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EXPERIMENTS IN ONION CULTURE

By JOHN W. LLOYD

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EXPERIMENTS IN ONION CULTURE

By JOHN W. LLOYD, Chief in Olericulture

The Illinois Agricultural Experiment Station has conducted experiments in onion culture on the Station grounds at Urbana for six years. The chief objects of the experiments have been to determine: (1) the effect of time of planting upon the yield and size of bulbs; (2) the relative merits of thinning and of not thinning; (3) the feasibility of producing ripe onions from bottom sets; and (4) the effect of supplementing manure with wood ashes as a fertilizer for onions.

METHOD OF CONDUCTING THE TESTS

The land used for the onion experiments was part of the area formerly occupied by the "Farmer's Vegetable Garden" reported in Bulletin No. 105[1] of this station. The soil is the typical upland prairie soil of the corn belt, technically known as brown silt loam. During the five years from 1900 to 1904 inclusive, when the half-acre in question was used as a "farmer's garden," ninety-eight loads of manure were applied; and in the fall of 1904, thirty-six loads were applied. The land was used in 1905 for the growing of carnations and other flowering plants. In 1906, eight loads of manure were applied in the spring and nineteen loads in the fall. The land was used for growing a general assortment of early vegetables in 1906, and was plowed late in the fall after manuring. Thus, during the seven years preceding the beginning of the onion experiments in 1907, the land had been fertilized with manure at the rate of 322 loads per acre, or an average of forty-six loads per acre per year. It had also been kept relatively free from weeds, and was therefore in good condition for starting the onion experiments.

Each year during the progress of the onion experiments, the land was given a dressing of manure in the fall at the rate of approximately thirty-six tons per acre. The manure was usually plowed under late in the fall, and the land was allowed to lie rough in the furrow until spring. At the very earliest date in spring that it was possible to work the ground to advantage, the land was thoroly disked, and harrowed and planked repeatedly until a fine seed bed was prepared. It was then laid out in plats one rod wide and four rods long.

[1] No longer available for distribution.

Each plat thus consisted of exactly one-fortieth of an acre. Sixteen rows of onions were planted lengthwise of each plat. The seed was sown by means of a garden seed drill. The sets, when used, were planted by hand after the land had been marked off with a sled marker.

The growing crop was invariably given good care thruout the season. As soon as the seedlings were up so that it was possible to distinguish the rows, tillage was started. Cultivation with wheel hoes, equipped with various attachments, was repeated at frequent intervals until the plants were so large that further tillage was impracticable. Hand weeding was commenced early and repeated as often as was necessary in order to keep the plantation clean.

A complete record was kept of the time employed in each operation on each plat. When the onions were harvested, the product of each plat was graded and weighed, and the bulbs were counted. The crop was then sold on the local market. Thus the cost of production, the yield, and the profits for each plat could be determined. Except where noted, the Southport Yellow Globe was the variety of onion used in all the tests.

EFFECT OF USING WOOD ASHES IN ADDITION TO MANURE AS A FERTILIZER FOR ONIONS

Since it is generally conceded that the onion requires a large amount of potassium, and since the potassium in wood ashes is in a readily available form, a test was made to determine the value of ashes for the onion crop on land of the type in question that had already been heavily manured. Each year, fifty pounds of commercial unleached hard-wood ashes were applied to Plat 1. This was at the rate of one ton per acre. During the first two years of the test, the ashes were applied as a top dressing between the rows of the growing crop shortly after the seedlings had appeared. During the other four years, they were applied broadcast during the final fitting of the land immediately preceding the sowing of the seed. Plat 2 received precisely the same treatment as Plat 1 thruout the season, except that no ashes were applied. The yields of onions from these two plats, calculated to the acre basis, are given in Table 1.

TABLE 1.—YIELDS OF ONIONS, WITH AND WITHOUT ASHES

(Bushels per acre)

Plat	Treatment	1907	1908	1909	1910	1911	1912	Average
1	Manure and wood ashes..	540.17	308.94	466.59	369.82	103.86	522.11	385.25
2	Manure alone	413.46	312.81	456.91	307.66	89.06	494.56	345.74
	Difference in favor of ashes	126.71	—3.87	9.68	62.16	14.80	27.55	39.51

These figures show that in five of the six years the plat treated with ashes in addition to manure outyielded the plat treated with manure alone, and that the average increase in yield per year evidently due to the use of the ashes was 39.51 bushels per acre.

The ashes used were purchased in Chicago at $8.00 per ton. The cost of freight, handling, and application was $4.75 per ton, thus making the cost of the ashes treatment $12.75 per acre, since one ton per acre was the amount used. The onions were sold at market price soon after the harvest. The value of the crop from the plat treated with manure alone, and the value of the crop from the plat treated with manure and ashes minus the cost of the ashes, are given on the acre basis in Table 2.

TABLE 2.—NET VALUE OF ONION CROP PER ACRE, WITH AND WITHOUT ASHES

Plat	Treatment	1907	1908	1909	1910	1911	1912	Average
1	Manure and wood ashes..	$392.38	$200.54	$336.01	$281.44	$58.13	$299.78	$261.38
2	Manure alone..	310.10	212.77	341.65	242.91	60.13	295.95	243.92
Profit for ashes.....		$82.28	$–12.23	$–5.64	$38.53	$–2.00	$ 3.83	$17.46

It will be seen that altho the yield was increased five years of the six by the use of the ashes, the net value of the increase was sufficient to make their use profitable only three years of the six. The average for the six years, however, shows that the use of the ashes resulted in a net profit of $17.46 per acre per year, if no account is taken of the slight differences in the cost of harvesting the different crops.

INFLUENCE OF TIME OF PLANTING UPON YIELDS AND PROFITS

Directions for the culture of onions usually specify that the seed should be sown as early in the spring as the ground can be worked. This date varies from year to year in the same locality, and is especially variable where the soil is of such a nature that it does not quickly become workable after being thoroly wet. However, in four years of the six during which the onion tests have been in progress, it has been possible to prepare the soil at Urbana and sow the seed between the 20th and 26th of March. In the other two years, planting was delayed until April 1 and 11, respectively, by reason of the soil being wet.

In order to make a thoro test of the influence of the time of planting upon the yield of onions, one planting was made each year at the very earliest date that it was possible to prepare a good seed bed, and subsequent plantings were made at intervals of as near fourteen days as the soil conditions would permit. In 1907, 1908, 1909, and

1910, four plantings were made each year, and in 1911 and 1912, three plantings. The plats for the entire series of onion experiments were treated alike when being fitted for the earliest planting. Areas to be occupied by later plantings were harrowed or otherwise cultivated at intervals so that the soil would retain moisture, and the growth of weeds would be prevented, until the plats were needed for planting. The actual dates of the different plantings each year are given in Table 3.

TABLE 3.—DATES OF PLANTING THE ONIONS

Plat		1907	1908	1909	1910	1911	1912	Average date
2	Earliest planting . . .	Mar. 20	Mar. 26	Apr. 1	Mar. 22	Mar. 22	Apr. 11	Mar. 27
7	Second planting	Apr. 3	Apr. 13	Apr. 16	Apr. 2	Apr. 17	Apr. 25	Apr. 13
8	Third planting.	Apr. 17	May 2	May 3	Apr. 20	Apr. 26	May 9	Apr. 28
9	Fourth planting	May 2	May 20	May 15	May 5	.....	.....	May 11

The onions from the earliest planting usually continued growing almost as late as those from the second planting, and sometimes fully as late. For the six years, the growing period averaged 13 days longer for the earliest planting than for the second, and 11 days longer for the second than for the third. The actual dates of harvesting the onions from the various plantings each year are given in Table 4, together with the length of the growing period for each planting. It will be seen that, in general, the period of growth decreased as the date of planting was deferred.

YIELDS

That the shortening of the growing period by reason of late planting had a decidedly unfavorable influence on yield is clearly shown in Table 5, which gives the yields, in bushels per acre, from the different plantings each year. It will be seen that every year that the fourth planting was tested, it gave a smaller total yield than the third planting; that in every year except 1907, the third planting gave a smaller yield than the second; and that in three years of the six, the second planting gave a smaller yield than the first. The smaller yield from the first planting in 1907 was plainly due to a poor stand resulting from too thin seeding. In average yield for the six years, the first planting was clearly superior to the second and the second far superior to the third. The fourth planting was made only four years of the six, but each of these years it resulted in a lower yield than the third planting. Thus there appears to be a fairly close relation between the time of planting and the yield of onions.

TABLE 4.—DATES OF HARVESTING ONIONS, AND NUMBER OF DAYS REQUIRED FOR GROWTH OF CROP

Plat		1907		1908		1909		1910		1911		1912		Average	
		Date	Days	Date	Days	Date	Days	Date	Days	Date	Days	Date	Days	Date	Days
2	Earliest planting..	Aug. 28	161	Aug. 7	134	Aug. 6	127	Aug. 12	143	July 24	124	Aug. 23	134	Aug. 12	137
7	Second planting...	Aug. 22	141	Aug. 14	123	Aug. 10	116	Aug. 12	132	Aug. 10	115	Aug. 23	120	Aug. 15	124
8	Third planting....	Aug. 28	133	Aug. 19	109	Aug. 20	109	Aug. 12	114	Aug. 10	106	Aug. 27	110	Aug. 19	113
9	Fourth planting...	Aug. 29	119	Sept.17	120	Aug. 28	105	Aug. 12	99	.....	...	.....	...	Aug. 29	110

TABLE 5.—YIELDS OF ONIONS FROM EARLY AND LATE PLANTINGS

(Bushels per acre)

Year	Plat 2: Earliest planting			Plat 7: Second planting			Plat 8: Third planting			Plat 9: Fourth planting		
	Large	Small	Total	Large	Small	Total	Large	Small	Total	Large	Small	Total
1907.....	413.46	.....	413.46	519.95	.....	519.95	547.72	.....	547.72	509.47	.....	509.47
1908.....	225.44	87.37	312.81	164.56	63.16	227.72	78.60	47.72	126.32	36.04	76.14	112.18
1909.....	452.77	4.14	456.91	273.82	22.18	296.00	196.00	22.67	218.67	93.40	55.02	148.42
1910.....	296.92	10.74	307.66	176.21	11.58	187.79	93.61	28.77	122.38	58.25	46.81	105.06
1911.....	62.39	26.67	89.06	68.77	31.93	100.70	11.93	25.79	37.72	.....	.....	.....
1912.....	491.93	2.63	494.56	572.28	2.04	574.32	261.40	1.75	263.15	.....	.....	.....
Average..	323.82	21.92	345.74	295.93	21.82	317.75	198.21	21.12	219.33	174.29	44.49	218.78

SIZE OF BULBS

Another feature brought out by Table 5 is the larger proportion of small onions in the crops from the later plantings. This is especially pronounced in the fourth planting, when for three years (1908, 1909, and 1910) an average of over 48 percent of the crop, by bushels, consisted of small onions. In this grading, onions less than 1¼ inches in diameter were classed as small.

The influence of the time of planting upon the size of the onions is further shown by Table 6, which gives the actual number of large and of small onions produced by each plat each year, together with the average weight per bulb in both the large and the small sizes, and the average weight per bulb for the entire crop.

TABLE 6.—NUMBER OF LARGE AND SMALL ONIONS AND AVERAGE WEIGHT OF BULBS FROM EACH PLAT: EARLY AND LATE PLANTING

(All weights expressed in pounds)

Year	Large		Small		Total		Large		Small		Total	
	No.	Av. wt.	No.	Av. wt.	No.	Av. wt.	No.	Av. wt.	No.	Av. wt.	No.	Av. wt.
	Plat 2: Earliest planting						Plat 7: Second planting					
1907	2278	.259	....	...	2278	.259	3936	.188	....	...	3936	.188
1908	1900	.169	1660	.075	3560	.125	1400	.168	1330	.068	2730	.119
1909	3755	.172	139	.042	3894	.167	3075	.127	694	.046	3769	.112
1910	1974	.214	280	.055	2254	.194	2040	.123	263	.063	2303	.116
1911	1975	.045	1992	.019	3967	.032	1822	.054	1827	.024	3649	.039
1912	3722	.188	165	.023	3887	.181	3862	.211	99	.029	3961	.207
Average	2601	.177	706	.044	3307	.149	2689	.157	702	.044	3391	.134
	Plat 8: Third planting						Plat 9: Fourth planting					
1907	4514	.173	....	....	4514	.173	4380	.166	...	...	4380	.166
1908	857	.131	1172	.058	2029	.089	443	.109	2087	.052	2530	.062
1909	2645	.106	779	.041	3424	.091	1601	.083	1897	.041	3498	.060
1910	1929	.069	771	.053	2700	.065	855	.097	1507	.044	2362	.063
1911	436	.039	2312	.016	2748	.019	...	...	....	....	....	...
1912	1693	.220	111	.023	1804	.208	...	...	....	...	....	...
Average	2012	.140	858	.035	2870	.109	1820	.136	1373	.046	3193	.097

RELATION OF WEATHER TO SIZE AND YIELD OF ONIONS

Table 6 shows that in general the proportion of small to large onions increased and the average size of the bulbs decreased as the planting became later. However, there was more difference in the size of the onions from the same plat in different seasons than from different plats in the same season. The bulbs were especially large in 1907 and especially small in 1911. The late plantings in 1907 and 1912 produced much larger bulbs than the late plantings in other

years. Some of the variation in the size of the bulbs was doubtless due to lack of uniformity in stand, but since in no case were the bulbs overcrowded, the difference in size must have been due mainly to some other cause.

An examination of the temperature and rainfall records for the months of June, July, and August in each year from 1907 to 1912 inclusive shows that there were some striking relations between the weather and the size of the onion bulbs. Tables 7, 8, and 9 show the maximum temperatures for each day in June, July, and August of the years in question, and also the amount and distribution of rainfall for these months.[1]

TABLE 7.—WEATHER RECORD FOR JUNE

Day	1907		1908		1909		1910		1911		1912	
	Max. temp.	Rainfall	Max. temp.	Rainfall	Max. temp.	Rainfall	Max. temp.	Rainfall	Max. temp.	Rainfall	Max. temp.	Rainfall
	°F	inches	°F	inches	°F	inches	°F	inches	°F	inches	°F	inches
1	54	2.41	68	...	78	...	72	...	80	...	82	.32
2	58	...	74	T	71	.65	59	.10	77	.03	74	...
3	69	.08	68	.09	78	T	58	...	92	...	80	...
4	71	.46	79	...	76	T	65	T	98	...	73	.06
5	71	...	84	...	84	T	70	T	96	T	78	T
6	71	.33	84	...	85	...	70	.03	93	.05	73	...
7	74	...	85	...	85	...	70	...	84	...	66	...
8	67	...	82	T	85	.18	74	...	86	...	69	...
9	75	.34	77	...	78	.15	71	.11	95	...	73	...
10	77	.04	68.5	...	72	.03	71	...	98	...	79	...
11	79	...	72	...	79	...	76	...	86	...	83	...
12	78	...	80	...	81	.15	80	...	71	T	84	T
13	75	...	82.5	.05	80	.40	84	...	80	...	84	.01
14	79	...	78	.41	72	...	83	T	80	...	78	.25
15	85	...	69	...	71	...	89	...	83	...	83	.14
16	88	...	74	...	79	T	89	...	86	T	78	.92
17	90	...	78	T	78	.54	89	...	88	.06	70	.08
18	89	...	88.5	...	72	...	90	...	79	...	61	.01
19	81	...	86	.18	78	...	95	...	85	...	66	T
20	81	...	87	.12	84	...	89	...	92	...	78	.07
21	87	...	90	.13	76	.24	92	...	94	...	72	...
22	88	...	92	...	82	.51	93	...	96	...	78	...
23	87	...	89	T	85	...	92	...	90	.04	78	...
24	70	1.90	81	...	91	.01	92	...	80	.48	81	...
25	78	...	80	...	87	.36	91	...	84	.01	84	...
26	74	...	82	...	85	.14	93	1.27	85	...	88	...
27	73	...	84	...	85	.39	76	1.48	84	.15	87	...
28	75	...	84	T	88	...	85	...	82	...	87	...
29	82	...	74.5	1.01	90	...	87	...	87	...	83	...
30	85	...	77	...	87	...	91	...	93	T.	86	...
Mean	77.03	...	79.93	...	80.73	...	81.20	...	86.80	...	77.97	...
Total	....	5.56	....	1.99	....	3.75	....	2.99	....	.82	....	1.89

[1] These data are from the official weather records of the University and were furnished the author thru the courtesy of Professor J. G. Mosier.

TABLE 8.—WEATHER RECORD FOR JULY

Day	1907		1908		1909		1910		1911		1912	
	Max. temp.	Rainfall	Max. temp.	Rainfall	Max. temp.	Rainfall	Max. temp.	Rainfall	Max. temp.	Rainfall	Max. temp.	Rainfall
	°F	inches	°F	inches	°F	inches	°F	inches	°F	inches	°F	inches
1	85	.11	83.5	...	90	...	90	...	96	...	82	.57
2	73	...	86	T	92	...	89	...	98	...	77	.03
3	80	...	73	.26	92	...	84	.05	99	...	75	.53
4	89	T	77	...	75	...	76	...	102	...	83	...
5	93	...	86	...	62	.99	84	...	100	...	88	...
6	93	.50	89	...	67	2.16	88	...	94	...	84	...
7	88	...	67	.42	74	.46	90	...	96	T	82	...
8	93	T	74	...	82	...	91	...	93	...	83	.01
9	90	.55	83	...	85	...	89	...	94	...	88	T
10	86	.89	87	...	81	...	82	...	90	T	81	.08
11	77	.08	93	...	80	1.86	85	...	99	.10	85	...
12	79	...	94	...	79	1.82	84	.78	87	...	82	...
13	81	...	94	...	82	.02	81	...	84	T	91.5	...
14	82	.98	87	.80	82	...	87	T	89	...	90	...
15	85	T	85	...	85	...	84	.10	93	...	85	...
16	87	.43	85	.24	81	...	84	.93	81	.10	81	...
17	85	...	86	...	83	...	76	.01	86	...	86	...
18	86	...	82	...	80	.09	78	...	82	...	83	...
19	88	...	81	...	78	...	80	...	76	.16	73	...
20	88	...	68	.21	81	...	84	...	88	...	88	...
21	90	...	85	.08	84	...	83	...	89	...	83	1.62
22	88	...	84	...	84	T	85	...	86	...	80	...
23	89	...	83	...	79	...	87	...	78	.24	89	.30
24	91	T	83	.12	80	...	92	.08	76	T	94	...
25	90	T	85	...	81	...	93	...	74	.01	86	...
26	76	.11	84	...	67	.05	88	...	75	...	79	...
27	80	...	84	.18	78	.12	93	...	82	...	81	...
28	69	.33	90	...	89	...	82	.27	85	T	80	.39
29	83	...	91	...	93	...	84	.54	86	.01	81	...
30	85	...	93	...	91	...	83	...	84	...	83	...
31	82	1.03	87	...	80	T	81	...	85	...	75	.15
Mean	84.87	....	84.17	..	81.19	...	85.06	...	87.97	...	83.18	...
Total	....	5.01	....	2.31	....	7.57	....	2.76	....	.62	....	3.68

An examination of these records shows that in 1907, when all the plantings of onions produced large yields and all the bulbs were large, the rainfall was exceptionally heavy and well distributed, and the mean maximum temperatures were quite low, especially for June and August. Under these conditions the onions continued to grow until late in August, as indicated in Table 4, and were able to produce the large yields indicated in Table 5. In 1912 somewhat similar conditions prevailed. Altho the rainfall was considerably less than in 1907, it was quite well distributed, and aided the crop at critical times. The heavy rain of July 21 and the frequent showers from August 5 to 16 were important factors in the development of the crop. The temperature also was favorable to the growth of onions, there being very few excessively hot days, and the mean maximum

TABLE 9.—WEATHER RECORD FOR AUGUST

Day	1907		1908		1909		1910		1911		1912	
	Max. temp.	Rain-fall	Max. temp.	Rain-fall	Max. temp.	Rain-fall	Max. temp.	Rain-fall	Max. temp.	Rain-fall	Max. temp.	Rain-fall
	°F	inches	°F	inches	°F	inches	°F	inches	°F	inches	°F	inches
1	82	.10	88	...	87	...	85	...	85	.46	78	...
2	72	...	93	...	91	...	88	...	90	...	74	...
3	75	...	93	...	89	T	85	...	85	...	69	...
4	77	...	86	...	83	.03	81	...	89	...	69	...
5	82	.98	89	T	88	...	81	...	88	...	72	.01
6	84	...	88	T	86	...	82	...	91	...	80	T
7	85	.90	82	...	88	...	71	.22	87	.08	77	T
8	87	.03	79	...	91	...	82	...	90	...	81	.39
9	86	...	80	T	91	T	80	T	94	T	72	.02
10	87	...	83	...	85	...	82	...	97	...	74	.24
11	90	...	85	...	89	...	83	...	92	...	79	.02
12	80	.25	88	1.24	93	.01	85	...	88	T	81	.06
13	83	...	86	...	90	...	84	...	91	...	86	.29
14	73	T	89	...	94	...	88	...	90	...	83	T
15	84	...	87	.71	92	T	90	...	93	...	83	T
16	84	1.42	93	T	91	...	89	.85	97	...	71	.36
17	81	.26	88	...	79	...	89	.50	93	T	88	...
18	84	...	81	...	84	...	75	.10	88	...	90	...
19	86	...	78	T	89	...	80	...	81	...	86	...
20	72	.41	73	...	82	...	83	...	81	...	82	.45
21	73	...	82	...	80	...	84	...	86	...	83	...
22	73	...	81	...	83	...	87	...	79	...	83	.22
23	75	...	76	...	87	...	85	.87	71	.42	77	...
24	80	...	74	...	91	...	83	...	62	1.62	87	...
25	77	...	76	...	88	2.32	80	T	75	T	91	...
26	79	...	81	...	88	.01	70	...	78	...	89.5	...
27	86	.07	84	...	92	T	74	...	86	...	73.5	...
28	80	...	87	...	91	...	79	...	76	.77	91	...
29	83	T	83	.10	74	...	84	...	71	...	81	...
30	92	...	89	...	79	...	90	...	75	...	88	...
31	91	...	89	...	84	...	78	.08	83	...	92.5	...
Mean	81.38	...	84.22	...	87.22	...	82.48	...	84.58	..	81.01	...
Total	....	4.42	....	2.05	....	2.37	....	2.62	....	3.35	....	2.06

temperatures being especially low for June and August. The onions kept on growing till after August 20, and were nearly all of large size. Those from the last planting were as large as any, altho the yield was smaller on account of a poor stand.

In marked contrast to the conditions in 1907 and 1912 were those of 1911, when the total precipitation for the months of June and July was only 1.44 inches, and abnormally high temperatures prevailed, especially during June and the first half of July. Under these conditions the onions remained small and ripened early.

In the other three years (1908, 1909, and 1910), the weather during the three months in question was less abnormal, there being at least a fair amount of rainfall in June and July and comparatively few excessively hot days. The first part of August was in each case

dry, and nearly all the onions stopped growing during that period. With the exception of the last planting in 1908, which responded to the rain of August 12, the onions had either been pulled before the August rains came, or were practically mature at that time and were pulled a few days later. Under these conditions, which may be considered more nearly normal than those of 1907, 1911, and 1912, the early plantings produced much larger bulbs and hence larger yields than the late plantings.

The relation between time of planting and size of bulbs was most strikingly illustrated in 1910, when the crops from all four plantings were harvested on the same day and the onions from the last two plantings were only one-third the size of those from the first planting, while those from the second planting were about midway between the two extremes.

Relation of Time of Planting to Profits

As soon as feasible after the onions were harvested, they were sold on the local market. The value of the crop from each plat was calculated from the yield and the prices obtained. The cost of production was also determined, and calculated to the acre basis. The difference between the value of the crop and the cost of production thus gave the net profit. Data on these points for each planting in each year are given in Table 10.

It will be seen that the average values of the crops from the first and second plantings were very much greater than those from the third and fourth; and that altho the cost of production was usually less for the later plantings, the average profits were much greater for the earlier plantings. The table further shows that in 1908 and 1910, when there were fairly good profits from the first two plantings, the last two plantings resulted either in a loss or in very slight profits. An additional point brought out by this table is the fact that in an unfavorable season, like 1911, even early-planted onions may be grown at an actual loss.

THINNING

The common practice in growing onions has been to sow the seed thickly in order to insure a full stand, and then to thin the seedlings to the desired distance. However, within recent years there has been a tendency among commercial growers to sow the seed more thinly and to dispense with the thinning of the seedlings. In order to secure data regarding the influence of thinning on the size and yield of bulbs and the relative cost of growing onions with and without thinning, tests were made in 1908, 1909, 1911, and 1912. The plats designed to be thinned were sown quite thickly. After the seedlings had become fully established, they were thinned to a distance of

TABLE 10.—VALUE OF CROPS PER ACRE AND PROFITS FROM ONIONS PLANTED AT DIFFERENT DATES

Year	Plat 2: Earliest planting			Plat 7: Second planting			Plat 8: Third planting			Plat 9: Fourth planting		
	Value of crop	Cost of production	Profits	Value of crop	Cost of production	Profits	Value of crop	Cost of production	Profits	Value of crop	Cost of production	Profits
1907	$310.10	$89.10	$221.00	$389.96	$104.70	$285.26	$410.79	$106.30	$304.49	$382.10	$101.70	$280.40
1908	212.77	104.15	108.62	155.00	100.90	54.10	82.81	95.15	−12.34	65.10	90.10	−25.00
1909	341.65	104.15	237.50	216.46	102.73	113.73	158.34	93.85	64.49	97.56	86.35	11.21
1910	242.91	93.10	149.81	146.76	76.80	69.96	89.27	84.80	4.47	70.01	73.40	−3.39
1911	60.13	110.20	−50.07	67.55	122.50	−54.95	21.85	62.50	−40.65	....	....	....
1912	295.95	109.90	186.05	343.98	97.90	246.08	157.37	83.40	73.97	....	....	....
Average	$243.92	$101.77	$142.15	$219.95	$100.92	$119.03	$153.41	$87.67	$65.74	$153.69	$87.89	$65.80

approximately three inches. The date of thinning varied from May 31 to June 10. Unavoidable gaps in the rows, due to unequal distribution of seed, failure to germinate, accidents during tillage, etc., made the stand in the thinned plats less than the theoretical number of onions that there would have been if an onion had occupied each and every three-inch space in the row. The plats to be left unthinned in 1908 and 1909 were sown much more thinly than the plats to be thinned. The stands were not uniform, the onions being more or less in patches, with vacant spaces between. In 1911 and 1912 all the onions were sown thickly. Thinned and unthinned plats were treated alike in reference to all matters of tillage and care except the thinning.

EFFECT OF THINNING ON SIZE OF BULBS

When harvested, the onions from each plat were graded into large and small, and each lot was counted and weighed. The number of bulbs and the average weight per bulb in each grade are given in Table 11.

TABLE 11.—NUMBER OF LARGE AND SMALL ONIONS AND AVERAGE WEIGHT OF INDIVIDUAL BULBS, FROM PLATS THINNED AND UNTHINNED

(All weights expressed in pounds)

Year	Plat 2: Thinned						Plat 3: Unthinned					
	Large		Small		Total		Large		Small		Total	
	No.	Av. wt.	No.	Av. wt.	No.	Av. wt.	No.	Av. wt.	No.	Av. wt.	No.	Av. wt.
1908	1900	.169	1660	.075	3560	.125	2000	.166	2249	.066	4249	.113
1909	3755	.172	139	.042	3894	.167	5309	.135	1267	.045	6576	.117
1911	1975	.045	1992	.019	3967	.032	597	.039	16712	.013	17309	.014
1912	3722	.188	165	.023	3887	.181	8383	.083	2893	.022	11276	.068
Average	2838	.155	989	.044	3827	.126	4072	.109	5780	.021	9853	.057

This table shows that in 1908, when the unthinned plat contained only about 20 percent more bulbs than the thinned plat, there was not a large amount of difference in the average size of the onions from the two plats; but that in 1909, when the unthinned plat contained approximately 70 percent more bulbs than the thinned plat, there was much greater difference in the average weight of the bulbs. On account of dry weather in 1911, none of the onions attained normal size, but those from the thinned plat were, on an average, over twice as large as those from the unthinned plat. Nearly the entire crop from the unthinned plat consisted of bulbs less than 1¼ inches in diameter, while approximately 50 percent of the bulbs from the thinned plat were above that size. It should be noted in this connection that the unthinned plat contained over four times as many

bulbs as the thinned plat. In 1912, a season favorable to the production of onions, the bulbs from the unthinned plat were, as an average, only slightly over one-third as large as those from the thinned plat.

RELATION OF THINNING TO YIELD

On account of the excessive number of bulbs produced, the total yield of onions was greater every year from the unthinned than from the thinned plat. The yields of large and of small onions from each plat, in terms of bushels per acre, are given in Table 12. These figures show that the increase in the yield of the unthinned plats was due more to an increase in the yield of small onions than to an increase in the yield of large onions. In fact, in the two years that the unthinned onions were especially thick, the yields of large onions were actually less from the unthinned than from the thinned plats, the increased yield being due to the superabundance of small onions. The average yields of large onions for the four years were practically the same from both plats.

FIG. 1.—THINNED ONIONS AT LEFT; UNTHINNED ONIONS AT RIGHT

TABLE 12.—YIELDS OF ONIONS, THINNED AND UNTHINNED
(Bushels per acre)

Year	Plat 2: Thinned			Plat 3: Unthinned		
	Large	Small	Total	Large	Small	Total
1908	225.44	87.37	312.81	232.46	103.68	336.14
1909	452.77	4.14	456.91	501.30	40.21	541.51
1911	62.39	26.67	89.06	16.14	158.25	174.39
1912	491.93	2.63	494.56	489.65	45.61	535.26
Average	308.13	30.20	338.34	309.89	86.94	396.83

COST OF THINNING

The principal reason assigned for growing onions without thinning is that the labor and expense of the operation are avoided. It is true that thinning onions is a tedious task, and that while thinning can be combined with one of the weedings, it is considerably more expensive than weeding alone, especially on land that has been properly handled to keep it comparatively free from weed seeds. The expense avoided by not thinning may be partly balanced by the greater labor of harvesting a crop of small, unthinned bulbs. The relation of these two items of expense in the production of the four onion crops considered in this connection is set forth in Table 13.

TABLE 13.—DIFFERENCES IN COST OF GROWING ONIONS WITH AND WITHOUT THINNING

	1908	1909	1911	1912	Average
Plat 2: Thinned—					
Cost of weeding and thinning	$27.00	$28.80	$47.50	$40.50	$35.95
Cost of harvesting	17.00	18.75	14.60	17.40	16.94
Total, two items	44.00	47.55	62.10	57.90	52.89
Plat 3: Not thinned—					
Cost of weeding	$ 7.00	$12.70	$ 3.50	$14.40	$ 9.40
Cost of harvesting	18.70	38.10	37.60	48.90	35.83
Total, two items	25.70	50.80	41.10	63.30	45.23
Difference in favor of Plat 3	$18.30	$–3.25	$21.00	$–5.40	$ 7.66

The figures in this table indicate that the thinning cost from $16 to $44 per acre (the difference between the cost of thinning and weeding Plat 2 and the cost of weeding Plat 3). This wide difference from year to year was due mainly to differences in the thickness of the original stand. The extremely low cost of weeding in 1911 was due to dry weather which was unfavorable to weed production. This table also shows that the cost of harvesting the thinned onions was fairly uniform, while that of harvesting the unthinned onions varied with the number of bulbs produced. In 1908, when the number of

bulbs in the unthinned plat was not much greater than in the thinned plat, the cost of harvesting was likewise not much greater. In other years the cost of harvesting was considerably greater for the unthinned than for the thinned plat. In 1911 the unthinned onions were so small and numerous that they were handled like onion sets, and the cost of harvesting was thus made smaller than it would otherwise have been. This, combined with the low cost of weeding, already mentioned, shows a greater saving of expense by not thinning than would otherwise have been the case. The average for the four years shows a saving of $7.66 per acre in favor of not thinning.

GROWING RIPE ONIONS FROM SETS

In this part of the country, onion sets are used chiefly for the production of green bunch onions. In order to test their adaptability, as compared with seed, for the production of ripe onions, like areas were planted with seed and with sets, and records were kept of the labor and cost of production, the yield and size of bulbs, the time of ripening, and the selling price of the product. These tests extended over a period of six years. During the first three years, only yellow bottom sets were used; during the last three years, Prize Taker sets also were employed. The yellow bottom sets were usually purchased, while the Prize Taker sets were grown on the Station grounds, since they could not readily be obtained in the trade. The home-grown yellow bottom sets that were used were from the same strain of seed as the ripe onions grown from seed. The variety and strain of the commercial yellow bottom sets were unknown. The Prize Taker sets and seeds were always of the same strain.

For the first two years, the commercial sets were planted as received from the dealers, without screening. They included many large, overgrown sets, and quite a high percentage of the plants sent up seed stalks. For the last four years, the sets were screened before planting. They were first thrown on a ¾-inch screen and those that would not go thru were discarded; then the remaining sets were passed over a ½-inch screen and all those that dropped thru were discarded. Thus, only the medium-sized sets were used for planting. A considerably smaller quantity of sets was needed for planting a given area when the screened sets were used than when the unscreened sets were used, and a smaller percentage of the plants sent up seed stalks.

Data regarding the kind and quantity of sets planted each year and the percentage producing seed stalks are given in Table 14. The area of each plat employed in these tests was one-fortieth of an acre. In calculating the quantity of sets needed to plant an acre, it was assumed that the sets weighed 32 pounds per bushel.

TABLE 14.—DATA REGARDING ONION SETS USED

	1907	1908	1909	1910	1911	1912
Kind of sets						
Yellow Globe	Commercial	Commercial	Home-grown	Commercial Home-grown	Mixed Home-grown	Commercial Home-grown
Prize Taker	.....	.....	.....			
Size of sets						
Yellow Globe	Unscreened	Unscreened	½" to ¾"	½" to ¾"	½" to ¾"	½" to ¾"
Prize Taker	.....	.....	.....	½" to ¾"	½" to ¾"	½" to ¾"
Sets per plat						
Yellow Globe	24 lbs.	18.5 lbs.	14.75 lbs.	13.75 lbs.	14.5 lbs.	13.25 lbs.
Prize Taker	.....	.....	.....	12.75 lbs.	15.5 lbs.	11.75 lbs.
Sets per acre						
Yellow Globe	20 bu.	23.13 bu.	18.44 bu.	17.19 bu.	18.13 bu.	16.56 bu.
Prize Taker	.....	.....	.....	15.94 bu.	19.38 bu.	14.69 bu.
Percent seed stalks						
Yellow Globe	11.4	13.3	8.5	.8	3.6	.7
Prize Taker	...	...	.....	2.2	1.8	.3

NOTE.—The term "Yellow Globe" is used to designate the sets other than Prize Taker, whether they were commercial yellow bottom sets or sets grown on the Station grounds from Southport Yellow Globe seed.

Each year of the tests, the seeds and sets were planted the same day, in soil that had received identical preparation. The seeds were sown with a drill, and, except in 1907, when the stand was very thin, the Yellow Globe seedlings were thinned to a distance of approximately three inches, and the Prize Taker, to four inches. The sets were planted by hand in drills made by a sled marker, and were placed at approximately the same distances as those to which the onions from seed were thinned. The planting of the sets was a tedious operation, requiring from twelve to twenty times as much labor as the planting of the seed. However, the crop grown from the sets

FIG. 2.—ONIONS FROM SETS AT LEFT; FROM SEEDS AT RIGHT

developed rapidly and did not require so much tillage (owing principally to the shorter period of growth) nor nearly so much labor in weeding, as did the crop grown from seed. Furthermore, there was a uniform stand from the sets without any expense for thinning.

Data regarding the comparative amount of labor employed in planting, tillage, and weeding and thinning, in the two ways of growing the onions are given in Table 15. The figures for the last three years represent the average for the two varieties. It will be seen that while the labor of planting the sets was enormous, it was usually more than balanced by the saving in the labor of tillage, and weeding and thinning.

TABLE 15.—COMPARISON OF LABOR IN GROWING ONIONS FROM SEED AND FROM SETS

(Hours per acre)

Treatment	1907		1908		1909		1910		1911		1912		Average	
	Seed	Sets	Seed	Sets	Seed	Sets	Seed	Sets	Seed	Sets	Seed	Sets	Seed	Sets
Labor planting, hrs..	10	140	10	180	10	120	10	129⅓	8	162⅔	8⅔	166	9.44	149.66
No. times hand-tilled.	15	10	13	8	11	8	9	7	7	4½	9½	9	10¾	7¾
Labor tilling, hrs....	144⅔	144	134⅓	82⅓	110⅔	86⅔	80⅓	58	65⅔	39	71⅔	70⅔	101.22	80.11
No. times weeded....	3	1	1	1	4½	2	3	2	2	2	3	2	2¾	1⅔
Labor weeding and thinning, hrs.	98⅔	26	190	52	199	52	260	138⅓	321	110⅔	239	63⅓	217.94	73.72
Total labor: planting, tilling, weeding and thinning.....	253⅓	310	334⅓	314⅓	319⅔	258⅔	350⅓	325⅔	394⅔	312⅓	319⅓	300	328.60	303.49

TABLE 16.—COMPARISON OF COST OF GROWING ONIONS FROM SEED AND FROM SETS

(Average cost per acre of two varieties)

	1907		1908		1909		1910		1911		1912		Average	
	Seed	Sets	Seed	Sets	Seed	Sets	Seed	Sets	Seed	Sets	Seed	Sets	Seed	Sets
Manure	$27.00	$27.00	$27.00	$27.00	$27.00	$27.00	$27.00	$27.00	$27.00	$27.00	$27.00	$27.00	$27.00	$27.00
Preparations for planting	4.50	4.50	4.50	4.50	4.50	4.50	4.50	4.50	4.50	4.50	4.50	4.50	4.50	4.50
Seeds or sets.	10.00	75.00	7.00	69.36	7.00	55.32	6.50	41.29	6.00	15.19	8.50	31.25	7.50	47.90
Planting . . .	1.50	21.00	1.50	27.00	1.50	18.00	1.50	19.40	1.20	24.40	1.30	24.90	1.42	22.45
Tillage	21.70	21.60	20.15	12.35	16.60	13.00	12.05	8.70	9.85	5.85	10.75	10.60	15.18	12.01
Weeding and thinning....	14.80	3.90	28.50	7.80	29.85	7.80	39.00	20.75	48.15	16.60	35.85	9.50	32.69	11.06
Harvesting . .	19.60	24.00	17.00	28.00	17.52	33.45	12.70	34.80	12.40	20.00	17.85	19.75	16.18	26.67
Total	$99.10	$177.00	$105.65	$176.01	$103.97	$159.07	$103.25	$156.44	$109.10	$113.54	$105.75	$127.50	$104.47	$151.59

RELATIVE COST OF GROWING ONIONS FROM SEED AND FROM SETS

As shown in Table 15, the excess of labor in planting the onion sets as compared with sowing the seed was usually fully offset by the saving of labor in tillage, weeding, and thinning. Since the same amount of manure was used on each plat and the same preparation was given the land, any differences in the cost of growing the crop the two ways, in addition to the differences already mentioned, would depend upon the relative cost of the seed and the sets, and the cost of harvesting the crop. The prices both of the seed and of the sets varied from year to year, but except under the abnormal conditions of the onion-set market in the spring of 1911, the sets for planting a given area cost from somewhat less than four to nearly ten times as much as the seed.

The various items of expense in growing the crops from seed and from sets, calculated to the acre basis, are shown in Table 16. The figures given represent the average for the two varieties, except in the case of the sets in the years when only one variety was used. The cost of the seed each year is figured on the basis of four pounds per acre at the actual price paid for the seed that year. High-grade seed was invariably used. The cost of the sets is based upon the market price of sets in this locality at planting time each year and the actual quantity planted. The cost of labor is figured at the uniform rate of 15 cents per hour. In commercial practice, much of the labor in growing onions would in many cases be done by women and children at a lower figure. Likewise, the cost of manure would vary in different places. In this estimate it has been figured at 75 cents per ton. However, since the same amount of manure was used on each plat, the price would have no influence on the relative cost of growing the onions the two ways.

YIELDS OF ONIONS FROM SEED AND FROM SETS

Table 16 shows that on account of the much greater cost for sets than for seed, and the greater expense of harvesting the crop from the sets, the cost of growing onions from sets averaged nearly 50 percent greater than the cost of growing the crop from seed. Therefore, unless some other compensating feature can be found, in addition to the saving of labor in tillage, weeding, and thinning, there is no valid reason for growing ripe onions from sets. Table 17, which gives the yields, in bushels per acre, of the onions grown from seed and from sets each year, throws some light on this point.

TABLE 17.—YIELDS OF ONIONS FROM SEED AND FROM SETS

(Bushels per acre)

Year	Yellow Globe						Prize Taker					
	Seed			Sets			Seed			Sets		
	Large	Small	Total	Large	Small	Total	Large	Small	Total	Large	Small	Total
1907	413.46	....	413.46	533.81	.....	533.81	582.32	.....	582.32	.....	.....	.....
1908	225.44	87.37	312.81	291.23	14.04	305.27	276.49	28.07	304.56	.....	.....	.....
1909	452.77	4.14	456.91	670.46	9.65	680.11	364.18	5.61	369.79	.....	.....	.....
1910	296.92	10.74	307.66	520.91	10.81	531.72	356.56	20.14	376.70	804.77	7.72	812.49
1911	62.39	26.67	89.06	255.79	1.12	256.91	19.65	15.79	35.44	350.18	.84	351.02
1912	491.93	2.63	494.56	444.91	1.40	446.31	706.32	1.96	708.28	668.77	.70	669.47
Six-year average	323.82	21.92	345.74	452.85	6.17	459.02	384.25	11.93	396.18	.....	.....	.....
Three-year average	.....	....	.....	407.20	4.44	411.64	360.84	12.63	373.47	607.90	3.09	610.99

It will be seen that except in 1912, the yield of large onions (i. e., onions of standard market size) was greater from the sets than from the seed, and that except in 1908 and 1912 the total yield also was greater. The six-year average shows an advantage of 129 bushels of large onions per acre in favor of the yellow bottom sets as compared with the Southport Yellow Globe seed; while for the three years in which Prize Taker sets were used, the average yield of large onions is shown to have been 247 bushels greater from the sets than from seed of the same strain. The marked superiority of sets over seed in certainty of producing a crop is clearly shown by the yields for 1911, when conditions during June and July were so unfavorable for the growth of onions (see Tables 7 and 8). The vigorous growth made in April and May by the onions from the sets enabled them to produce a fair crop in spite of the drouth in June. The smaller yield from the sets than from the seed in 1912 can be accounted for when the difference in the stage of development of the respective crops is considered in connection with the weather conditions at certain periods. The onions grown from sets ripened normally during a dry spell in July (at approximately the average date), but on account of late planting their period of growth was shorter than in any other year of the six. About the time these onions ripened, there was a heavy rain, followed by temperate weather, which was very favorable to the development of the onions grown from seed. These latter continued to grow for a full month after the crop from the sets had been harvested. In 1910, when the Prize Taker sets produced their highest yield, the crop from the sets continued growing until within ten days of the time of the ripening of the crop from the seed.

SIZE OF BULBS FROM SEED AND FROM SETS

The larger yields from the sets were due sometimes to a more complete and uniform stand, and sometimes to the larger size of the bulbs. In 1907 and 1910, the stands from Yellow Globe seed were rather thin and the bulbs grew larger than those from the yellow bottom sets, yet the better stands from the sets resulted in much larger yields. In 1909 and 1911, altho the stands of Yellow Globe from the seed were almost perfect, the bulbs from the sets were so very much larger that the yields greatly exceeded those from the seed. In 1910 and 1911, the stands of Prize Taker from the sets were thicker than the stands from the seed, and the bulbs were also very much larger. Under these conditions, the yields from the sets were greatly in excess of those from the seed. In 1912 the Prize Taker onions grown from seed continued growing until very late, as already noted, and reached an enormous size. This gave the seed an advantage in yield over the sets that year, in spite of the thicker stand from the sets.

Notwithstanding the variations from year to year, the averages for the six years and three years, respectively, for the two varieties show that the bulbs grown from sets were substantially larger than those grown from seed. The most striking difference in size of bulbs appeared under the trying conditions of 1911, when the sets were able to produce fair-sized bulbs regardless of the drouth. Detailed data regarding the number of large and small onions and the average weights of the bulbs for each variety each year are given in Table 18.

TABLE 18.—NUMBER OF LARGE AND SMALL ONIONS PER PLAT, AND AVERAGE WEIGHT OF BULBS GROWN FROM SEED AND FROM SETS

(All weights expressed in pounds)

Year	Seed						Sets					
	Large		Small		Total		Large		Small		Total	
	No.	Av. wt.	No.	Av. wt.	No.	Av. wt.	No.	Av. wt.	No.	Av. wt.	No.	Av. wt.
Yellow Globe												
1907	2278	.259	...	...	2278	.259	3689	.206	....	....	3689	.206
1908	1900	.169	1660	.075	3560	.125	3140	.132	580	.034	3720	.117
1909	3755	.172	139	.042	3894	.167	3350	.285	146	.094	3496	.277
1910	1974	.214	280	.055	2254	.194	4163	.178	223	.069	4386	.173
1911	1975	.045	1992	.019	3967	.032	3240	.113	54	.030	3294	.111
1912	3722	.188	165	.023	3887	.181	3102	.204	70	.029	3172	.201
Average	2601	.177	706	.044	3307	.149	3447	.187	179	.049	3626	.180
Prize Taker												
1907	3884	.214	...	...	3884	.214	....	....	....	....	....	....
1908	1730	.228	460	.087	2190	.198	....	....	....	....	....	....
1909	2921	.178	201	.040	3122	.169	....	....	....	....	....	....
1910	2302	.221	317	.091	2619	.205	3006	.382	153	.072	3159	.367
1911	609	.046	1235	.018	1844	.027	3016	.165	39	.031	3055	.164
1912	2591	.388	109	.026	2700	.374	3462	.275	33	.030	3495	.273
Six-year average.	2340	.234	387	.044	2727	.207	....	....	....	....	....	....
Three-year aver..	1834	.280	554	.035	2388	.223	3161	.274	75	.059	3236	.269

TIME OF RIPENING OF ONIONS FROM SEED AND FROM SETS

As already intimated, the onions grown from sets ripened earlier than those from seed. The date of harvest and the number of days from planting to maturity are given for each variety each year, in Table 19. This table shows that the crop from the sets normally matured in July and the crop from seed in August, and that altho the difference in the time of the ripening of the two crops varied from 9 to 42 days, the average difference was 25 days for the Yellow Globe and 23 days for the Prize Taker.

TABLE 19.—TIME OF RIPENING OF ONIONS FROM SEED AND FROM SETS

Year	Yellow Globe				Prize Taker			
	Seed		Sets		Seed		Sets	
	Date	Days	Date	Days	Date	Days	Date	Days
1907	Aug. 28	161	July 17	119	Aug. 21	154	.....	...
1908	" 7	134	" 13	109	" 7	134	.....	...
1909	" 6	127	" 28	118	" 16	137	.....	...
1910	" 12	143	" 27	127	" 12	143	Aug. 2	133
1911	July 24	124	" 1	101	" 3	134	July 7	107
1912	Aug. 23	134	" 19	99	" 23	134	" 23	103
Six-year average	Aug. 12	137	July 18	112	Aug. 14	139	.....	...
Three-year average	.....	...	.....	...	" 12	137	July 21	114

RELATIVE PROFITS IN GROWING ONIONS FROM SEED AND FROM SETS

The true value of the difference in the time of the ripening of onions from seed and from sets can be appreciated more fully when considered in connection with market conditions at different times in the season. Since comparatively few ripe onions are grown from sets in this part of the country, the local markets are normally not very fully supplied with onions at the time the crop from the sets matures; and unless the crop of Texas Bermudas is large and late, there is likely to be little competition from onions of any kind until the main crop from seed matures. There is usually, therefore, an opportunity to dispose of ripe onions grown from sets, immediately after they are harvested, and prices at that time are likely to be good. The large onions from the experimental plats were sold to a local wholesale dealer; those grown from sets were disposed of as soon after harvesting as they could be cured, and brought a higher average price than those sold later that were grown from seed. The small onions were usually sold to peddlers or to private parties for pickling. The prices received for each type of onions each year are given in Table 20.

TABLE 20.—PRICES PER BUSHEL RECEIVED FOR ONIONS

Year	Yellow Globe				Prize Taker			
	Seed		Sets		Seed		Sets	
	Large	Small	Large	Small	Large	Small	Large	Small
1907	$0.75	....	$1.25	....	$0.75	....	....	....
1908	.75	$0.50	.80	$0.50	.75	$0.50	....	....
1909	.75	.50	.80	.50	.75	.50	....	....
1910	.80	.50	.80	.50	.80	.50	$1.00	$0.50
1911	.75	.50	1.00	.50	.75	.50	1.00	.50
1912	.60	.30	.60	.30	.60	.30	.60	.30
Average	$0.73	$0.46	$0.88	$0.46	$0.73	$0.46	$0.87	$0.43

Since the onions grown from sets had the advantage of those grown from seed both in yield and in price per bushel, the average

TABLE 21.—COMPARISON OF PROFITS IN GROWING ONIONS FROM SEED AND FROM SETS

Year	Yellow Globe						Prize Taker					
	Seed			Sets			Seed			Sets		
	Value of crop	Cost of production	Profit	Value of crop	Cost of production	Profit	Value of crop	Cost of production	Profit	Value of crop	Cost of production	Profit
1907	$310.10	$ 89.10	$221.00	$667.26	$177.00	$490.26	$436.74	$109.10	$327.64	.....	.....	.....
1908	212.77	104.15	108.62	240.00	176.01	63.99	221.41	107.15	114.26	.....	.....	.....
1909	341.65	104.15	237.50	541.20	159.07	382.13	275.95	103.78	172.15	.....	.....	.....
1910	242.91	93.10	149.81	422.14	167.93	254.21	295.32	113.40	181.92	$808.63	$144.95	$663.68
1911	60.13	110.20	–50.07	256.35	118.37	137.98	22.64	108.00	–85.36	350.60	108.70	241.90
1912	295.95	109.90	186.05	267.37	129.73	137.64	424.38	101.60	322.78	401.47	125.28	276.19
Six-year average	$243.92	$101.77	$142.15	$399.05	$154.69	$244.38	$279.41	$107.17	$172.23	.....	.....	.....
Three-year average	.....	.....	.....	.....	.....	.....	247.45	107.67	139.78	$520.23	$126.31	$393.92

value of the crops produced from sets was considerably greater than that of the crops produced from seed. Table 21 gives the value of the crop, the cost of production, and the net profit for each of the crops of onions from sets and from seed.

Altho the cost of growing the crop from sets was every year greater—and usually very much greater—than that of growing the crop from seed, the higher yield and the higher prices combined usually resulted in the crop from the sets being much more profitable than that from the seed. The only exceptions occurred in 1908 and 1912, when the crop from the sets was smaller than that from the seed, as already mentioned, and the prices little or no higher. The six-year average shows an advantage of $102.23 per acre per year in favor of growing the Yellow Globe onions from sets rather than from seed. For the three years that the Prize Taker sets were used, the average annual profits per acre were $254.14 greater for the crop grown from sets than for the crop grown from seed of the same strain. This average is not comparable with the six-year average for the other type, on account of the very low yields from seed in 1911 and the higher price received for the Prize Taker onions grown from sets in 1910. However, it shows something of the possibilities in the line of the profits that may be secured from Prize Taker onions grown from sets, as compared with the same variety grown from seed.

CONCLUSIONS

Wood Ashes as a Fertilizer for Onions.—The results show that, on the type of soil used in these experiments, the use of wood ashes as a fertilizer for onions is not attended with sufficiently regular profits to warrant its recommendation.

Time of Planting.—The results of the tests herein reported indicate that onions should be planted within two weeks after the soil first reaches workable condition in the spring; and that planting at the beginning of this period is likely to result in larger average yields than planting at its close. Furthermore, there is more certainty of getting the onions planted sufficiently early if they are planted at the earliest opportunity, than if the first period of good planting weather is allowed to pass. It is therefore advisable to plant onions at the very earliest date in spring that a good seed bed can be prepared. In central Illinois this is usually some time between March 20 and April 1.

Thinning.—The chief objection to thinning onions is the expense. On the other hand, if onions are not thinned, there is likely to be a large percentage of undersized bulbs, and even those that are of marketable size (that is, more than 1¼ inches in diameter) are likely to be much smaller than those that have been thinned. The tendency of the market at the present time is to give preference to large-sized

onions, so that altho the accepted minimum standard size for market onions is 1¼ inches in diameter, unless most of the onions in a given lot are considerably above the minimum, it is difficult to sell them on some markets, even at a reduced price. Therefore, if onions are to be grown without thinning, great care must be taken in sowing the seed to secure a thin and uniform stand. This involves testing the seed for germinative power, and adjusting the seed drill with extreme precision.

Growing Onions from Sets.—On the whole it appears that altho the cost of growing onions from sets is considerably greater than growing the crop from seed, the sets are more certain than the seed to produce a paying crop, especially under unfavorable weather conditions; the crop is likely to be larger; it ripens earlier, and can usually be disposed of promptly at harvest time. The chief objection to the growing of onions from sets is the enormous amount of labor involved in planting them. However, this is usually offset by the saving of expense in weeding, thinning, and tillage. The excess cost of sets over seed and the increased labor of harvesting the larger crop from the sets are usually more than balanced by the greater value of the crop; thus, under present conditions, the growing of onions from sets for local market in Illinois towns appears to offer greater opportunity for large profits from small areas than growing onions from seed. The growing of ripe onions from sets may well form part of a general market-gardening business, provided the quantity grown in a given locality does not exceed the capacity of the available markets.