., January 27, 1888. }

Mr. James Cassidy, Fort Collins, Colo.:

DEAR SIR:—The Havanna seed-leaf samples left with me have been thoroughly examined and put to the usual test. The cigars made from the leaf prove to be superior to anything grown in those districts which are supposed to yield our finest native-grown Havanna seed-leaf. Other tobacco experts who have tested the cigars made from your samples, say the flavor of the cigars will compare very favorably with the Havanna-grown leaf. I have no doubt but a large demand exists at the present time in Colorado for tobacco of this class. The market will by no means be confined to our home demand. You have sent me other samples of leaf, grown from Eastern seed. Same, however, do not possess the good quality that the Havanna seed-leaf contains.

Respectfully, yours,

FRITZ THIES.

CONCLUSIONS.

As the result of experiments with this plant for the past two years, we have reached the following conclusions:

1. That tobacco of any variety may be grown and matured at this altitude by September 1st.
2. That the best quality of cigar tobacco is that grown on our upland sandy loams.

3. That of the varieties tested, the most desirable and valuable for Colorado are the forms of Havana seed-leaf; our soil and climate producing a quality of leaf not equalled by that of any tobacco-growing State in the Union.

4. That usually one irrigation, with good cultivation, will be sufficient to mature the crop. If the plants are irrigated late in the season, the leaf will not ripen before frost.

5. That in raising plants, thin seeding is expedient, as this will give strong plants, resulting in the early and uniform maturity of the leaf.

6. That the plants should be raised in a moderate hot-bed in this climate, sowing the seed last week in March, observing that previous to transplanting the last week in May, that the plants have been thoroughly exposed to the open air in the hot-bed.

7. That the cutting and wilting of the plants should be effected either quite early or late in the day, as the leaf is much more easily scorched here than at a lower altitude and in a moister climate.

8. That in curing Havana, or other thin-leaved tobaccos, in this climate, it is necessary to lay the plants, after cutting, in thin layers on the ground, and cover with straw or burlaps for twenty-four to forty-eight hours, until the leaf has partially colored, observing not to allow the plants to heat, or the leaf will be ruined. Afterwards remove to a close, dark shed, or barn, and keep close in a damp atmosphere until the leaf is fully colored. The philosophy of this treatment is to prevent the too rapid drying of the leaf, and thus facilitate and assure its uniform coloring.

The Agricultural Experiment Station of Colorado.

OFFICERS:

*Executive Committee of the State Board of Agriculture in Charge of
Experiment Station:*

HON. JOHN J. RYAN, HON. W. F. WATROUS,
HON. GEORGE WYMAN.

CHARLES L. INGERSOLL,
Director.

FRANK J. ANNIS,
Secretary and Treasurer.

A. E. BLOUNT,
Agriculturist.

JAMES CASSIDY,
Botanist and Horticulturist.

DAVID O'BRINE,
Chemist.

ELWOOD MEAD,
Meteorologist and Irrigation Engineer.