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STATE AGRICULTURAL COLLEGE

The Agricultural Experiment Station.

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POTATOES ~~AND~~ SUGAR BEETS

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INTRODUCTORY.

It has long been supposed that the arid region presented such new and changed conditions of soil and atmosphere, that nearly all plants grown under these conditions would change in one way or another from their normal condition as grown in Eastern States in different latitudes. This has been found to be true of the wheat plant, and to some extent the other cereals. The Experiment Station of Colorado has undertaken the examination of other plants. It has carried on the work begun two years ago in potatoes, and added the chemical analysis of 303 varieties for the content of starch, in order that some general comparison could be made with Eastern and Southern grown varieties. Within a few years Colorado potatoes have become well known for their elegant table quality. It is the aim of this Station to grow, comparatively, many varieties, and to originate from seed new ones, in order to improve upon those we now have, if possible to do so. The work has been well done, and we hope will meet the needs of the State. The investigation of the sugar producing problem is important, and will be continued.

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Director.

POTATOES AND SUGAR BEETS.

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POTATOES.

The potatoes in this experiment were planted May 11, on a clay loam soil, that had been in clover sod for two years previous, and was plowed in the fall of 1887, and again in the spring of 1888. The area in crop was half an acre, in two plats of one-fourth of an acre each. The tubers of the named kinds were cut to one-eye sets of fair substance; but with seedlings, whole tubers of medium size were used. The planting was in rows three feet apart, with the pieces or tubers one foot apart in the rows. The plants from whole tubers appeared above ground five days earlier than those from the one-eye pieces, and, in agreement with previous experience, gave the largest yield and the most vigorous development of tops. The yield was very light and the tubers small for this region, owing to the extreme high temperature which prevailed in July and August, and the lack of the usual midsummer rains. The seedling varieties are the best of over 2,000 kinds raised here during the past three years from seed, very largely of our own saving, some varieties of which in other hands and in peculiarly favorable soils yielded better crops and larger individual tubers the past season, than standard varieties grown in this region under the same conditions. Most of the named kinds were untried here, hence the past season cannot be called a good or sufficient test of their real value under our conditions. Although so many kinds were a failure, and none were up to our expectation, yet,

on the whole, the test is not unprofitable, because it has enabled us to see what varieties do best under adverse conditions.

While the yield of tubers is of great importance, yet the quality is of still greater moment. The chemical composition of the potato varies with the soil in which it is grown, the season, the nature of the fertilizers used, its size and maturity. The best tubers contain about 20 per cent. of starch, which is formed in the leaves; hence, to have potatoes of good quality, the leaves must be uninjured during the season of growth. The varieties are arranged in the accompanying table in the order of content of starch; the average per cent. of starch for the seedlings is 18.85 per cent.; for the named kinds, 17.17 per cent. The soil best adapted to the potato is one that is cool, loose and friable, its mechanical condition being more important, in connection with irrigation, than its fertility.

The plats were irrigated four times, cultivated four times, sprayed with Paris green three times, and all were dug by September 21. Land more level and having a greater affinity for water than our clay loam soils, has often a sufficiency in two waterings, and in certain cases, even, without any moisture but the usual rains. The tables give the number of hills planted of each kind, the yield in pounds, the per cent. of starch, and the condition of the tubers April 1, in regard to sprouting. All were treated exactly alike in the field, and were wintered in a basement cellar, the temperature of which ranged from 35° to 45° Fahrenheit.

The most prolific among the named kinds were Stray Beauty, Red Elephant, Grange, Bliss' Triumph, Summit and Jordan's Russet, in the order named. These varieties yield profitable crops of tubers in congenial soils, and in seasons not favorable to the best development of this plant in all soils and situations.

The best yields of seedlings were Nos. 72, 44, 38, 105 and 58, in the order named.

POTATOES—Named Varieties.

VARIETY.	No. of Hills.	Yield in Pounds.	Per Cent. of Starch.	Condition April 1st, 1889.	REMARKS.
Solanum Jamesii.....			22.95	Unsprouted....	This species exhibits no improvement under cultivation.
Spaulding	9	6½	22.50	Sprouted.....	Tubers round, eyes shallow.
Jordan's Russet	10	11¼	22.48	Sprouted.....	Tubers irregular, eyes deep.
Michigan Late Rose	11	12	21.25	Sprouted.....	Tubers irregular, roundish, eyes prominent.
White Beauty of Hebron.....	6	7	21.15	Sprouted.....	Tubers irregular, eyes deep, rather coarse.
Early Pearl.....	52	33	21.01	Sprouted.....	Tubers round, eyes deep, skin smooth.
Delaware	30	25	20.83	Sprouted.....	Tubers flat, irregular, skin smooth, eyes shallow, fine.
Vanguard	39	35	20.47	Sprouted.....	Tubers pointed at seed end, eyes shallow.
Rural Blush.....	39	30	20.44	Sprouted.....	Tubers roundish, eyes deep.
New Eximus	10	8½	20.43	Sprouted.....	Tubers round, skin rough, eyes deep.
Chicago Sun.....	6	4	20.25	Sprouted.....	Tubers oblong, eyes shallow, skin smooth.
California White	6	3¾	19.89	Sprouted.....	Tubers irregular, eyes shallow, skin smooth.
Sterling.....	8	5½	19.89	Sprouted.....	Tubers irregular, eyes shallow, skin smooth.
Big Benefit.....	8	5	19.80	Sprouted.....	Tubers irregular, eyes shallow, skin smooth.
Watson's Seedling	39	22	19.80	Sprouted.....	Tubers irregular, eyes prominent.
Pearl of Savoy	55	35	19.80	Sprouted.....	Tubers oblong, eyes deep, skin smooth.
White Sport	28	13	19.57	Sprouted.....	Tubers round, eyes deep, skin rough.
Beauty of Hebron.....	28	25	19.57	Sprouted.....	Tubers oblong, irregular, eyes deep, skin smooth.

EXPERIMENTS WITH POTATOES.

POTATOES—Named Varieties—(Continued).

VARIETY.	No. of Hills.	Yield in Pounds.	Per Cent. of Starch.	Condition April 1st, 1889.	REMARKS.
American Giant	28	14½	19.39	Sprouted	Tubers round, eyes deep, skin rough, rather coarse.
Grange	9	12	19.39	Sprouted	Tubers round, eyes deep, skin smooth.
Stray Beauty	22	30	19.35	Sprouted	Tubers round, eyes deep, desirable.
Early Perfection	8	7	19.21	Sprouted	Tubers long, eyes shallow, good.
President Cleveland	15	9	19.20	Sprouted	Tubers roundish flat, skin smooth.
Yankee Nation	19	7	19.20	Unsprouted	Tubers cylindrical, eyes deep, skin rough.
Randall's Rose	44	36	19.08	Sprouted	Tubers oblong, eyes shallow, skin smooth.
Rochester Favorite	12	9	19.08	Sprouted	Tubers oblong, eyes prominent, skin smooth. *
Rubiana	11	8½	19.08	Sprouted	Tubers round, eyes deep, skin rough.
Garrison's No. 8	7	5½	19.08	Sprouted	Tubers roundish, irregular, eyes shallow, smooth.
Empire State	54	36	19.08	Sprouted	Tubers long, skin smooth, eyes deep.
Hoag's Seedling	40	25	19.08	Unsprouted	Tubers long, tapering to seed end, eyes shallow.
Queen of the Valley	61		19.03	Sprouted	
Queen of the Roses	9	9	18.80	Sprouted	Tubers long, pointed at seed end, eyes deep.
Rose's Beauty of Beauties	29	26¾	18.80	Sprouted	Tubers irregular, eyes deep, a desirable kind.
Tremont	8	5½	18.76	Unsprouted	Tubers round, eyes shallow.
Vermont Champion	12	9	18.76	Sprouted	Tubers oblong, eyes deep, skin smooth.
Shannon's Seedling	12	9	18.72	Sprouted	Tubers round, eyes shallow, desirable.

EXPERIMENTS WITH POTATOES.

El Paso.....	11	9	18.50	.....	.....	.....	.....	.....	Tubers round, eyes shallow, skin smooth.
Newton.....	11	7½	18.45	.....	.....	.....	.....	.....	Tubers irregular, eyes shallow, rough skin.
Norway White Rose.....	8	7	18.45	.....	.....	.....	.....	.....	Tubers roundish flat, eyes shallow, desirable.
Durham.....	7	7¼	18.45	.....	.....	.....	.....	.....	Tubers irregular, eyes shallow, skin smooth.
Beauty of Sheba.....	42	31*	18.45	.....	.....	.....	.....	.....	Tubers irregular, eyes few and shallow, skin smooth.
Bliss' Triumph.....	10	12½	18.45	.....	.....	.....	.....	.....	Tubers irregular, eyes deep, skin smooth.
Hercules.....	10	7½	18.45	.....	.....	.....	.....	.....	Tubers long, eyes shallow, skin smooth.
Magnum Bonum.....	6	5	18.30	.....	.....	.....	.....	.....	Tubers irregular, eyes deep, rough skin.
Early Sunrise.....	45	30	18.20	.....	.....	.....	.....	.....	Tubers long and tapering, eyes deep, skin smooth.
Champion of America.....	10	7	18.13	.....	.....	.....	.....	.....	Tubers round, skin smooth, eyes deep, color red.
New Champion.....	9	10	18.13	.....	.....	.....	.....	.....	Tubers roundish flat, eyes deep, skin smooth.
Early Ohio.....	20	13½	18.13	.....	.....	.....	.....	.....	Tubers roundish, skin rough, a desirable early variety.
Summit.....	22	24	18.10	.....	.....	.....	.....	.....	Tubers oblong, eyes prominent, fine.
Superb Beauty.....	6	6	18.00	.....	.....	.....	.....	.....	Tubers oblong, eyes few and deep, skin smooth.
Paragon.....	10	5	18.00	.....	.....	.....	.....	.....	Tubers irregular, skin spotted, desirable.
Perfect Peachblow.....	10	5¼	18.00	.....	.....	.....	.....	.....	Tubers irregular, skin spotted, desirable.
Leopard.....	7	4	18.00	.....	.....	.....	.....	.....	Tubers round, eyes deep, skin smooth and spotted.
Brigham.....	9	5¾	18.00	.....	.....	.....	.....	.....	Tubers irregular, eyes shallow, rough skin.
Early Ease.....	85	17¾	18.00	.....	.....	.....	.....	.....	Tubers roundish, flat, eyes deep, skin smooth.
Rand's 42.....	10	9	18.00	.....	.....	.....	.....	.....	Tubers irregular, eyes deep.
Putnam's New Rose.....	11	5	18.00	.....	.....	.....	.....	.....	.....
Climax.....	6	5¼	18.00	.....	.....	.....	.....	.....	Tubers round, eyes deep, skin rough.

EXPERIMENTS WITH POTATOES.

POTATOES—Named Varieties—(Continued).

VARIETY.	No. of Hills.	Yield in Pounds.	Per Cent. of Starch.	Condition April 1st, 1889.	REMARKS.
California Red.....	12	10½	18.00	Sprouted	Tubers irregular, eyes deep, skin rough.
Agnoth's Favorite.....	8	8	17.98	Sprouted	Tubers round, eyes deep, skin rough.
Maine Champion.....	8	6	17.85	Sprouted	Tubers round, eyes shallow, skin smooth.
Fearnaught.....	62	52½	17.85	Sprouted	Tubers irregular, eyes deep, skin smooth, good.
Green Mountain.....	65	37	17.84	Sprouted	Tubers irregular, eyes deep, skin rough.
Rose's Seedling.....	18	8	17.55	Sprouted	Tubers irregular, eyes deep, skin spotted red.
Cream of the Field.....	6	7	17.55	Unsprouted	Tubers irregular, eyes deep, skin smooth.
O. K. Mammoth.....	28	17	17.55	Sprouted	Tubers irregular, skin smooth, eyes deep.
Rosy Morn.....	7	7	17.55	Sprouted	Tubers irregular, eyes shallow, skin smooth.
Mammoth Pearl.....	28	22	17.55	Sprouted	Tubers roundish, flattened, eyes few.
Early Howard.....	7	5	17.55	Sprouted	Tubers oblong, eyes deep, skin smooth, fair.
Early Electric.....	10	6¾	17.55	Sprouted	Tubers round, eyes shallow, dark red, skin smooth.
Ohio Queen.....	7	2	17.50	Sprouted	Tubers oblong, skin smooth.
Early Telephone.....	10	5.	17.48	Sprouted	Tubers oblong, eyes shallow, skin smooth.
Burbank.....	50	42	17.20	Sprouted	Tubers long, eyes deep, skin smooth.
Howard.....	10	9½	17.10	Sprouted	Tubers long, eyes shallow, good.
Late Snowflake.....	7	4½	17.10	Sprouted	Tubers irregular, roundish, eyes deep.
Corless Matchless.....	10	3¾	17.10	Sprouted	

Lion	8	5½	17.10	Sprouted	Tubers oblong, eyes deep, color red.
White Mercer	9	5½	17.10	Sprouted	Tubers irregular, eyes deep and red, skin smooth.
Baker's Imperial	36	8¾	17.10	Sprouted	Tubers cylindrical, eyes rather deep.
Golden Age	9	5	17.10	Sprouted	Tubers long, eyes deep, skin smooth.
Steuben Beauty	9	6	17.05	Sprouted	Tubers round and course.
Snowflake	11	7	17.00	Sprouted	Tubers round, eyes shallow, skin smooth.
Brownell's No. 55	10	5	16.78	Sprouted	Tubers round, eyes prominent.
Collum's Superb	13	9	16.65	Sprouted	Tubers long, irregular, skin smooth, eyes prominent.
Chicago Market	36	.80	16.65	Sprouted	Tubers irregular, eyes shallow, skin smooth.
Portage	6	3¾	16.65	Sprouted	Tubers oblong, eyes shallow, desirable.
Ohio Fancy	10	10	16.65	Sprouted	Tubers round, eyes deep, skin rough.
Weld's	18	10	16.33	Sprouted	Tubers roundish, eyes deep, rough.
Golden Flesh	24	11	16.29	Sprouted	Tubers irregular, eyes deep, skin rough.
Seek no Further	6	5	16.06	Sprouted	Tubers oblong, eyes deep, skin smooth.
Canfield Seedling	11	7	16.06	Sprouted	Tubers irregular, eyes prominent and shallow.
Ladies' Favorite	10	6	15.84	Sprouted	Tubers round, eyes shallow, skin smooth, fine tubers.
Blue Victor	8	5½	15.84	Sprouted	Tubers irregular, eyes deep, rough skin.
White Star	32	.22	15.75	Sprouted	Tubers cylindrical, eyes deep, skin rough.
Irish Cup	6	1	15.75	Sprouted	Worthless.
Early Maine	11	11	15.60	Sprouted	Tubers oblong, skin smooth, eyes shallow, good.
St. Patrick	43	.92	15.52	Sprouted	Tubers oblong, eyes deep, skin rough.
Hampshire Beauty	38	.24	15.52	Sprouted	Tubers long, eyes shallow, smooth skin.

POTATOES—Named Varieties—(Continued).

VARIETY.	No. of Hills.	Yield in Pounds.	Per Cent. of Starch.	Condition April 1st, 1889.	REMARKS.
Iroquois.....	9	7	15.52	.....Sprouted	Tubers round, eyes deep, smooth skin.
California Rose.....	8	6½	15.30	.....Sprouted	Tubers oblong, eyes deep, skin smooth.
Thunderbolt.....	52	35	15.00	.....Sprouted	Tubers round, eyes shallow, skin smooth.
Red Elephant.....	8	15	14.98	.....Sprouted	Tubers irregular, eyes deep.
Mayflower.....	48	26	14.98	.....Sprouted	Tubers roundish, flat.
Early Puritan.....	10	10	14.85	.....Sprouted	Tubers oblong, eyes deep, skin fairly smooth.
Arizona.....	10	6¾	14.85	.....Sprouted	.....
Junkers.....	10	10½	14.85	.....Sprouted	Tubers long, skin smooth, eyes shallow—fine.
Early New Zealand.....	8	8	14.85	.....Sprouted	Tubers long, eyes shallow, smooth skin.
Gold Flake.....	6	8	14.58	.....Sprouted	Tubers round, eyes shallow, skin smooth and spotted.
Farina.....	8	8	14.53	.....Sprouted	Tubers long, eyes shallow, smooth skin.
Early Excelsior.....	5	1¼	14.40	.....Unsprouted	Tubers irregular, eyes deep, skin rough—poor.
Late Ohio.....	7	5¾	14.40	.....Sprouted	Tubers oblong, eyes shallow and red, skin smooth.
Pride of Japan.....	6	3	14.40	.....Sprouted	Tubers round, eyes deep, skin smooth.
Early Albion.....	10	8¾	14.38	.....Sprouted	Tubers oblong, eyes deep, skin rough.
Lady Finger.....	20	4½	14.31	.....Unsprouted	Tubers long, eyes deep, skin smooth.
White Elephant.....	10	8	14.22	.....Unsprouted	Tubers long, eyes deep, skin smooth.
Early Snowflake.....	8	4	14.04	.....Sprouted	Tubers round, eyes shallow, skin smooth.

Charles I.....	10	6½	14.04	Sprouted.....	Tubers irregular, skin smooth, eyes deep.
Crandall's Seedling.....	18	12½	13.50	Sprouted.....	Tubers oblong, skin smooth and spotted, eyes prominent.
Dakota Red.....	32	17	13.50	Unsprouted.....	Tubers irregular, skin rough, eyes deep.
Pride of America.....	9	9	13.48	Sprouted.....	Tubers long, eyes prominent, skin rough.
White Boston Market.....	10	3½	12.60	Sprouted.....	Tubers long, eyes shallow, skin smooth.
Early Prolific.....	6	7	10.44	Sprouted.....	Tubers long, irregular, eyes deep, smooth skin.
Mullaly's White.....	8	7	10.35	Sprouted.....	Tubers irregular, eyes deep, skin rough.
Churchill's Seedling.....	10	7½	6.88	Sprouted.....	Tubers round, eyes prominent, smooth skin.
Early Jinks.....	5	6½	6.40	Sprouted.....	Tubers oblong, irregular, eyes deep, skin smooth.
Early Sunrise.....	30	18	6.30	Sprouted.....	Tubers irregular, eyes deep, skin smooth.

POTATOES—Seedlings.

VARIETY.	No. of Hills.	Yield in Pounds.	Per Cent. of Starch.	Condition April 1st, 1889.	REMARKS.
No. 80.....	10	10	25.00	Sprouted.....	Tubers roundish, eyes few, desirable.
" 11.....	10	12	24.97	Sprouted.....	Tubers long, smooth, eyes few, shallow, good.
" 31.....	10	14¾	24.80	Sprouted.....	Tubers long, smooth, eyes shallow, desirable.
" 22.....	10	8½	24.60	Sprouted.....	Tubers oblong, a poor variety this year.
" 82.....	10	18	23.67	Sprouted.....	Tubers oblong, smooth, prolific.
" 3.....	10	9½	23.53	Unsprouted.....	Tubers roundish, flat, smooth, eyes deep.
" 75.....	10	13¾	22.95	Sprouted.....	Tubers irregular, eyes shallow, good.

POTATOES—Seedlings—(Continued).

VARIETY.	No. of Hills.	Yield in Pounds.	Per Cent. of Starch.	Condition April 1st, 1889.	REMARKS.
No. 52.....	10	15½	22.95 .....	.....Sprouted	Tubers smooth, eyes medium deep, desirable.
" 38	10	18	22.50 .....	.....Sprouted	Tubers oblong, eyes deep, prolific.
" 69	10	12	22.50 .....	.....Unsprouted	Tubers rough, eyes deep.
" 91	10	14¾	22.50 .....	.....Sprouted	Tubers roundish, smooth, eyes few and shallow.
" 70	10	8	22.50 .....	.....Unsprouted	Tubers irregular, eyes shallow, desirable.
" 72	10	20¼	22.50 .....	.....Unsprouted	Tubers cylindrical, smooth, desirable.
" 4	10	9	22.50 .....	.....Sprouted	Tubers roundish, flat, fairly smooth, eyes shallow.
" 51	10	12½	22.50 .....	.....Sprouted	Tubers oval, eyes deep, rough.
" 28	10	4½	22.50 .....	.....Unsprouted	Tubers oblong, pointed at seed end, eyes shallow.
" 71	10	8	22.50 .....	.....Sprouted	Tubers roundish, smooth, desirable.
" 1	10	16	22.30 .....	.....Sprouted	Tubers oblong, smooth, eyes shallow, fine.
" 57	10	6½	22.30 .....	.....Sprouted	Tubers oblong, rather rough, eyes deep.
" 40	10	5¼	22.00 .....	.....Sprouted	Tubers irregular, poor.
" 12	10	7¼	21.60 .....	.....Sprouted	Tubers long and smooth, eyes many, deep.
" 79	10	5¾	21.60 .....	.....Sprouted	Tubers oblong, smooth, eyes shallow.
" 93	10	5	21.42 .....	.....Sprouted	Tubers oblong, eyes deep, poor.
" 45 .....	.....	.....	21.15 .....	.....Sprouted .....	.....
" 102	10	16	20.88 .....	.....Unsprouted	Tubers oblong, smooth, eyes few, good.

EXPERIMENTS WITH POTATOES.

No. 28	10	8	20.83	Sprouted	Tubers oblong, smooth, eyes shallow.
" 6	10	5½	20.83	Unsprouted	Tubers oblong, skin rough, eyes deep.
" 39	10	5¼	20.70	Sprouted	Tubers irregular, eyes deep, rather rough.
" 18	10	5¼	20.70	Unsprouted	Tubers smooth, eyes medium deep.
" 108	10	7	20.47	Sprouted	Tubers oblong, smooth, eyes few.
" 65	10	11	20.45	Sprouted	Tubers long, smooth, desirable.
" 42	10	12	20.29	Sprouted	Tubers long, eyes deep, prolific.
" 98	10	11½	20.25	Sprouted	Tubers irregular, eyes deep, prolific.
" 44	10	19½	19.89	Sprouted	Tubers long, rather rough, prolific.
" 34	10	12¾	19.80	Sprouted	Tubers oblong, eyes few and shallow, fine.
" 90	10	4¼	19.80	Sprouted	Tubers oblong, smooth, eyes few.
" 88	10	12	19.57	Unsprouted	Tubers oblong, smooth, eyes shallow.
" 94	10	11¾	19.57	Sprouted	Tubers long, slender, smooth.
" 47	10	6¼	19.57	Sprouted	Tubers roundish, irregular, eyes deep, skin smooth.
" 46	10	7	19.40	Sprouted	Tubers irregular, eyes deep, poor.
" 14	10		19.39	Sprouted	.....
" 78	10	4½	19.39	Sprouted	Tubers oblong, eyes deep.
" 50	10	5¼	19.39	Sprouted	Tubers roundish, eyes deep, rough.
" 15	10	7¼	19.39	Sprouted	Tubers oblong, irregular, eyes medium deep.
" 48	10	13½	19.35	Sprouted	Tubers oblong, smooth, desirable.
" 85	10	7¼	19.35	Sprouted	Tubers oblong, flat, eyes shallow, skin smooth.
" 74	10	10	19.08	Sprouted	Tubers irregular, eyes shallow, good.

POTATOES—Seedlings—(Continued).

VARIETY.	No. of Hills.	Yield in Pounds.	Per Cent. of Starch.	Condition April 1st, 1889.	REMARKS.
No. 105.....	10	17	19.08	Sprouted	Tubers irregular, eyes shallow, desirable.
" 100.....	10	7	18.72	Unsprouted	Tubers oblong, eyes deep, rather rough.
" 62.....	10	10½	18.58	Sprouted	Tubers long and smooth, eyes few, desirable.
" 59.....	10	5½	18.45	Unsprouted	Tubers oblong, eyes few and shallow.
" 83.....	10	7	18.45	Unsprouted	Tubers oblong, smooth, eyes medium deep.
" 97.....			18.45	Sprouted	.....
" 92.....	10	9½	18.45	Unsprouted	Tubers oblong, smooth, eyes shallow, desirable.
" 21.....	10	6½	18.27	Sprouted	Tubers roundish, rough, eyes deep.
" 36.....	10	8½	18.27	Sprouted	Tubers roundish, flat, smooth, desirable.
" 48.....	10	7½	18.00	Sprouted	Tubers oblong, smooth, desirable.
" 98.....	10	11½	17.90	Unsprouted	Tubers irregular, eyes deep, prolific.
" 85.....	10	9½	17.90	Sprouted	Tubers irregular, eyes deep.
" 29.....	10	8	17.90	Sprouted	Tubers long, flattened, smooth, eyes prominent.
" 67.....	10	3¾	17.90	Sprouted	Tubers roundish, flat, a failure this season.
" 54.....	10	2¾	17.90	Unsprouted	Tubers cylindrical, poor.
" 19.....	10	5¾	17.80	Sprouted	Tubers roundish, eyes deep, skin rough.
" 77.....	10	14	17.55	Unsprouted	Tubers long, smooth, desirable.
" 25.....	10	11½	17.80	Sprouted	Tubers smooth, eyes medium deep.

No. 88	10	15¾	17.14	.....	Sprouted	Tubers oblong, smooth, desirable.
" 10	10	6½	16.92	.....	Sprouted	Tubers oblong, irregular, eyes deep, poor.
" 66	10	7	16.90	.....	Unsprouted	Tubers oblong, flattened, good.
" 101	10	9	16.70	.....	Sprouted	Tubers slender, oblong, smooth, eyes few.
" 5	10	7	16.65	.....	Sprouted	Tubers oblong, rather smooth, eyes shallow.
" 82	10	10½	16.65	.....	Sprouted	Tubers irregular, eyes shallow and few.
" 87	10	7½	16.65	.....	Sprouted	Tubers oblong, eyes medium deep.
" 99	10	6¾	16.40	.....	Unsprouted	Tubers irregular, eyes deep.
" 104	10	6	16.29	.....	Sprouted	Tubers roundish, eyes shallow.
" 68	10	14	16.20	.....	Unsprouted	Tubers roundish, flat, desirable.
" 89	10	4¾	16.06	.....	Unsprouted	Tubers irregular, rather rough.
" 61	10	6¾	16.06	.....	Sprouted	Tubers roundish, eyes medium deep.
" 53	10	7	15.97	.....	Unsprouted	Tubers irregular, eyes deep.
" 58	10	16¼	15.95	.....	Sprouted	Tubers cylindrical, eyes deep, fine.
" 80	10	8¾	15.84	.....	Unsprouted	Tubers oblong, smooth, eyes shallow.
" 20	10	3¾	15.61	.....	Unsprouted	Tubers irregular, eyes deep, skin smooth.
" 27	10	2¾	15.52	.....	Unsprouted	Tubers oblong, small and undesirable.
" 18	10	6¼	15.48	.....	Sprouted	Tubers irregular, eyes deep.
" 55	10	6½	15.30	.....	Sprouted	Tubers irregular, eyes deep.
" 96	10	7	14.98	.....	Sprouted	Tubers irregular, eyes deep.
" 49	10	8¾	14.89	.....	Unsprouted	Tubers roundish, flat, skin smooth, fine.
" 37	10	13	14.50	.....	Unsprouted	Tubers roundish, irregular, eyes few, desirable.

POTATOES—Seedlings—(Continued).

VARIETY.	No. of Hills.	Yield in Pounds.	Per Cent. of Starch.	Condition April 1st, 1889.	REMARKS.
No. 2	10	12	14.04 .....	..... Sprouted	Tubers irregular, eyes deep.
" 24	10	6½	13.81 .....	..... Sprouted	Tubers oblong, rough, eyes deep.
" 81	10	8	12.28 .....	..... Sprouted	Tubers roundish, eyes deep.
" 14 .....	.....	.....	12.19 .....	..... Sprouted .....	.....
" 28	10	3	11.97 .....	..... Sprouted	Tubers roundish, eyes deep, poor.
" 64	10	6¾	11.70 .....	..... Unsprouted	Tubers oblong, smooth, desirable.
" 41	10	5	11.70 .....	..... Sprouted	Tubers oblong, eyes deep, poor.

CHEMICAL SECTION.

The following method (Sachsse's) was used for determining the starch in potatoes :

Ten grams of potatoes, cut from a section through the center, were grated fine and pulverized in a mortar, and 200 cubic centimeters of water added, 20 cubic centimeters of hydrochloric acid (sp. gr. 1.125), and the flask heated 100° C. on a water bath for three hours. The flask is provided with a glass tube, three feet long and one-fourth inch in diameter, fastened in the cork, to act as a condenser. After cooling, enough sodium hydroxide is added to nearly neutralize the acid, and the liquid made up to 500 cubic centimeters. An alkaline copper solution, made as follows : Solution No. 1 contains 173 grams of Rochelle salts and 125 grams of caustic potash, dissolved in 500 cubic centimeters of water. Solution No. 2 contains 34.69 grams crystalized copper sulphate, dissolved in 500 cubic centimeters of water. Five cubic centimeters of No. 1 and five cubic centimeters of No. 2 are mixed in a casserole and heated to boiling, the boiling being continued while the solution of dextrose is being added from a burette, until all the copper is precipitated as a sub-oxide. The end reaction being tested for copper by acetic acid and ferrocyanide of potassium. The amount of dextrose multiplied by 9-10 gives the weight of starch, according to the formula $C_6H_{10}O_5$. The analyses were completed about the 1st of January, 1889.

COMPARATIVE METHODS.

A number of methods of determining starch were tried, for the purpose of comparison of results. It has long been claimed by some chemists that the direct heating of agricultural products, as potatoes, grain, etc., with acids, changes the cellulose into dextrose, and may render some of the ash ingredients soluble, and that in that condition they might afterward precipitate the copper solution. In order to test the accuracy and also the convenience of the many methods pro-

posed, the following experiments were tried; the same sample of potatoes (Lady of London) being used in each case. Only the per cent. of starch in the potato was estimated, as, other things being equal, the greater the per cent. of starch, the greater their nutritive value; the richer in starch, the poorer, generally, in protein; the more watery it is, the less the percentage of starch and the greater, as a rule, is the amount of protein, and, usually, also of ash. Grown in a very rich soil, or in a wet place, the same variety of potato contains far less starch, but is richer in protein than when grown in sandy soil or a sandy loam. Manuring generally lessens the percentage of starch and increases the percentage of protein. The ash of the potato contains considerable phosphoric acid and is rich in potash, but has only a little lime and soda; this must be borne in mind when they are used for feeding milch cows or young and growing animals. The following table gives the composition of the ash :

Carbonic anhydride	21.06
Sulphuric anhydride	2.77
Phosphoric anhydride	5.72
Potash	53.47
Soda	Trace
Chloride of Sodium	Trace
Calcic carbonate	.84
Magnesian carbonate	3.53
Calcic sulphate	Trace
Tri-calcic phosphate	3.36
Tri-magnesian phosphate	9.25
Basic ferric phosphate	Trace
Silica	Trace
Total	100

First—In regard to the time the potatoes were on the water bath, all the other conditions being alike :

Time of heating.	Per cent. of starch.
1 hour	17.79
2 hours	17.78
3 hours	17.74
6 hours	17.70
9 hours	17.20

This shows that for three hours the starch was practically what was obtained before (17.75), and that for longer time there was diminution in the per cent. of starch.

Second—In regard to heating the potatoes under pressure, all the other conditions being alike :

Strong glass beer bottles were used, and the cork securely fastened so as to admit of no escape of vapor ; they were placed in water bath and heated as before described.

Time of heating.	Per cent. of starch.
3 hours-----	17.80
6 hours-----	18.40
9 hours-----	18.00

This shows that putting the potato under pressure while heating increased the per cent. of starch, or possibly it renders other matters soluble, that assist in reducing the copper solution.

Third—Potato starch was made by grating the potatoes and pulverizing them in a mortar, and washing out the starch upon a fine linen filter ; the starch was dried at 100° C. Three-tenths of a gram was taken and treated as in Sachsse's method for starch.

Time of heating.	Per cent. of starch.
3 hours-----	.309 grams
8 hours-----	.306 grams
12 hours-----	.304 grams

Theoretically there should be only 3-10 gram, and the small error may be due to the starch not being absolutely pure.

Fourth—The potatoes were washed clean, dried with a towel and placed in a solution of common salt, in which some would sink and others float. The specific gravity of the solution ascertained with a hydrometer, which would give the specific gravity of potatoes. The tables giving the specific gravity and the corresponding per cent. of dry matter, and also of starch, varied so much that no

dependence could be placed upon them. Compare J. J. Pohl, Watt's Dictionary of Chemistry, article Potatoes, also Biedermann Chemiker, Kalender, the table of Behren's Marker, und Morgen :

	Watt's Dictionary.	Biedermann's.	Found.
Sp. gr.	Starch.	Starch.	Starch.
1.094	17.52	16.90	17.75

The most complete table is that of Heideprien, (Jour. Chem. Soc., vol. xxxii.—233).

Parke's Hygiene, 6th edition, p. 260, states that when potatoes have a specific gravity below 1.068, the quality is very bad; between 1.068 and 1.082, inferior; between 1.082 and 1.105, rather poor; above 1.105, good.

Fifth—Two experiments were tried comparing sulphuric with hydrochloric acid, all other conditions remaining the same :

Time.	Sulphuric acid.	Hydrochloric acid.
3 hours	17.50	17.76
6 hours	17.46	17.71

Besides the per cent. of starch being less with sulphuric acid, the dark color on prolonged heating is decidedly against its use.

Sixth—Five kilograms (11 lbs.) of potatoes were grated and pulverized in a mortar and the starch washed out through a linen towel, to see what per cent. of starch could be obtained by this method.

Starch washed out.	Starch by Sachsse's method.
16.84 per cent.	17.75 per cent.

The above was washed twenty-four times with water and the process extended over a period of two days.

Seventh—Allihn's method was tried, which in substance, consists in reducing the sub-oxide of copper to the metallic form by heating it to redness in a stream of hydrogen, to prevent oxidation. From Allihn's table, the weight of dextrose corresponding to the weight of copper was found :

Allihn's method.	Sachsse's method.
17.79 per cent.	17.75 per cent.

The filtering and reducing of metallic copper involves a loss of time overbalancing, in our judgment, the increased accuracy. The accuracy was greater in using an alkaline copper solution freshly mixed than one which had stood some time; the length of time the solution is boiled influences the result. Prolonged boiling increases the per cent. of starch. The analysis of potatoes by the Kentucky Agricultural Experiment Station is given by way of comparison: Bulletin No. 9, page 9. Highest yield (Empire State), 15.48 per cent.; lowest yield (Dakota Red), 12.05 per cent. of starch.

SUGAR BEETS.

Seeds of four varieties of sugar beets were received from the Department of Agriculture, and were sown April 15, on 1-4 of an acre of ground. The planting was in rows three feet apart, the seeds being sown with a drill. The soil was a clay loam which had been in clover sod for three years previous, and was broken in the fall of 1887. The plants were irrigated four times, cultivated six times and hoed twice. The estimated yield per acre is based upon the product of an average row of each kind 450 feet long.

DESCRIPTION OF VARIETIES.

Lane's Imperial—Roots very smooth, skin white, shading to red above—growing well below ground; yield per acre, 30.45 tons.

Excelsior Sugar—Roots smooth, skin dull white, growing under ground; yield per acre, 29.04 tons.

Vilmorin Sugar—Roots smooth, skin white with a purplish tinge, somewhat wrinkled—growing below ground; yield per acre, 25.09 tons.

Improved Imperial Sugar—Roots rough, skin dull orange, growing one-half above the surface of the soil; yield per acre, 24.15 tons.

CHEMICAL ANALYSIS.

Preparation of the Sample—The beets were washed and dried with a towel; then weighed, the top and small rootlets cut off, again weighed and this loss carefully noted. Three average beets were taken and quartered parallel to the axis; a quarter from each beet was selected, and successive slices made lengthwise of each quarter were taken, in all amounting to 200 grams (about 4-10 lb.); this was reduced to a fine pulp by grating, and afterward pulverized in a mortar; the juice was extracted by a strong filter press, and the marc moistened with boiling water, the pressure renewed and this operation repeated until all soluble matter had been extracted and the residue was dry, care being taken to avoid undue diluting of the solution. We have found the best results from solutions containing from 1-2 to 3-4 of a per cent. of sugar; the coloring matter was precipitated by tannin and acetate of lead; it was filtered and the grape sugar determined as before described under potatoes. The sugar in the beet is principally cane sugar, containing a small per cent. of grape sugar; the cane sugar was inverted (process of hydrolysis) by heating the solution with dilute (1 to 5) hydrochloric acid, on the water bath for fifteen minutes; about a drop of the dilute acid was used for each c. c. of the sugar solution. The solution was neutralized with sodium carbonate and the sugar again determined; the difference between the results gives the per cent. of cane sugar present in each variety.

The per cent. of cane sugar is 95-100 of the grape sugar produced by inversion of the cane sugar.

NAME.	Grape Sugar.	Cane Sugar.	Total Sugar.	Loss on Dressing.
Excelsior.....	.11	9.47	9.58	7
Lane's Imperial.....	.25	11.83	12.08	12
Vilmorin.....	.21	11.18	11.39	11
Imperial Improved.....	.10	8.73	8.83	7

The following table shows the yield of sugar in pounds per ton of beets, and also the relative yield per acre, as computed from the above results of chemical analysis :

YIELD OF SUGAR.

VARIETY.	Tons Beets Per Acre.	Lbs. Sugar Per Ton of Beets.	Lbs. Sugar Per Acre.
Excelsior.....	29.04	190	5,517.60
Lane's Imperial.....	30.45	240	7,318.00
Vilmorin	25.09	227	5,695.43
Imperial Improved.....	24.15	176	4,250.40

From the above it will be seen that there is quite a wide variation in sugar content in the four varieties tried last season. Enough, however, has been developed to create a lively interest in the cultivation of the sugar beet in this state for purposes of sugar production. The serious drawback seems to be the cost of the diffusion plant, as quite a large amount of capital is required to prepare a suitable plant and furnish adequate machinery.

