EXPERIMENT STATION

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EXPERIMENTS WITH POTATOES.

A COMPARISON OF THE RESULTS OF THE USE OF FIRST-CROP AND SECOND-CROP POTATOES FOR SEED.

POTATO growers in Kansas meet with conditions differing widely from those which prevail in the more northern States, where potatoes have been a staple crop for many years.

Our growing season is long, it often being possible to plant by the middle of March, and always by the first of April.

Periods of heat and drought during the summer are liable to check the crop, while succeeding rains will induce a second growth in the form of knobs and projections, or very late sorts may be set back beyond recovery.

After the crop is matured we still have one or two months of quite warm weather, during which it is a question whether potatoes are better off left in the ground or stored in the warm cellars which such a climate affords. It naturally follows that the bulk of Kansas-grown potatoes are marketed

early for immediate use, and that those which are stored for winter are usually inferior in texture and flavor to those shipped in from cooler regions. These same home-grown potatoes at planting time are often found to be much sprouted and more or less shriveled. How much their vitality and consequent value for seed is reduced by this is a question of much importance.

The sprouting of potatoes left in the ground during August and September, and the occasional growth of small new tubers, has probably been the means of suggesting to a few gardeners the idea that a second crop could be grown in the latter part of the season. The use of these potatoes for seed the following spring having often been found to give much better returns than planting the regular crop, and the advertisements of certain dealers claiming superior merits for second-crop potatoes for early planting, led us to make a series of trials of this method of culture and comparisons of this seed with that commonly used.

Our first experiment in the growth of a second crop of potatoes the same season was made in the summer of 1889, and is referred to in our annual report of 1889, page 196.

From a list of potatoes planted March 15, two hills were dug from each of sixteen of the earliest sorts July 11, and the same day planted on ground cleared of early peas. They were all rather slow in starting, and made at first but an uneven stand, while Early Ohio, Ohio Junior and Ladies' Favorite failed to appear.

It was noticeable that the tops were in all cases small. The yield was very little, ranging from 1 to 10 pounds to the 30 feet of row planted. Some of the tubers were of fine size, and all were very smooth and firm.

The following spring, seed of the best nine sorts from this lot was planted in comparison with that from the early crop from which it was grown, and with a third lot of the same varieties grown later in the season.

The three lots were as follows:

Lot I, seed from early planting; tubers rather shriveled and small, having sprouted badly in storage.

Lot II, seed from main planting of April 24; tubers of good size, firm but slightly shriveled, having sprouted but moderately.

Lot III, second crop, grown from seed dug from the rows that produced lot I; tubers of medium average size, very firm, none sprouted.

Three pounds of seed were used of each, cut to three-eye pieces. These were planted about a foot apart, making the rows of variable length, according to the number of pieces. The ground used being of as nearly uniform quality as could be secured, each lot had a fair chance on its own merits.

All were planted the same day, March 18. Lots I and II were the first to appear, coming up at about the same time, April 14 to 16. Only one sort in lot III appeared on the 14th, the others ranging from the

19th to the 22d; but when they came it was noticeable that they were much stronger and darker green than the others, and in a few weeks they grew much beyond them. Blossoms were much more numerous on lot III than on the others.

Half of the crop was dug June 24–26, when of first table size, the balance July 24, after they were ripe. The product of the three lots will appear in table I, showing each variety. The average for all varieties of lot I is estimated at 53.2 bushels per acre; of lot II, 77.6 bushels; and of lot III, 97.5 bushels.

That all of these yields are light, is explained in part by the early digging of half of them, and more fully by the dry growing season they had to endure, all varieties, under all methods of culture, suffering severely. The relative value of the three kinds of seed is clearly suggested by these results; and the much more uniform size and high percentage of marketable tubers in lot III was still stronger evidence in their favor.

On July 24, the date of digging the last half of these lots, five pounds of seed from each variety in lot III were planted for second crop. The season following planting was in this case unusually favorable, the rainfall for August being abundant, and a good stand was the result. The product from five pounds of seed ranged from 15 to 32½ pounds, the highest being at the rate of 200 bushels per acre. The potatoes were very fine, and the same superior keeping qualities were noted as in the previous year, being firm and scarcely sprouted at planting time, while main-crop sorts were usually much sprouted and shriveled.

In the spring of 1891 a more extensive and systematic trial of this quality of seed was made than had been possible before.

Ten pounds of second-crop seed from each of eight varieties were planted in comparison with equal amounts of first-crop seed, with the exception of three sorts, in which only five pounds of the second sort could be spared.

The tubers were cut to three-eye pieces, and planted at the rate of five pounds to the 100 feet of row, the entire list being planted April 8.

The first-crop sorts were all in sight April 24. The second-crop sorts were from the 27th to the 30th in appearing, came up much stronger and darker colored, and rapidly outgrew the others.

At the time of blooming, the difference in size and vigor in the parallel rows was striking, as appears imperfectly in the photograph of the plat (plate XVI). This photograph shows also another difference of importance, namely, that all the rows from second-crop seed bloomed heavily, while of those from first-crop seed but three bloomed, and these scantily.

As noted June 19, the average height of tops for first-crop sorts was 15 inches, while that of the second-crop rows was 21 inches. The tops of the latter, from samples dug, weighed 50 per cent. more than the others.

A rod of row from each class and variety was dug at the above date, all sorts being as nearly as possible in marketable condition as “new potatoes.”

Of these, six sorts gave the greatest total yield from second-crop seed, while in the other two the first-crop yield was ahead, but when sorted to marketable size the second-crop lots were in all cases ahead, not only in actual weight of marketable tubers, but in average size and appearance of these.

Plate XVII is from a photograph of the product of five hills of each lot of No. 192, Thorburn, and No. 214, White Prize, in which the difference was most marked in favor of the second-crop seed. The marketable tubers are shown in the background, with the small ones in front. The ratio of marketable to small is well shown, but the small tubers, being in front, appear too large in proportion.

In plate XVIII, the same arrangement is shown of Nos. 133, New Queen, and 168, Rochester Favorite, two sorts in which the minimum of difference was found; but in these, also, we find that the ratio of marketable to small tubers is in favor of second-crop seed.

Table II shows the number of days from planting to first appearance and first bloom of the different lots, the product in pounds from 25 feet of row, dug June 19–22, with percentages of marketable tubers for each lot, the total yield in pounds to 100 feet of row, and the estimated yield per acre in bushels. It will be seen that the total product column shows a much higher balance in favor of second-crop seed than the early digging, which may be explained by the fact that the latter part of the growing season for these lots was quite dry, and the superior vigor of the second-crop vines seemed to carry them to maturity, while the others were cut short.

In 1892, the amount of second-crop seed at disposal was small, and the planting was made quite late, May 18, when the second-crop seed was also considerably sprouted. Five pounds of selected tubers, of eight varieties of each class of seed, were cut, as usual, to three-eye pieces and planted in 100 feet of row. There was in this case but little difference in the time of appearance or of blooming, and the growth of tops did not differ as much as in previous years. As noted July 8, the tops of second-crop rows were usually somewhat taller and heavier and of darker color, with the single exception of No. 168, Rochester Favorite, in which the rows, as tabulated and recorded, showed a condition of things exactly the reverse of the usual results; tops on first-crop rows much taller and more rank. The suspicion that these lots of seed may have been transposed in planting seems to be a valid one in this case.

Table III shows the results of this year's work. It will be noticed that in three varieties the product from first-crop seed was greater, though the percentage of marketable potatoes to the entire yield is still in favor of the second-crop seed, with the exception of No. 168, previously mentioned.

In digging potatoes to plant for a second crop, the questions arise, first, at what age they should be dug; and second, whether they should be planted

at once, or the seed exposed to light and air for a longer or shorter time, and then planted. The seed used in 1889 was dug at 118 days from planting, and planted the same day. That of 1890 was dug 128 days from planting, and planted the same day. Of these, we had the nearest to a full stand in 1890, but how much of that was due to the seed, and how much to the more favorable season as regards rainfall, is uncertain.

In 1891, four different lots of seed were planted from each of the main-crop and second-crop varieties:

Lot A was dug 72 days from planting, and planted at 92 days.
Lot B was dug 92 days from planting, and planted at 92 days.
Lot C was dug 92 days from planting, and planted at 99 days.
Lot D was dug 99 days from planting, and planted at 99 days.

Of these, the only one that made anything of a stand was lot A of the main crop. Of the others, only here and there a single stalk came up.

In the planting of 1892, the date of digging the different lots of seed planted for second crop, and the time allowed from digging till planting, is indicated by the letters B, C, D, and E, in the column following the variety in table IV:

Lot B was dug 79 days from planting, and planted at 113 days.
Lot C was dug 102 days from planting, and planted at 113 days.
Lot D was dug 113 days from planting, and planted at 113 days.
Lot E was dug 114 days from planting, and planted at 114 days.

Lots B, C and D were planted July 29, and lot E, July 30. The tubers were of quite even size and cut to three-eye pieces. Planted at the rate of 10 pounds of seed to 100 feet of row, they averaged a piece to about eight inches. In the second and third columns are shown the number of feet of row and the number of plants which came up, from which may be had a fair idea of the stand obtained. The rows were three feet apart, which is ample space, as this crop never makes a rank growth. In the next three columns are shown the total product, and the product to 100 feet of row, in pounds, and the estimated yield per acre, in bushels.

The varieties are arranged in the order of productiveness, some sorts seeming to be much better adapted to this method of culture than others. Little seems to be shown in favor of either quality of seed. Lot D, dug and planted at 113 days, leads in a majority of cases, but not uniformly Further trial is necessary in this particular direction. From our former trials, in which the seed was cut in halves, it is inferred that larger pieces of seed are better than the three-eye pieces used this season.*

The conclusions, as far as they may be drawn from these experiments, are, first, that by the early planting of early varieties seed may be secured in July sufficiently matured to produce a second crop that season; second, that this second crop will be comparatively light under the most favorable

*Mr. H. A. Earhart, in a paper before the State Horticultural Society, in 1892, on this meth od o culture, strongly recommended planting whole potatoes.

conditions, often small but firm, and of fine quality; third, that the potatoes keep through the winter and until planting time in remarkably fine condition, coming out sound, firm, and nearly free from sprouts, under the same conditions in which the ordinary crop of the same sorts become badly sprouted and shriveled; fourth, that this seed planted on an equal footing with that from the usual crop gives in nearly all cases a greatly increased yield, and that of much better average size and quality; the average gain in 1890 of the product from second-crop seed over that from main-crop seed being 27 per cent., and in 1891, 70 per cent., an average of 48½ per cent. for the two, while the gain for varieties best adapted to this trial has in several cases been more than 100 per cent. Now, an average gain in product of nearly 50 per cent. evidently gives this crop a greatly increased value for seed, and points to this as its most profitable use. The greatly increased growth of tops and the more abundant bloom seem to indicate greater vigor and vitality in the plants, an inference strengthened by their greater resistance to drought.

There is little doubt that these advantages are due to the seed not having sprouted in storage, and hence to its unimpaired vitality. The average product of the three lots shown in table I has been referred to, and clearly illustrates this point. The yield of lot I, from seed badly sprouted, was the lightest; of lot II, from seed later grown, less sprouted and more firm, was better; while the highest was from lot III, second-crop seed, not sprouted, and firm as when put in the cellar.

Again, as shown in table III, from seed not planted till May 18, and both lots badly sprouted, we get an average gain in product of only 14 per cent. from second-crop seed, though the size and quality is still considerably better, showing that this seed, if allowed to become sprouted and soft before planting, loses much of its advantage. It will be seen that the growing of a second crop is only practicable where the growing season is of considerable length. In 1889 and 1890, about 225 days elapsed from the planting of the first crop to the digging of the second, and frosts interfered somewhat with these plantings, both in spring and fall. In 1891, the season was backward, and the first planting could not be made till April 8, shortening the growing season to 195 days, which proved too short for a successful second crop. The southern part of the State would doubtless prove better adapted to this method than the northern counties. Plenty of moisture during the month following planting, either from rainfall or irrigation, will be found necessary to the full success of this crop.

FLAT CULTURE *vs.* HILLED CULTURE FOR POTATOES.

In 1891, two plats of ground, each one rod wide and 400 feet long, lying side by side, were planted to potatoes of College Seedling No. 2, receiving the same treatment up to the time for second cultivation, when each plat was measured into blocks of 100 feet. Blocks I and III, in plat A, and

blocks II and IV, in plat B, were then given high-ridge cultivation for the rest of the season, while the alternating blocks were given flat cultivation. The product of each block was dug, weighed and sorted separately, with the results shown in the following table:

BLOCK.	HILLED.				UNHILLED.				BLOCK.
	Total product, in lbs.	Large.	Small.	Per ct. market-able.	Total product, in lbs.	Large.	Small.	Per ct. market-able.	
A I.....	388.25	283.50	104.75	73.00	446.50	335.00	111.50	75.0	A II
A III.....	384.50	307.50	77.00	80.00	330.50	241.50	89.00	73.0	A IV
B II.....	516.50	382.00	134.50	74.00	423.00	315.00	108.00	74.0	B I
B IV.....	332.00	249.00	83.00	72.00	447.00	339.00	108.00	76.0	B III
Totals..	1,621.25	1,222.00	399.25	74.75	1,647.00	1,230.50	416.50	74.5	
Yield per acre, 166.74 bushels.					Yield per acre, 169.39 bushels.				

TABLE I.—COMPARISON OF EARLY-GROWN (I), MAIN-CROP (II), AND SECOND-CROP (III) SEED.

Three pounds of each. Cut to three-eye pieces. Planted March 18, 1890.

o	VARIETY.	First appearance, days from planting.			First bloom, days from planting.			Yield to acre, estimated in bushels.			Weight of six best tubers, in ounces.			Per cent. of marketable tubers.		
		I.	II.	III.	I.	II.	III.	I.	II.	III.	I.	II.	III	I.	II	III.
42	Cuyahoga	27	27	27	88	88	78	72 76	71 51	104.13	18	13	32	50	44	50
48	Durham	27	27	32	92	73	78	45.19	57.90	100.79	17	10	29	40	40	90
56	Early Harvest	27	27	32	*	73	78	39.80	59.70	85.51	10	11	25	12	30	80
74	Early Washington	29	29	34	*	*	81	14.50	67 53	80 37	10	14	15	16	50	80
132	New Queen	27	27	34	73	73	73	47.50	102.20	116 71	16	20	44	40	55	90
168	Rochester Favorite	27	27	35	*	73	73	49.17	76.13	108 88	16	23	40	50	62	75
192	Thorburn	27	27	35	83	73	78	69 33	99.89	114.40	23	18	35	45	30	80
195	Vanguard	27	27	35	88	81	80	65.61	65 09	79 22	20	19	29	60	60	60
214	White Prize	27	27	35	88	73	73	75.26	98.73	87.44	20	16	24	20	50	50

* No bloom.

TABLE II.—COMPARISON OF FIRST-CROP (I) AND SECOND-CROP (II) SEED.

Cut to three-eye pieces. Five pounds of seed to 100 feet of row. Planted April 8, 1891.

No.	VARIETY.	First appearance, days from planting.		First bloom, days from planting.		Product, in lbs., of 25 ft of row, June 19–22.		Per cent. of marketable tubers, June 19–22.		Total product, in lbs., to 100 ft. of row		Estimated yield per acre, in bushels.	
		I.	II.	I.	II.	I.	II.	I	II.	I.	II.	I.	II
42	Cuyahoga	16	19	54	52	10.25	15.15	54	91	82 00	172.07	168.67	353 95
48	Durham.	16	19	*	52	9 15	11 70	49	90	75.15	121.97	153.58	250.90
56	Early Harvest	16	19	*	52	11 70	14.65	65	93	54 47	134 57	112.05	276.82
132	New Queen	16	21	58	52	15.70	18.15	56	93	69.45	140.95	142.85	289.93
168	Rochester Favorite	16	19	54	53	18.20	15 70	60	86	97.47	138.22	200.49	284.31
192	Thorburn	16	19	*	53	16 50	15.00	75	84	96 87	108 75	199 26	223 69
195	Vanguard	16	22	*	72	10 50	8 10	51	93	63.50	55.92	140 61	115.02
214	White Prize	16	21	*	52	13 20	17.05	71	93	59.72	144.27	112.84	296.76
										598 63	1,016 72		

*No bloom.

TABLE III.—COMPARISON OF FIRST- (I) AND SECOND-CROP (II) POTATO SEED. CUT TO THREE-EYE PIECES. FIVE POUNDS OF SEED TO 100 FEET OF ROW. Planted May 18, 1892.

No.	VARIETY.	Product, in pounds, per 100 feet of row.		Per cent. of marketable tubers.		Yield per acre, estimated in bushels.	
		I.	II.	I.	II.	I.	II.
42...	Cuyahoga	12¾	27	41	61	26.24	55.53
62...	Early Ohio	15⅚	22¼	37	75	31.19	45.76
74...	Early Washington	11½	20¼	36	67	23.65	41.65
132...	New Queen	15¼	31	51	60	31.36	63.66
168...	Rochester Favorite	26¼	16½	69	41	53.99	33.94
192...	Thorburn	32.04	22	51	65	65.91	45.25
195...	Vanguard	29¼	21	47	56	60.16	43.19
214...	White Prize	28.51	20.92	59	68	58.64	43.03

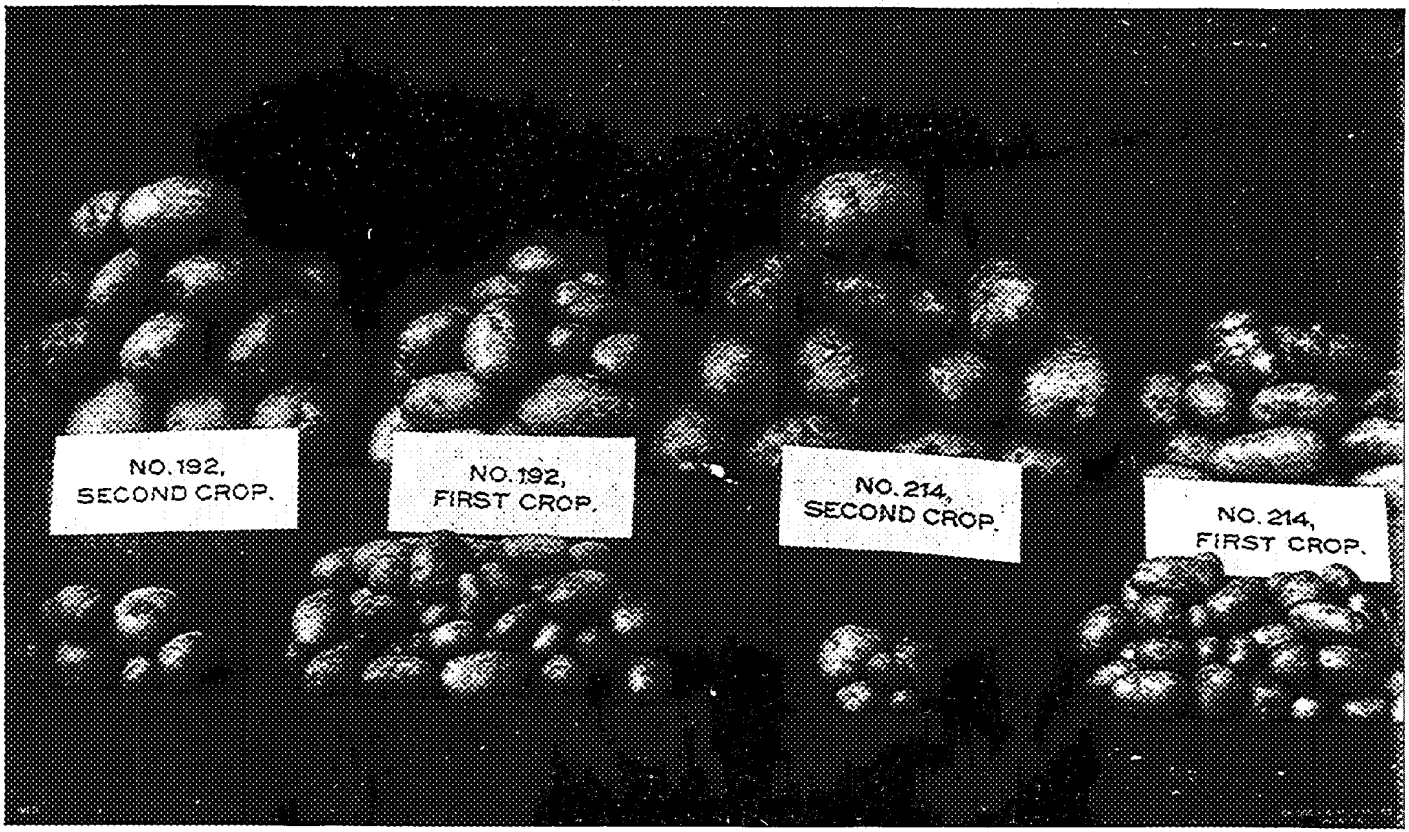
TABLE IV.—SECOND-CROP POTATOES. Planted July 29 and 30, 1892.

List No.	VARIETY.	Seed.	Feet of row planted.	No. of plants.	Total product, pounds.	Product to 100 feet of row, pounds.	Estimated yield per acre, bushels.
289...	Omaha Market	D	375	253	127.00	33.8	81.8
289...	Omaha Market	C	300	196	80.80	27.0	65.3
.....	College Seedling No. 2	B	125	77	33.75	27.0	65.3
.....	College Seedling No. 2	D	350	221	91.90	26.3	63.6
.....	College Seedling No. 2	C	150	88	34.75	23.2	56.1
195...	Vanguard	C	200	127	52.75	26.4	63.9
281...	Six Weeks Market	D	250	189	50.75	20.0	48.4
281...	Six Weeks Market	C	175	109	10.50	6.0	14.5
72½...	Early Telephone	E	250	182	49.20	19.7	47.8
266...	Putnam's Early	E	250	177	48.50	19.4	47.7
.....	College Seedling No. 4	D	350	207	75.75	18.7	45.3
.....	College Seedling No. 4	B	125	73	18.40	14.4	34.8
297...	Early Wisconsin	C	200	137	34.00	17.0	41.1
168...	Rochester Favorite	D	275	199	44.25	16.0	39.0
168...	Rochester Favorite	B	250	150	34.25	13.7	33.2
74...	Early Washington	E	250	204	35.10	14.0	33.9
294...	Bassler's Seedling No. 3	C	225	139	24.25	10.7	25.9
42...	Cuyahoga	E	250	164	26.50	10.6	25.7
293...	Bassler's Seedling No. 2	C	225	156	22.20	9.9	24.0
62...	Early Ohio	E	250	145	21.10	8.4	20.3
182...	Snowflake	B	125	61	9.25	7.4	17.9
182...	Snowflake	D	350	132	15.20	4.0	9.7
133...	New Queen	E	250	178	15.50	6.2	15.0
39...	Cowles' Seedling	E	500	309	52.10	5.2	12.6
177...	Rural New Yorker No. 2	D	125	24	5.50	4.4	10.6
177...	Rural New Yorker No. 2	B	50	7	1.15	2.3	5.6
106...	Ladies' Favorite	D	125	32	5.00	4.0	9.7
106...	Ladies' Favorite	C	125	56	4.25	3.4	8.2
292...	Bassler's Seedling No. 1	C	125	63	1.20	1.0	2.4
295...	Bassler's Seedling No. 4	C	125	17	0.00	0.0	0.0

PLATE XVI.

POTATOES: Field view of comparative growth from first-crop and second-crop seed.

PLATE XVII.



POTATOES: Varieties showing maximum difference in favor of seed from second crop. No. 192, Thorburn; No. 214, White Prize.

PLATE XVIII.

POTATOES: Varieties showing minimum difference in favor of seed from second crop. No. 168, Rochester Favorite; No. 133, New Queen.