3-1896

Tomatoes, Beans, Onions. A Cheap Hot House

L.C. Corbett
South Dakota Agricultural College

SOUTH DAKOTA
Agricultural College
AND
EXPERIMENT STATION

BROOKINGS, S. D.

BULLETIN NO. 47.

MARCH, 1896.

DEPARTMENT OF HORTICULTURE.

TOMATOES, BEANS, ONIONS. A CHEAP HOT HOUSE.

PRINTED BY ORDER OF COUNCIL.

Will A. Beach, Printer and Binder, Sioux Falls, S. D.

GOVERNING BOARDS.

REGENTS OF EDUCATION.

HON. J. W. SHANNON, Pres.....Huron
HON. L. T. BOUCHER, Vice Pres.....Eureka
HON. E. T. SHELDON, Sec'y.....St. Lawrence
HON. A. B. SMEDLEY.....Milbank
HON. F. D. ADAMS.....Groton
DR. G. J. COLLER.....Brookings
REV. W. S. PETERSON.....Rapid City
DR. H. M. FINNERUD.....Watertown
HON. W. W. EGLESTON.....Chamberlain

BOARD OF TRUSTEES.

HON. A. H. WHEATON, Pres.....Brookings
HON. JOHN GIESE.....Watertown
HON. C. B. COLLINS.....Groton
HON. FRANK PALMER.....Madison

STATION COUNCIL.

DR. G. J. COLLER, Regent Member.
HON. A. H. WHEATON, Trustee Member.
PROF. DICE MCLAREN, Acting Pres. of College.

JAS. H. SHEPARD, Director.....Chemist
E. C. CHILCOTT, Vice Director.....Agriculturist
T. A. WILLIAMS.....Botanist
DICE MCLAREN.....Zoologist
N. E. HANSEN.....Horticulturist

F. G. ORR, Secretary and Accountant.

ASSISTANTS.

H. B. MATHEWS.....Chemistry
J. M. TRUEMAN.....Dairy Science
F. K. LUKE.....Horticulture and Entomology

INTRODUCTORY NOTE.

The work recorded in this bulletin was planned and partly completed by Professor L. C. Corbett, now of the West Virginia station, before his connection with this station was severed. In the work he was ably assisted by F. K. Luke, upon whom it devolved to complete and record the results obtained. Professor Corbett has kindly consented to prepare the manuscript for publication, and although from the force of circumstances it was not possible for him to give the synonymy of the vegetables treated, nevertheless the work *per se* was too valuable to be lost to the state.

Although somewhat delayed the bulletin will be a welcome addition to the literature of small crops in South Dakota.

JAS. H. SHEPARD,
Director.

TOMATOES.

L. C. CORBETT.

Too much stress cannot be put upon the importance of the tomato as a garden crop for South Dakota. There is no reason for the annual importation of hundreds of bushels of this fruit which could be produced at home, and the money saved.

With a view of aiding the prospective grower in the selection of varieties an extensive trial of the several kinds of tomatoes was made. In these tests all the varieties under consideration were treated as nearly alike as possible. All were sown upon the same day, March 15, in soil of uniform character; were shifted to pots of various sizes at the same time, i. e., to 3-inch pots April 6; 4-inch pots May 4; and were all set in the field on the same day, May 31. The subsequent culture was the same for all cases of variety tests. The harvesting and weighing were done with equal care and precision.

The following table "Varieties Compared," explains itself. The yield, size and color of the various sorts can be seen at a glance. The relative earliness of the varieties can be determined from the date of the ripening of the fruit.

The comparison of the varieties as to yield per acre is just, because the conditions were those of a commercial patch, and the total area occupied was considerably more than an acre.

In all cases the yield of the plants, as recorded in each test, unless otherwise stated, is that of *ripe* fruit *only*, and all plants used in the tests were grown under the same conditions and treated the same, prior to planting in the field, as those used in the general variety test, unless otherwise stated in the description of a particular experiment.

VARIETIES COMPARED.

No.	VARIETY.	SEEDSMAN.	No. Plants.	Date of First Bloom.	Date of First Ripe Fruits	Avg. Number Fruits per Plant.	Avg. Weight of Individual Fruits.	Yield per Acre in bu. of 60 lbs.	REMARKS.
							Oz.		
4	Ignotum	Cornell Station	10	July 5	Aug. 23	26.7	3.31	250.65	Brick red, regular.
5	Bond's Ey Minnesota	Iowa Seed Store	7	June 17	" 9	79.3	1.77	396.00	Red, smooth, medium to small.
6	Yellow Pear Shaped	Livingston's Sons	10	" 17	" 16	206.4	.25	151.98	Yellow, pear-shaped, small.
7	Livingston's Gold Ball	" "	10	" 24	" 27	35.4	1.00	99.35	Yellow, medium to small.
8	Canada Victor	" "	10	" 24	" 27	28.7	2.00	159.69	Brick red, irregular.
9	Mikado (Turners Hyb.)	" "	9	" 18	Sep. 3	5.6	3.55	56.70	Pinkish red, smooth.
10	Livingston's Golden Queen	" "	10	" 24	Aug. 27	22.9	4.53	212.77	Yellow, smooth.
11	Livingston's Beauty	" "	7	" 17	" 27	13.9	3.86	146.98	Pink, regular.
12	Essex Hybrid	" "	10	" 24	" 23	30.4	2.90	250.65	Pink, regular.
13	Trophy	" "	10	" 20	.....	5.1	3.51	50.81	Red, rather irregular.
14	Livingston's Perfection	" "	10	" 20	Aug. 23	25.0	3.10	223.20	Brick red, regular.
15	Red Cherry	" "	9	" 16	" 2	440.7	.17	212.76	Too small for profit.
16	Optimis	" "	8	" 17	" 23	31.7	2.11	190.54	Brick red, regular.
17	Acme	" "	10	" 17	" 20	29.8	3.25	274.43	Rich red, regular.
18	Paragon	" "	10	" 28	" 20	19.6	4.17	232.27	Brick red, regular.
19	Potato Leaf	" "	10	" 17	" 23	21.4	2.9	173.90	Pinkish red, regular.
20	Livingston's Favorite	" "	10	" 17	" 23	24.1	3.33	227.74	Brick red, regular.
21	New Golden Peach	" "	10	" 28	" 6	33.5	1.14	111.15	Peach type, yellow.
22	Livingston's Royal Red	" "	10	" 28	" 27	29.7	2.95	245.43	
23	Livingston's Dwf. Aristocrat	" "	10	July 1	" 23	28.7	2.51	205.96	Brick red, regular.

VARIETIES COMPARED.—*Continued.*

No.	VARIETY.	SEEDSMAN.	No. Plants.	Date of First Bloom.	Date of First Ripe Fruits	Avg. Number Fruits per Plant.	Avg. Weight of Individual Fruit.	Yield per Acre in bu. of 60 lbs.	REMARKS.
							Oz.		
24	Livingston's Buckeye State..	Livingston's Sons...	10	June 20	Sep. 10	3.4	4.53	43.55	Rich red, regular.
25	New Ponderosa	" " ...	10	" 18	Aug. 27	6.2	6.00	105.08	Light pink, inclined to be rough.
26	Livingston's Stone	" " ...	10	" 28	Sep. 3	23.5	2.73	192.47	Bright red, some fruits rough.
27	The Democrat	J. M. Thorburn	10	" 22	Aug. 30	13.9	4.40	172.84	Brick red, regular.
28	Conqueror.....	" "	10	" 17	" 6	59.8	1.74	295.33	Brick red, irregular.
29	New Paragon	" "	10	" 17	" 8	32.5	3.91	360.66	Brick red, slightly irregular.
30	Cardinal	" "	10	" 22	" 27	20.9	4.60	277.64	Brick red, slightly irregular.
31	Puritan	" "	10	" 22	" 30	21.4	3.85	233.64	Rich red, rather regular.
32	Thorburn's New Jersey.	" "	10	" 24	" 23	18.9	3.49	188.27	Rich red, rather regular.
33	Lorillard	" "	10	" 22	" 27	25.2	3.34	238.63	Rich red, rather regular.
34	Early Advance.....	" "	10	" 17	" 6	54.5	2.00	308.50	
35	Volunteer.....	" "	10	" 24	" 27	23.8	3.00	203.01	Brick red, regular.
36	Thorburn's Long Keeper	" "	9	" 20	" 27	32.2	2.40	219.12	Rich red, regular.
37	Large Yellow.....	" "	10	" 20	Sep. 3	11.9	3.32	112.28	Yellow irregular.
38	Terra Cotta.....	" "	10	" 24	" 6	31.2	1.81	170.12	Peach type.
39	The Autocrat*.....	" "	10	" 28	Aug. 20	12.6	4.53	162.18	Pink, large, a little irregular.
40	Lemon Blush.....	" "	10	" 22	" 30	27.0	2.05	158.21	Yellow, regular.
41	Northern Lights*	" "	9	" 17	" 20	30.1	2.36	233.18	Yellow, irregular.
42	The Hovey	" "	9	" 18	" 23	30.1	2.89	251.78	Dwarf champion type fruit.
43	Meteor*	" "	10	" 18	" 9	21.1	2.79	166.55	Brick red, somewhat irregular

VARIETIES COMPARED.—*Continued.*

No.	VARIETY.	SEEDSMAN.	No. Plants.	Date of First Bloom.	Date of First Ripe Fruits	Avg. Number Fruits per Plant.	Avg. Weight of Individual Fruits.	Yield per Acre in bu. of 60 lbs.	REMARKS.
							Oz.		
44	Ring Leader.....	Dreer	9	July 1	Sep. 7	.6	13.00	24.49	Red, rough.
45	Dreer's Selected Trophy	"	10	June 17	Aug. 30	10.9	3.73	115.68	
46	McCullom's Hyb.....	Ki-Ote Seed Co.	10	" 28	" 27	25.6	3.52	249.51	Rich red, regular.
47	Pott's Choice Canner*..	T. W. Wood & Sons.	10	" 28	" 27	23.5	2.92	194.62	Brick red, rather regular.
48	Upright or Tree.....	Burpee	10	July 23	" 20	2.2	3.50	21.55	Brick red, irregular.
49	Early Optimus.....	"	10	" 1	" 30	27.2	2.93	226.23	Brick red, regular.
50	Burpee's Climax	"	10	June 24	" 27	31.6	3.05	286.54	Pink or dwarf champion color.
51	Essex Ey. Hybrid.....	"	10	" 24	" 23	28.4	2.63	212.09	Pink or dwarf champion color.
52	Fordhook First	"	10	" 24	" 23	25.6	3.39	246.68	Pink or dwarf champion color.
53	Salzer's Giant Tree.....	Salzer	10	" 28	" 20	32.8	2.79	359.72	Dwarf champion type of fruit.
54	Salzer's Morning Star ..	"	10	" 17	" 27	11.6	3.49	115.68	Approach dwf. champion type of fruit.
55	Yellow Pear	"	9	" 17	" 6	175.3	.33	146.87	
56	Early LaCrosse	"	9	" 28	" 23	32.4	2.88	264.48	Approach dwf. champion color of fruit.
57	One Hundred Day	"	9	" 24	" 30	23.3	4.08	269.47	Brick red, regular.
58	Perfect Gem	"	10	July 1	" 20	19.6	3.52	196.43	Brick red, regular.
59	Salzer's New Pot.....	"	10	June 24	" 20	25.3	2.81	203.69	Dwarf champion type, inferior strain.
60	Ferris Wheel	"	10	" 28	Sep. 13	4.6	4.54	58.97	
61	Salzer's First Prize.....	"	10	" 17	Aug. 13	42.0	3.90	465.00	Brick red, regular, green about stem.
62	Salzer's Golden Glory*.	"	10	" 28	" 30	19.6	4.20	235.30	Yellow, regular.
63	Fifty Days the Earliest*	"	5	" 28	" 16	42.6	2.28	279.00	Pink, smooth, green about stem.

VARIETIES COMPARED.—*Continued.*

No.	VARIETY.	SEEDSMAN.	No. Plants.	Date of First Bloom.	Date of First Ripe Fruits	Avg. Number Fruits per Plant.	Avg. Weight of Individual Fruits.	Yield per Acre in 60 lbs.	REMARKS.
							Oz.		
64	Trophy Etra Selected	Henderson	10	June 24	Aug. 27	24.3	3.31	327.06	Brick red, some fruits irregular.
65	Crimson Cushion	"	10	July 1	" 23	6.1	4.31	74.85	Brick red, a few fruits irregular
66	Golden Sunrise	"	10	June 24	" 23	35.3	2.18	219.12	Yellow, regular.
67	White Apple	Huntington Seed Co.	10	" 28	" 30	42.8	1.08	131.56	White, small.
68	Ten Ton	" "	10	" 18	" 27	38.8	2.68	295.79	Rich red, regular.
69	General Grant	Harrison's Seed Co.	10	" 20	" 20	30.0	3.07	260.85	Brick red, some fruits irregular.
70	Potomac	" " "	10	" 28	" 30	20.1	4.67	266.30	Dwarf champion color, irregular.
71	Cumberland Red	Gregory & Sons	10	" 28	" 23	22.7	3.17	204.15	Bright red, regular.
72	The "Comrade"	" "	10	July 1	" 27	26.1	3.75	271.85	Beautiful red, regular.
73	Early Ruby	" "	10	June 17	" 13	41.4	3.36	395.14	Brick red, rarely rough, good.
74	Mitchell's New	" "	10	" 24	" 9	31.6	3.34	269.08	Brick red, regular.
75	Red Cross	" "	9	" 28	" 13	21.6	3.30	253.14	Brick red, regular, attractive size.
76	Earliest of All	" "	10	" 17	" 2	73.6	2.10	438.69	Deep red, rough, *too rough.*
77	Maul's New Imperial*	Maule	10	" 24	" 27	24.5	4.56	317.11	Dwarf champion color, regular, good.
78	May's First of All*	L. L. May	10	" 17	" 6	41.0	3.22	375.18	Brick red, regular.
79	New Early Red Tree*	Pitcher & Mauda	10	" 28	" 30	13.5	3.94	151.07	Dwarf champion type, fruit redish cast
80	Child's Picture Rock	Childs	10	" 24	" 23	35.2	3.55	354.30	Brick red, regular.
81	Child's Golden Jubilee	"	10	" 24	Sep. 3	16.7	4.33	204.60	Yellow, quite regular.
82	Child's Ruby Queen	"	10	" 22	" 3	26.0	3.19	234.93	Rich yellow, quite rough.
83	Boston Market	Rawson	10	" 28	Aug. 27	21.4	3.25	197.34	Brick red rough.

VARIETIES COMPARED.—*Concluded.*

No.	VARIETY.	SEEDSMAN	No. Plants.	Date of First Bloom.	Date of First Ripe Fruits	Avg. Number Fruits per Plant.	Avg. Weight of Individual Fruit.	Yield per Acre in bu. of 60 lbs.	REMARKS.
							Oz.		
84	Rawson's Puritan.....	Rawson	10	June 28	Aug. 27	16.9	4.12	197.34	Brick red, regular.
85	Hubbard's Early.....	Geo. W. P. Jerard...	10	" 24	" 23	67.8	2.82	542.11	Brick red, irregular.
86	New Liberty Bell	Johnson & Stokes...	10	" 24	" 27	29.0	3.59	295.37	Beautiful red, regular.
87	Cumberland Red.....	" " ...	10	" 24	" 27	19.4	3.51	193.71	
88	Brandywine	" " ...	10	" 22	" 27	23.9	4.09	277.19	Rich red, regular.
89	Mitchell's Impr'v'd No. 1	" " ...	10	" 17	" 23	39.8	2.59	293.06	Brick red, regular.
90	King of the Earlies	" " ...	10	" 22	" 16	58.6	1.62	269.00	Brick red, irregular.
91	Early Paragon	" " ...	10	" 28	" 23	17.4	2.48	153.37	Brick red, smooth.
92	The Queen	" " ...	10	" 18	Sep. 3	13.5	4.09	121.58	Brick red, a few irregular.
93	Cook's Favorite.....	" " ...	10	July 1	Aug. 30	22.3	3.94	249.97	Beautiful red, regular.
94	Early Market Champion	" " ...	8	June 28	" 27	36.5	2.90	326.64	Approach dwf. champ. color, regular.
95	The Great B. B.....	" " ...	10	" 17	" 27	35.0	3.70	368.70	Brick red, regular.
96	Fiji Island	" " ...	9	July 5	" 27	31.0	3.40	317.53	Pink, regular.
97	Horsford's Prelude.....	" " ...	10	June 28	" 30	27.4	3.63	313.03	Brick red, somewhat rough.
98	Climax	" " ...	10	July 1	" 23	22.7	3.05	195.99	Brick red, quite regular.
99	Johnson & Stoke's No. 75	H. C. Warner	10	June 24	" 23	25.5	3.80	294.88	Brick red, smooth.
100	Long Keeper	" "	10	" 28	" 27	36.4	3.08	322.10	Pink, smooth.
104	Chemin	" "	10	" 17	" 6	38.8	2.80	309.85	Brick red, smooth.
105	Dakota*.....	" "	6	" 20	" 30	25.5	4.34	313.48	Approach dwf. champ. in color, solid.
109	Dwarf Champion	" "	10	" 28	" 23	26.3	3.20	239.53	Type.
110	Atlantic Prize.....	" "	10	" 22	" 16	37.5	2.83	301.40	Brick red, generally regular.

FERTILIZERS.

Previous to this writing little has been done to throw light upon the future problem of maintaining the cropping power of the prairie soils, and even now it can not be looked upon as a question of general importance except to those interested in market gardening.

The grower of any crop, however, desires to make as large a profit as possible from the capital and labor invested and this is as true of the farmer of the northwest as of the east. In order to determine the possible advantage from the use of various commercial manures the several quantities and combinations tabulated below were carefully prepared and the quantities accurately weighed. These were sown June 6, upon the surface of the soil and raked in to the depth of about 1½ inches, about the roots of a carefully selected and very uniform set of Dwarf Champion tomato plants. All were grown from seed sown March 16 in a hot-bed and subsequently all treated alike until they received the application of fertilizers.

In every test of this sort a normal or check plot must be retained and in this case we have it in No. 125, this serves as a basis for comparison of all others. From a glance down the column of dates of ripening it will be noted that in general the fertilizer had a tendency to retard the period of ripening, the exceptions being, Nos. 134, 138 and 142. In these cases the crop was hastened and quite materially increased save in the instance of 134 where there is a marked falling off.

The combinations proving themselves of most value for tomatoes upon a prairie soil are those containing a large per cent of phosphoric acid, as in Nos. 138, 139 and 140 where super-phosphate of bone was the manure used.

A light dressing of nitrate of soda also increased the yield as shown in 126. This together with Nos. 130 and 131 make up all the marked cases of increased yield from the use of commercial fertilizers.

FERTILIZER TEST. (Variety Dwarf Champion.)

	TREATMENT.	No. Plants.	Date of First Bloom.	First Ripe Fruits.	No. Fruits per Plant.	Weight of Fruits per Plant in pounds.	Weight of Individual Fruits. (Oz.)	Yield per Acre in bushels.
125	Normal	10	June 28	Aug. 13	19.1	5.5	4.22	249.51
126	Nitrate Soda, 2 oz.	10	" 28	" 13	29.0	5.7	3.16	259.95
127	Nitrate Soda, 4 oz.	9	" 28	" 20	28.8	5.3	2.92	240.44
128	Nitrate Soda, 6 oz.	9	" 24	" 13	25.1	4.1	2.91	186.00
129	German Pot. Salts, 2 oz...	9	" 24	" 13	29.1	5.4	2.62	244.98
130	German Pot. Salts, 4 oz...	8	" 27	" 20	33.5	*6.35	3.04	284.74
131	German Pot. Salts, 6 oz...	5	" 24	" 20	29.8	*6.1	3.26	276.73
132	Muriate Pot., 2 oz.....	8	" 28	" 20	21.3	4 56	3.40	206.87
133	Muriate Pot., 4 oz.....	6	" 24	" 23	30.3	4.6	2.43	208.68
134	Muriate Pot., 6 oz.....	6	" 24	" 9	24.3	4.5	2.95	204.15
135	Sulphate Pot., 2 oz.....	10	" 24	" 13	20.4	4.25	3.15	192.80
136	Sulphate Pot., 4 oz.....	10	" 24	" 20	23.8	4.84	3.25	219.57
137	Sulphate Pot., 6 oz.....	10	" 28	" 20	20.7	4.05	3.12	183.40
138	Super Phosphate, 2 oz....	8	" 24	" 9	31.25	*7.3	3.59	331.17

FERTILIZER TEST. (Variety Dwarf Champion.)—*Concluded.*

	TREATMENT.	No. Plants.	Date of First Bloom.	First Ripe Fruits.	No. Fruits per Plant.	Weight of Fruits per Plant in pounds.	Weight of Individual Fruits. (Oz.)	Yield per Acre in bushels.
139	Super Phosphate, 4 oz. . . .	10	June 22	Aug. 20	31.7	*6.38	3.22	289.44
140	Super Phosphate, 6 oz. . . .	10	" 24	" 13	33.4	*6.11	2.93	277.19
141	Land Plaster, 6 oz.	9	" 20	" 13	27.9	5.31	3.05	240.89
142	Land Plaster, 3 oz. . . . . Nitrate Soda, 3 oz.	8	" 28	" 6	27.3	5.05	2.95	229.10
143	German Pot. Salt, 3 oz. Nitrate Soda, 3 oz. . . .	5	July 1	" 23	23.6	4.10	2.77	186.10
144	Nitrate Soda, 2 oz. . . . . German Pot. Salt, 2 oz. Super Phosphate, 2 oz. .	8	" 1	" 16	26.3	5.20	3.14	235.90
175	Land Plaster, 3 oz. . . . . Salt, 3 oz.	4	" 1	" 16	25.0	4.4	2.80	216.28

From the above it becomes apparent that for the tomato crop, at least, soils of this region contain an ample supply of nitrogen and if any ingredient is lacking it is phosphoric acid or potash; and from a comparison of the results of 130 and 131 with those of 138, 139 and 140 the conclusion that small quantities of phosphoric acid is a benefit cannot well be disregarded.

CULTURAL METHODS.

Shallow culture is undoubtedly the ideal method of handling all hoe crops in a region of scanty rain fall. The proper depth of such cultivation in order that best results shall be obtained has been very carefully worked out by Professor King of the Wisconsin Station, but in order that we do not err on the side of too shallow culture the following trial was made from which it is evident that too shallow culture may be quite as injurious as too deep. Two sets of 40 plants each were selected, one was cultivated with a Plannet Jr. wheel hoe to the depth of 3 in. at least, while another set was merely raked with the garden rake and the weeds hand pulled or cut with the hoe.

CULTURAL METHODS. (Variety Early Ruby.)

No.	TREATMENT.	No. Plants.	Date of First Bloom.	First Ripe Fruit.	No. Fruits per Plant.	Weight of Fruit per Plant	Weight of Individual Fruits.	Yield per Acre in bu.
123	Shallow Culture	40	June 17	Aug. 16	50.4	9.9	3.14	446.13
124	Raked	39	" 18	" 6	48.5	7.3	2.42	332.53

While the raked plat gave the earliest fruits it gave fewer fruits of smaller size with a lesser average crop per plant. It is possible then to cultivate too shallow for best results; this is undoubtedly due to the layer of soil, which is to act as a mulch, being too thin to materially check the evaporation of the capillary water.

MULCHING. (Variety Early Ruby.)

No.	TREATMENT.	No. Plants.	Date First Bloom.	First Ripe Fruits.	No. Fruits per Plant.	Weight of Fruits per Plant.	Weight of Individual Fruits.	Yield per Acre in bu. of Ripe Fruits.	Yield in bu. of Fruit for Season, Ripe and Green.
120	Normal	20	June 17	Aug. 16	56.8	11.5	3.25	521.70	696.37
121	Manure	20	" 17	" 20	56.1	10.7	3.05	485.42	698.60
122	Straw.....	20	" 18	" 20	53.1	7.9	2.20	360.66	489.96

MULCHING.

Contrary to what might at first thought be expected, a mulch retards the maturity of the tomato. This is in keeping with the generally accepted idea of the function of a mulch.* In this case the retarding effect is undoubtedly due to the retention of mosture and the shading of the ground. Both having a tendency to render the soil cooler and consequently later. Of the two materials used the straw is the most efficent as a delaying agent and when this is the object straw may be used with good effect. The tomato, however, requires a season much longer than the usual Dakota summer, so we are to look for *forcing* or hastening agencies rather than those having the contrary effect.

In general, therefore, the mulching of tomatoes in Dakota is not to be advised.

---

* See Cornell Station Bulletin No. 59.

TOMATO TRAINING. (Variety Early Ruby.)

No.	TREATMENT.	No. Plants.	Date of First Bloom.	First Ripe Fruits.	No. Fruits per Plant.	Weight of Fruits per Plant in pounds.	Weight of Individual Fruits in ozs.	Yield per Acre in bushels.	No. Fruits to September 3.
113	Racks	20	June 17	Aug. 23	33·5	7·76	3.68	352.04	37
114	Single Stem	19	" 20	" 23	9.84	2.33	3.89	105.71	29
115	Trellis	20	" 17	" 16	46.55	10.13	3.52	459.58	63
116	Lath Support ...	20	" 17	" 13	38.6	8.88	3.66	402.85	33
117	Normal	20	" 17	" 6	32.6	6.47	3.17	293.50	88

TRAINING.

Training of tomatoes as is usually done is a tedious and expensive operation and in order that any form of support be adopted or even recommended it must carry with it some advantage either in the way of the production of early fruits or an enhanced yield which shall over-balance the cost of the trellis as well as the work of training. For the purpose of throwing light upon the problem the tests recorded here were made. From the table it will be seen that No. 117, the normal or untrained set gave the earliest product; 88 fruits up to September 3, while those trained in various ways, those tied to a simple three wire perpendicular trellis similar to those used for grapes but much lower, gave the best results both for the season and up to September 3d; in fact, the greatest yield of ripe fruit was made by the plants trained in this way. The wire support as described above was undoubtedly the cheapest form of trellis used although the expense of training the vines upon it may be somewhat more.

The lath support consisted of a rack running along one side of the row of plants and so constructed that as the plants grew they could be carried upon it and remain there without tieing. The rack being some 3 ft. wide and elevated, by means of stakes, to an angle of about 45 °. The advantage of this form lies in the fact that no expense for the training is necessary.

The single stem and rack forms were considered in Bulletin 37, pages 5 and 6.

CUTTINGS VS. SEEDLINGS.

For an early fruit crop the value of cutlings was formerly advocated as opposed to plants grown from seeds sown but a short period before the plants are to be set in the field.

Obviously if there are any advantages to be gained by the use of such plants over seedling plants there are likewise hinderances equally as great. The difficulty of carrying through the winter plants from which to make the necessary cuttings is a serious and in most cases an insurmountable obstacle to the ordinary grower, while the seeds can be had at small cost and are easily stored.

Notwithstanding the adverse and discouraging aspect of the problem a series of tests were instituted. The original stock of cuttings was taken from a plant grown from the same general seed sowing as the other plants used in the trials during the season of 1894. As noted, the cuttings were made October 5, and their subsequent history is detailed in the table.

CUTTINGS VS. SEEDLINGS.

No.	TREATMENT.	No. Plants.	Date of Bloom.	First Ripe Fruits.	No. Fruits per Plant.	Weight of Fruits per Plant in pounds.	Weight of Individual Fruits in ozs.	No. Fruits to August 31.	Weight of Fruits per Plant to Aug. 31 in ozs.
117	Early Ruby, (seedlings)	20	June 17	Aug. 6	32.6	6.47	3.17	4.40	12.22
167	Early Ruby, (cuttings), made Oct. 5, 1894	7	" 28	" 30	9.57	2.20	3.75	.14	.57
168	Early Ruby, (cuttings), from 167, made Dec. 19, 1894.....	2	" 18	" 13	22.5	3.40	2.44	4.00	7.37
169	Early Ruby, (cuttings), from 167, made March 11, 1895	10	" 18	July 26	10.5	2.36	3.61	.30	.62
170	Early Ruby, (cuttings), from 168, made April 16. 1895.....	2	July 1	Aug. 30	20.0	3.70	2.95	2.00	6.50
171	Dwarf Champion, (seed), seed sown Jany. 16, 1895	7	June 18	" 16	26.7	4.00	2.40	1.43	2.68
172	Dwarf Champion, (cuttings), from 171, made April 16, 1895	7	" 18	" 9	18.2	2.82	2.42	2.14	4.28

So far as the general crop of the season is concerned the cuttings fell far in the rear of the plants grown from seed. The only advantage possessed over the seedling plants is the fact that the cuttings from the time they are made until they are ready to go into the field occupy the space of the greenhouse a shorter period than do the seedling plants.

In the case of 171 and 172 there was a decided advantage in the earliness of the cuttings over the parent plants. Up to August 31, the cuttings had yielded 1.6 oz. per plant more. This amount even upon a thousand plants would only aggregate 100 lbs., a gain too small to be taken into consideration when the additional work is taken into account. But should a person, possessing only a limited stock of some choice variety, desire to increase it and at the same time hasten the maturity of the product, the plants might be treated as were those of No. 171. The tops were cut out and rooted as cuttings and the root and stalk retained to make a second growth.

INFLUENCE OF DATE OF SEED SOWING.

	VARIETY.	No. Plants.	Seed Sown.	Date of Bloom.	First Ripe Fruits.	No. Fruits per Plant.	Weight of Fruits per Plant in pounds.	Weight of Individual Fruits. (Oz.)	Yield per Acre in bushels. (60 lbs.)
1	Dwarf Champion	7	J a. 16	April 8	July 11	11.7	1.85	2.53	83.93
1 *a*	Dwarf Champion	8	" 26	" 20	" 11	17.9	3.33	3.03	151.07
1 *b*	Dwarf Champion	9	Feby. 5	" 30	Aug. 6	14.3	3.25	3.58	147.44
1 *c*	Dwarf Champion	10	" 15	May 10	" 6	16.2	3.75	3.05	170.12
1 *d*	Dwarf Champion	9	" 25	" 10	July 23	20.6	3.55	2.20	161.05
1 *e*	Dwarf Champion	10	March 7	June 17	Aug. 9	34.2	4.48	2.10	203.24
1 *f*	Dwarf Champion	10	" 17	" 28	" 16	33.5	6.35	3.03	*288.08*
1 *g*	Dwarf Champion	9	" 27	" 2	" 23	31.6	5.55	2.81	251.78
1 *h*	Dwarf Champion	10	April 6	July 7	" 23	25.9	4.02	2.50	182.37
1 *i*	Dwarf Champion	9	" 16	" 5	" 23	28.8	4.82	2.82	218.66
1 *j*	*Dwarf Champion	7	" 16	" 16	" 30	7.7	1.3	2.70	58.79
1 *k*	†Dwarf Champion	8	" 16	" 16	" 27	12.0	1.6	2.12	72.58

*Seed sown in hand boxes in field. †Seed sown in open, plants killed by frost, but were re-set from surplus in (1 *j*).

INFLUENCE OF TIME OF SEED GROWING UPON YIELD.

In my last report upon tomatoes, Bulletim 37, of this station, it was pointed out that there is a particular time at which seed should be sown to obtain best results. Careful and extended trials were made upon this point this season. The results as detailed in the table shows very clearly which of the several seed sowings gave the greatest yield. The planting of March 7, 17 and 27 gave the largest return with much in favor of the March 17th planting. No. 1 *E* gave 203.24 bu. but 1 *F* 288.08 bu. and 1 *G* 251.78 bu. a difference of almost 37 bushels per acre in favor of the planting nearest the middle of March.

It is frequently claimed that seeds planted in the open will give as much fruit as those grown as recommended by this department in Bulletim 37.

To decide this question beyond a doubt, seeds as recorded in 1 *J* and 1 *K*, were sown in a hand box in the open on April 16. The yield, as recorded, does not justify the practice even if there were no danger from losing the plants by frost.

PRUNED VS. UNPRUNED.

No.	TREATMENT.	No. Ripe Fruits per Plant for Season.	Weight Ripe Fruits for Season in Lbs.	Average Weight of Individual Fruits in Ozs.	No. Ripe Fruits to Aug. 31.	Weight Ripe Fruits per Plants in Ozs. to Aug. 31.	Yield per Acre for Season in Bu.
117	Early Ruby, *Normal*	32.6	6.47	3.17	4.4	12.6	293.5
118	Early Ruby, *Pruned Aug. 3*	48.9	9.70	3.07	1.5	4.59	460.0

PRUNED VS. UNPRUNED

Tomato Plants for Ripe Fruits.

It is maintained that pruning tomato plants, by removing the new growth and blossoms together with the small fruits after the plants have set the desired number, tends to hasten the ripening of the fruits left upon the plant. Accordingly two lots of Early Ruby plants were selected and given the same treatment up to August 3, when the young growth, together with the blossoms and small fruits near the end of the branches of the plants of lot No. 118 were cut off. As is shown in the table this had the effect of temporarily checking the ripening of the fruits upon this plot, for up to August 31, it had given only1.5 fruits per plant against 4.4 for those not pruned. The result for the whole season is reversed, and the normal plants produced only 293.5 bu. of ripe fruit against 460 bu. for the pruned.

SOAKED SEEDS.

Does the modern method of separating tomato seeds from the pulps by continued soaking and washing and drying injure or impair the germinating power of the seed?

To test this point seed of Early Ruby were selected and soaked as shown in the table.

SOAKED SEEDS.

Garden No.	No. Hours Soaked.	Per cent of Germination.
145	00	100
146	25	85
147	71	94
148	120	97
149	144	86
150	169	87
151	193	91
152	218	93
153	244	88
154	269	95
155	318	91
156	343	89
157	367	94
158	391	96
159	419	95
160	443	92
161	467	95
162	516	87
163	553	87

From the above account even the 553 hours of immersion in water did not impair the vitality of the seeds. It can, therefore, with safety be stated that the washing of seeds from the pulp can in no wise injure them for seed.

The record of these plants as fruit producers is as good as any not soaked and dried, and no marked difference in yield or time of maturity could be noted between those receiving the various treatments.

RIPE VS. SUN RIPENED AND GREEN FRUITS FOR SEED.

This line of work was begun in 1892 and it was thought best to continue it, notwithstanding the fact the field was very throughly worked over by Prof. E. S. Goff, of Wisconsin, while he was in charge of the horticultural department of the New York state experiment station at Geneva.*

The plants selected for this work were Dwarf Champions. The ripe fruits from which the seeds were taken were selected Aug. 18, 1892, from typical plants of the variety. The green fruits were selected on the same day and from similar plants; no fruit was taken that gave indication of color, although they were nearly full size. The other were picked July 5th, and allowed to color and ripen in the sun, they were good specimens but perfectly green at the time of picking.

On March 17, following, seeds from each of the three lots were sown in a flat so that the conditions for all should be the same. April 15, the young plants were transferred to thumbpots, and at this time the plants from the seed of fruit matured on the vines were considered the best. No accurate account was kept of the per centage of germination for the three sets, but it was evident that the naturally ripened seed was strongest. The sun-ripened specimens stood second both in vigor of plants and rate of germination. The seed from green fruits, while low in vitality gave a sparse stand of plants that soon grew to equal the others, and at planting time, June 4, it was impossible to note any difference in the thrift of the three sets. The comparisons of the Table are based on 120 plants from naturally matured seed; 100 from the seed of sun-ripened fruits, and 60 from the seed of green fruits.

*New York Station 3, annual '84, P. 224.
" " " 4, " '85, " 182.
" " " 8, " '89, " 329.
" " " 9, " '90, " 299.

NORMAL, SUN-RIPENED AND GREEN SEED.

VARIETY "Dwarf Champion."	Set in Field.	First Ripe Fruit.	No. Plants in Plat.	No. Fruits Ripened.	Total Weight.		Average Weight of Fruit per Plant.	Average No. Fruits per Plant.	Average Weight of Individual Fruits.
					Lbs.	Oz.			
Plat 1, Normal.....	June 3	Aug. 10	120	1616	302	2	2.51	13.4	2.99
Plat 2, Sun Ripened.	" 3	" 18	100	1595	260	5	2.60	15.9	2.61
Plat 3, Green	" 3	" 9	60	947	257	13	4.10	15.7	4.25

The above table records only the ripe fruit of the season ending Sept. 27. From this it will be seen that the plants from green seeds gave the first ripe fruit, although the difference was very little in comparison with that recorded in the experiments of Prof. Goff above noted. It will also be seen that the product of the plants from green seed, for the season, is considerable in excess of the normal and sun-ripened, both in aggrigate weight of product per plant as well as weight of individual fruits. The average number of fruits per plant was not quite equal to that of the sun-ripened, but considerably in excess of the normal.

At the above rate of production the different plats would have given the following yield per acre;—Plat I, 136.64 bushels, Plat II, 141.54 bushels, Plat III, 208.12 bushels, allowing the plants to be set four feet a part each way.

The same work was again repeated in 1895. The seed used were saved from the crop of 1893, so that the results should be emphasized by any accumulated effects from the treatment of 1893.

RIPE VS. SUN-RIPENED AND GREEN FRUITS FOR SEED.

	CONDITION.	No. Plants.	Date of Bloom.	First Ripe Fruits.	No. Fruits per Plant.	Weight of Fruits per Plant.	Weight of Individual Fruits.	Yield per Acre.	Per Cent of Seed Germination.
164	Ripe	10	June 28	Aug. 23	28.1	5.15	2.94	233.64	84.
165	Sun-ripened	9	" 28	" 23	25.6	5.11	3.18	231.82	86.
166	Green	6	" 28	" 20	30.8	6.08	3.00	276.16	10.6

The general results are the same as those recorded in Bull. 37 and repeated above. The same relative productiveness is maintained between the three sets, the sun-ripened seed producing a slightly greater product than either of the others, but the green seeds gave the greatest number of ripe fruits per plant during the season, showing a tendency toward increased earliness in this particular case. Further experiments along this line are desirable in order to determine the extent to which this tendency can be carried. The one drawback to the commercial value of this line of work is the low percentage of germination shown by the seeds from the green fruits. This is suffcient to discourage its general practice by seedsmen.

IS HOME GROWN SEED BETTER THAN COMMERCIAL SEEDS.

This question presents itself forcibly to the grower of plants requiring a long season for maturity under a climate naturally possessing only a short season. Or to state the proposition differently, will the tomato adjust itself to changed conditions as readily and to as marked a degree as corn does? We can not say this is impossible, but grown as it is, under artificial conditions and started in a forcing house or hot bed it is probable it will never shorten its period of maturity to the extent that corn has. If then we can not hope with reasonable assurance for an *earlier* product may we not anticipate an *increase* of product during the season?

COMPARISON OF COMMERCIAL AND DAKOTA GROWN TOMATO SEED.

No.	VARIETY.	SEEDSMAN.	No. Plants.	Date of First Bloom.	First Ripe Fruits.	Number Fruits per Plant.	Weight of Fruits per Plant.	Weight of Individual Fruits.	Yield per Acre.
							Lbs.	Oz.	
100	Long Keeper	Warner, S. D.	10	June 28	Aug. 27	36.4	7.10	3.08	*322.1*
36	Long Keeper	Thorburn, N. Y.	9	" 20	" 27	32.2	4.83	2.40	219.1
101	White Apple	Warner, S. D.	10	" 28	" 30	40.3	3.10	1.19	*140.6*
67	White Apple	Huntington Seed Co., Ind.	10	" 28	" 30	42.8	2.90	1.08	131.6
102	Earliest of All	Warner, S. D.	10	" 24	" 6	70.2	8.80	2.02	396.9
76	Earliest of All	Gregory & Son, Mass.	10	" 17	" 2	73.6	9.60	2.10	438.7
103	New Jersey	Warner, S. D.	9	July 1	Sep. 3	9.2	2.72	4.71	123.4
32	New Jersey	Thorburn, N. Y.	10	June 24	Aug. 23	18.9	4.15	3.49	188.3
106	Ignotum	Warner, S. D.	9	" 28	" 27	26.4	7.33	4.44	*332.5*
4	Ignotum	Cornell University, N, Y.	10	July 5	" 23	26.7	5.52	3.31	250.6
107	Beauty	Warner, S. D.	10	June 28	" 28	23.2	4.95	3.41	*207.9*
11	Beauty	Livingston, Ohio	7	" 17	" 27	13.9	3.24	3.86	146.9
108	Stone	Warner, S. D.	10	" 28	" 20	17 7	4.55	4.10	*206.4*
26	Stone	Livingston, Ohio	10	" 28	Sep. 3	23.5	4.25	2.73	192.5
111	Comrade	Warner, S. D.	10	" 17	Aug. 27	31.7	5.31	2.69	240.4
72	Comrade	Gregory, Mass.	10	July 1	" 27	26.1	6.11	3.75	271.8
112	Early Ruby	Staats, S. D.	10	June 17	" 13	45.5	9.83	3.45	*445.9*
117	Early Ruby	Vaughn, Ill.	20	" 17	" 6	32.6	6.47	3.17	293.5

The foregoing comparison of plants from commercial and Dakota grown seeds is made at this time for the purpose of solving this question.

A study of of the table shows a gain in earliness for Dakota grown seeds in two instances out of the nine under consideration and a gain in yield in favor of the Dakota seed in six cases out of nine.

By a further study the of columns marked "No. of fruits" and "Average weight of individual fruits" it will be noted that the gain in yield is more the result of increased size of fruits than the increased number of fruits per plant.

ONIONS.

The light in which such small crops as onions are generally viewed by the average grower of the cereals is well understood by the writer, and yet, notwithstanding the usual disregard for such products I feel all the more the importance of bringing these small crops before the agriculturists of South Dakota. No one looks upon potatoes as an impossible crop for the ordinary farmer, and the onion crop should be viewed from the same standpoint.

Onion seed is expensive but a little goes a long way, and while it may cost $8 to $10 for seed per acre this is not much more than it ordinarially costs for seed for an acre of potatoes. The work of planting is less in the case of onions, and the subsequent labor of caring for the crop need not be more. With the improved seed-drills and wheel-hoes the work is reduced to a minimum. While it is not advisable for a person to devote his whole time and attention to this, it can be made one of the valuable accessories to the general farm products and will go a long way towards paying the general running expenses, thus leaving a larger proportion of the main product of the farm for clear profit.

To guard against errors into which the inexperienced might unknowingly fall, the following cultural tests were conducted upon a good average South Dakota prairie soil.

INFLUENCE OF EARLY PLANTING ON YIELD.

To give best results onion seeds must be planted early. By early is meant as soon as ever the first two inches of the soil will permit stirring. Ordinarily such a period occurs during February or early March. If onion seed cannot be in the ground in South Dakota before April first it had better not be put in at all that year. If however it can be sown by March 20, or prior to that date, there is, other things being equal, a good prospect for a crop.

INFLUENCE OF EARLY PLANTING ON YIELD.

No.	VARIETY.	Date of Planting.	YIELD PER ROD.									YIELD PER ACRE.		
			MERCHANTABLE.			SCULLIONS.			TOTAL.					
			No.	Lbs.	Ozs.	No.	Lbs.	Ozs.	No.	Lbs.	Ozs.	Merchantable, Bush.	Scullions, Bush.	Total, Bush.
200	Large Red Weathersfield	Feb. 27	42	10	2	10	0	6	52	10	8	410.89	15.23	426.12
207	Large Red Weathersfield	Mch. 18	22	5	4	3	0	3	25	5	7	213.23	7.61	220.84
201	White Globe	Feb. 27	42	9	12	7	0	4	49	10	0	395.99	10.48	406.48
208	White Globe	Mch. 18	38	8	10	9	0	5	47	8	15	350.30	12.69	362.99
202	Southport Red Globe	Feb. 27	45	9	11	14	0	13	59	10	8	390.41	33.00	423.41
209	Southport Red Globe	Mch. 18	45	9	11	7	0	10	52	10	5	390.41	25.38	415.79
203	Southport Yellow Globe	Feb. 27	55	12	4	3	0	4	58	12	8	500.87	10.15	511.02
210	Southport Yellow Globe	Mch. 18	53	9	8	18	1	0	71	10	8	385.84	40.61	426.56
204	Early Red Globe	Feb. 27	56	8	13	16	0	7	72	9	4	357.92	17.76	375.59
211	Early Red Globe	Mch. 18	26	5	0	6	0	6	32	5	6	203.07	15.23	218.31
205	White Portugal	Feb. 27	37	7	12	2	0	2	39	7	14	314.76	5.07	319.84
212	White Portugal	Mch. 18	39	5	13	12	0	9	51	6	7	236.07	22.84	258.92
206	Extra Early Flat Red	Feb. 27	65	8	6	16	0	10	81	9	0	341.82	25.38	367.20
213	Extra Early Flat Red	Mch. 18	55	6	8	6	0	5	61	6	13	264.83	12.69	277.52

From the results of the trial recorded in the above table it will be seen that in no case were better results obtained from the March 18th planting than from the February 27th planting; and in all instances, except 202 and 209, the increase in favor of the earlier date for planting is remarkable. In the case of 203 and 210 the difference in favor of the early date for planting is one hundred fifteen bushels per acre. These results are not chance results from the yield of a single variety but are to be followed in different degrees through each of the seven varieties in the test.

FALL VS. SPRING PLOWING.

The test here recorded was conducted on a commercial scale, one half the ground having been plowed and prepared the previous fall while preparing for the other tests. The other half was prepared a few days prior to sowing the seed. The variety used was the Large Red Weathersfield; it was sown on March 27; the plants on the fall and spring plowing standing in contiguous rows so that any possible variation in soil or exposure was reduced to a minimum.

The seed on the fall plowing germinated two days sooner than that on spring plowing. This was the first advantage shown in favor of the fall prepared soil. As the season advanced the work of weeding was found to be considerably more in the case of the plants on the spring plowing. The fall working apparently had the effect of so exposing the weed seeds as to kill or to lessen their vitality to a marked degree. A safe estimate is to place the cost of labor for caring for the onions on spring plowing at one fourth more than for those on fall plowing.

At the end of the season another marked result was brought out as shown in the accompanying table.

FALL VS. SPRING PLOWING.

TREATMENT.	MERCHANTABLE.			SCULLIONS.			TOTAL.		
	No.	Lbs.	Ozs.	No.	Lbs.	Ozs.	No.	Lbs.	Ozs.
FALL PLOWING.	55	11	0	.....	.....	.....	55	11	0
	62	9	8	1	0	2	63	9	10
	52	10	8	4	0	3	56	10	11
	36	8	0	3	0	4	39	8	4
	35	6	8	3	0	8	38	7	0
Total	240	45	8	11	1	2	251	46	9
Avg. per Rod	48	9	6	2.2		3.4	.....	.....	.....
Avg. per Acre	369.59 bushels.			8.56 bushels.			378.16 bushels.		

TREATMENT.	MERCHANTABLE.			SCULLIONS.			TOTAL.		
	No.	Lbs.	Ozs.	No.	Lbs.	Ozs.	No.	Lbs.	Ozs.
SPRING PLOWING.	45	6	5	7	.....	7	52	6	12
	26	6	6	2	.....	2	28	6	8
	36	6	6	6	.....	11	32	7	1
	49	9	8	4	.....	6	53	9	14
	35	5	5	3	.....	6	38	5	11
Total	191	33	14	15	2	0	203	35	14
Avg. per Rod	38.2	7	7.6	3	.....	6.4	40.6	7	2.8
Avg. per Acre	303.61 bushels.			16.24 bushels.			319.86 bushels.		

The yield of merchantable onions was 66 bushels more per acre on the fall prepared than on the spring prepared soil. The proportion of scullions was likewise less on the fall plowing.

The reason for this is undoubtedly explained by the fact that fall plowing during the freezing and thawing of the winter has an opportunity to become thoroughly compacted and more perfectly saturated with moisture. In this state it gives up its moisture to the growing plant more regularly and continuously throughout the season. The thoroughly compacted soil of the fall plowing suffers less from drouth as well,

and hence possesses another advantage not to be lost sight of in South Dakota.

THE NEW VS. THE OLD ONION CULTURE FOR SOUTH DAKOTA.

The so called "new onion culture" has received much just praise and has done as much as any one improvement in modern horticulture to make that branch of industry remunerative.

It is based upon the idea that plants grown from seed started in a hot bed, by virtue of the earlier planting and the congenial conditions afforded by the hot-bed, are when planted out in May, better prepared to make a remunerative crop than those from seed sown at a later date in the open ground. This is undoubtedly true. Plants started in the hot-bed do have an advantage during the early part of the season and they suffer comparatively little from transplanting. Another advantage arises from the opportunity afforded to cultivate the soil after the weed seeds have started and before the crop is upon the ground, thus cheapening the labor of weeding.

But there are few places where onion-growing can be profitably carried on, that like South Dakota will usually allow an oppartunity for seed planting in February or early March. With this condition of affairs before us the question naturally arises does the "new onion culture" possess any advantages over the old when the seeds can be planted in the open at the same time they are in the hot-bed or green house.

With a view of throwing some light upon this question a preliminary test was made with seven varieties as noted in the accompanying table.

THE NEW VS. THE OLD ONION CULTURE.

No.	VARIETY.	Treatment.	YIELD PER ROD.									YIELD PER ACRE.		
			MERCHANTABLE.			SCULLIONS.			TOTAL.					
			No.	Lbs.	Ozs.	No.	Lbs.	Ozs.	No.	Lbs.	Ozs.	Merchantable, Bus.	Scullions, Bus.	Total, Bus.
207	Large Red Weathersfield	Field	22	5	4	3	0	3	25	5	7	213.23	7.61	220.84
254	Large Red Weathersfield	Hotbed	21	5	2	4	0	5	25	5	7	208.15	12.69	220.84
208	White Globe	Field	38	8	10	9	0	5	47	8	15	350.30	12.69	362.99
255	White Globe	Hot bed	20	7	4	2	0	6	22	7	10	294.62	15.23	309.85
209	South Port Red Globe	Field	45	9	11	7	0	10	52	10	5	390.41	25.38	428.84
256	South Port Red Globe	Hotbed	26	6	10	0	0	0	26	6	10	269.07	.....	269.07
210	South Port Yellow Globe	Field	53	9	8	18	1	0	71	10	8	385.84	40.61	426.56
257	South Port Yellow Globe	Hot bed	23	6	0	5	0	9	28	6	9	243.69	22.84	266.53
211	Early Red Globe	Field	26	5	0	6	0	6	32	5	6	203.07	15.23	218.30
258	Early Red Globe	Hotbed	20	5	0	4	0	9	24	5	9	203.07	22.96	226.03
212	White Portugal	Field	39	5	13	12	0	9	51	6	7	236.07	22.84	258.92
259	White Portugal	Hot bed	27	7	4	4	0	8	31	7	12	294.62	20.30	314.92
213	Extra Early Flat Red	Field	55	6	8	6	0	5	61	6	13	264.83	12.69	277.52
260	Extra Early Flat Red	Hot bed	22	4	4	.....	.....	.....	22	4	4	172.61	.....	172.61

From the yield per acre recorded for the several varieties under the two conditions it is evident that the field sown seed gave the largest product except in the case of Early Red Globe and White Portugal. In the first case the merchantable product was the same in both instances; but with the White Portugal there was a decided gain in favor of transplanted or hot-bed grown plants. Another point not clearly brought out in the table was the gain in size of bulb of the transplanted over the field grown plants; and yet another, that there were more plants per row in the the thinned or field grown plants than in the transplated ones. Or to use a different expression the field grown plants were not as carefully thinned as the transplanted plants. After making all due allowances for the discrepancies above alluded to, I am yet of the opinion that upon fall plowed land and where the two plantings can be done at the same time there is no advantage, unless it be in reduced cost of care or in earlier maturity, in the hot-bed grown plants over those grown from seed sown in the open. More light is needed upon this point before a definite conclusion will be justifiable.

BEANS.

One of the crops that might with profit be added to the the rotation practiced in South Dakota is beans.

The market gardener should have a supply of "snap" or "string beans" sufficient to meet the demands of his market, and the farmer, more remote from market who can not take advantage of the demand for string beans, can do no better than to grow this crop for the matured seed.

A peculiar fact was brought out upon inquiry at grocery stores in various parts of the state; and from information gathered it is safe to say that ninety per cent of this staple article of diet consumed in South Dakota is imported from the east. There is no reason for this when the crop can be successfully grown at home. From the following tables some idea of the yield of the various sorts of string or wax beans can be ascertained.

On May 13, the number of beans recorded below were planted under conditions as uniform as can be obtained in out-door culture, and on August 5th the weight of snap beans was taken. The variation in yield of the several varieties is clearly shown in the accompanying table:

VARIETIES OF STRING BEANS COMPARED.

VARIETY.	No. Beans Planted.	Weight of Crop August 5.	
		Lbs.	Ozs.
Crystal White Wax	91	9	00
Saddle Back Wax	100	9	00
Golden Wax	99	9	7
Golden Eye Wax	100	9	12
Dwarf Black Wax	100	11	00
New Prolific German Wax	98	9	14
Wardwell's Kidney Wax	98	7	14
Rustless Golden Wax	99	8	13
German Wax	100	14	6
Rust Proof Wax	100	9	10
Speckled Wax	100	9	6
Black Eyed Wax	98	4	9
White Dwarf Wax	100	4	9
Detroit Wax	100	7	4
New Rust Proof Golden Eye Wax	100	6	0
Challenge Dwarf Black Wax	99	5	9
Flageolet Wax	100	8	11
Giant Yosemite Wax	100	10	9
Dwarf Golden Wax	100	9	0
New Refugee Wax	100	14	4

HILLS VS. DRILLS.

No.	TREATMENT.	Quantity of Seed.	YIELD.	
			Lbs.	Ozs.
326	Hills, 5 seed, in a hill	500	5	15
327	Drills, 1 seed in a place, 4 inches apart	500	6	15
328	Hills, planted with hand corn planter	2 lbs.	12	10
329	Drill, garden drill	2 lbs.	32	3

HILLS VS. DRILLS.

If we are to grow beans what is the best and cheapest method of planting and caring for them?

To aid prospective planters the following simple comparisons were made: Two lots of five hundred beans each of the Prolific Tree Field Bean were counted out. One set was planted in hills 18 inches apart in the row, 3 feet between rows and five beans in a place. The other set was dropped one bean in a place and 4 inches apart, in rows same distance apart as in previous case. As shown in the table the drilled beans in this case gave one pound more seed at harvest time than the five hundred planted in hills.

To give the test more of a commercial bearing and yet keep it within bounds two lots of two pounds each of the above named variety of beans were carefully weighed out and one lot planted in hills about 18 inches apart with a hand corn planter; the other lot of two pounds was placed in a New Model garden drill and drilled in probably 1½ inches deep.

The results of this latter case are also recorded in the table and from the marked difference in favor of the drilled beans, I feel justified in recommending the use of the ordinary grain drill with the feed so stopped as to sow the seed in drills at the desired distance for the commercial planting of beans.

A CHEAP AND EFFICIENT GREEN HOUSE FOR THE NORTH-WEST.

(The following article was published in June, 1895, number of "Market Garden.")

"Of necessity forcing houses for vegetables are quite different structures in the Northwest from those used in the trucking districts around the great cities of the East. But here, as there, the use determines the style and structure of the house. For starting early plants, such as tomatoes, early cabbage, cucumbers and onions for transplanting, the ordinary hot bed is of less practical value here than further east, partly because of more severe and sudden changes and partly because of more intense winds of the prairies; making it more dangerous and difficult to manipulate the loose sash. For the last two seasons I have used as a substitute for the ordinary hot-bed a combination hot-bed and green-house constructed in the following manner: A hole three feet deep, ten feet wide and a multiple of eight feet in length was excavated, the length depending upon the number of sash to be used or the capacity of the house desired. Around the edge, but inside the bole, cedar posts were set six feet apart, the tops extending slightly above the surface of the soil; between these posts and the dirt bank, boards or planks were placed and the soil filled in and tamped down. The tops of the posts were sawed off at an angle corresponding to the pitch of the roof, a 2x4 scantling was then spiked to the top of the posts, forming the plate. Rafters were cut from 2x4's and so arranged that they would carry the ordinary 3x6 feet hot-bed sash. The rafters were notched so that the top of the rafter came flush with the top of the plate, which has the same slant as the rafters themselves. The sash were firmly screwed to the rafters and a ridge board placed over all.

The ends of the house above the soil should be double boarded and the ridge should extend north and south, the south end having a door at least two feet square to admit air for ventilation. At the north end an inclined plane should be arranged to accomidate the door at that point. Inside boards should be nailed to the posts, thus making an air space between the two walls, keeping the manure, which is

used to furnish the heat, away from the cold outer walls, which is a feature of considerable importance in a cold climate. Through the center of this house an alley is provided, which is tightly boarded from the bottom of the pit to a height corresponding with that of the side walls. The top boards of this alley wall should be six inches wide, and as the manure and earth settle these may be removed, thus making it more convienient to care for the plants. The only point requiring particular care is to *tramp* the manure, which should have the same preparation as for an ordinary hot-bed, *evenly* and *very hard*.

" The sash of course are removed as soon as the growing season is past, and upon the approach of winter the board shutters should be placed upon the roof in place of the sash. This will keep snow out, and the clean pit protected in this way can be filled much earlier the succeeding spring than if not so prepared.

" The advantages of this plan over an ordinary hot-bed are:

" First. There is no danger of breakage from wind blowing off the sash.

" Second. The house can be cared for more easily and at times when an ordinary hot-bed could not be opened with safety.

" Third. There is a larger air space above the plants and consequently less danger of injury to plants from sun scald and, all the sash being fastened, the doors at the ends serve as ventilators.

"Fourth. It may be used for a cold storage pit during the winter.

" The only disadvantage is a slight loss of area for growing plants as compared with the ordinary form of hot-bed.

" Houses for winter vegetables should be built upon the same plan as the pit-house above described, i. e., they should be exposed as little as possible, the roof being the only portion above ground. Narrow houses are more easily constructed in this way than three bench houses. For this climate all artificial heat used should be under immediate control, as it often happens that the thermometor drops 30° or more in two hours time. For this reason hot water, which acts slowly upon the temperature of a house, is not equal to such emer-

gencies. My experience has taught me that no matter how tight the house or how intense the fire, during a sudden change every degree of temperature lost in a house can not be made up with hot water; therefore, a quick acting heat which can be thrown on or turned off on short notice is preferable. Steam is rapidly replacing hot water in large plants in the east, and here, it is my belief, that it must take precedence of hot water under all conditions.

"Another means of heating that might be used with profit in heating houses for growing early vegetables requiring a moderate heat, such as lettuce, radishes, cauliflower, etc., is the warm water that comes from many of the artesian wells of the northwest. The temperate of the water of these wells ranges from 62° to over 90° in some cases. With an open flow this stored heat might be made to warm a green house sufficiently for the culture of the crops above named as well as supplying the necessary moisture. So far no experiments or attempts have been made to utilize this energy, but it is a force only awaiting use by the intelligent market gardener."

SUMMARY.

1. Out of one hundred varieties of tomatoes tested and recorded in table one, nineteen produced at the rate of over 300 bushels per acre, three over 400 bushels and one over 500 bushels per acre.

2. The five varieties giving the greatest crop are, in the order of their yield, as follows:

1. Hubbard's Early.
2. Salzer's Giant Tree.
3. Salzer's First Prize.
4. Bond's Early Minnesota.
5. Early Ruby.

3. If Dakota soils are lacking in any one of the three essential ingredients of plant food it is phosphoric acid.

4. It is possible to carry shallow culture beyond profitable limits, in general it is not advisable to cultivate less than 2½ to 3 inches in depth.

5. It is not desirable to mulch tomatoes in this state.

6. In general it does not pay to train tomatoes, how-

ever, the form of trellis giving the best results is the post and wire described on page 17.

7. The seed planting nearest the middle of March gave best results.*

8. Seed from green fruits give a lower percentage of germination, but the resulting plants give an increased crop for the season.

9. While home-grown seeds do not give earlier fruits they give a larger yield.

10. Onions are a profitable crop for Dakota.

11. Early planting of onion seed increases the yield.

12. There is no gain in "New Onion Culture" over the old when the seeds are planted on the same date.

13. There is a decided advantage in fall over spring plowing for onions.

14. Planting beans in *drills* is the most profitable method.

15. A cheap green house may be built that is within the reach of every farmer or market gardener in South Dakota.

---

*See also Bulletin 37.